THE MODERN FARM

THE REALITIES ABOUT POULTRY

BY

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Preface

Keeping poultry makes a substantial contribution to household food security throughout the world. It helps diversify incomes and provides quality food, energy, fertilizer and a renewable asset in over 80 percent of rural households.

Small-scale poultry farmers throughout the world are however, constrained by poor access to markets, goods and services; they have weak institutions and lack skills, knowledge and appropriate technologies. The result is that both production and productivity remain well below potential and losses and wastage can be high. However, adapted breeds, local feed resources, and appropriate vaccines are available, along with proven technologies that can substantially improve productivity and income generation. In the book, we shall equip the farmer with skills and knowledge that can be applied for successful poultry farming.

Among other aspects, the following are discussed in this book: Poultry farming in general, poultry housing, feeding, bio-security, pests, diseases, disease control, record keeping, and break-even analysis.

Acknowledgements

The author would like to acknowledge the assistance of colleagues and friends.

Dedications

The Modern Farm: The Realities about Poultry is dedicated to you (the reader) because you are the very reason why it was written.

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INTRODUCTION TO POULTRY FARMING

Poultry farming is the raising of domesticated birds such as chickens, turkeys, ducks, quails, and geese for the purpose of getting meat, or egg production. Birds are farmed in great numbers with chickens being the most numerous.

Poultry farms are farms that raise chickens, ducks, turkeys, and other birds for meat, or egg production. In the past, poultry farming involved raising chickens in the back yard for daily egg production and family consumption. However, poultry farming today is a huge business that is split into several operations including hatcheries, pullet farms for meat production, or farms for egg production. This book will focus on raising chickens.

As the human population increases, the poultry industry continues to grow to meet the demand for poultry products in world markets. The importance of poultry farms lies in the quality of products that are provided to humans. Broiler farms provide meat that supplies the human body with high quality proteins. Layer farms provide eggs rich in proteins and vitamins, especially the fat soluble vitamins (A, D, E, and K). Poultry farms can fulfill the demand for meat and eggs, and can be expanded easily to meet the ever-growing demand.

Each operation in the poultry business has become a huge business by itself. Some farms specialize in producing eggs for market consumption, or for hatching chicks for the purpose of meat production. Many large farms specialize in raising broilers for meat production. Other businesses are focused on feed preparation or on using the wastes of poultry farms for compost production and fertilizing farmlands. If managed and marketed well, all segments of the poultry business can be profitable.

Keys to Successful Poultry Farming

Owing to the increasing demand for chicken, eggs and the quest for self-employment, many people are turning to poultry farming with mixed results. Some have succeeded while due to poor planning, others have failed. They have failed due to their failure to plan. If someone is planning or is already into poultry farming and he or she wishes to grow it big, there are factors he or she needs to consider. Some of these factors include:

1. **Type of Birds:** This is vital as other factors are dependent on it. The housing system, feeds, equipment and facilities someone may require for this venture are dependent on the type of birds to be kept. Chicken can be kept for their eggs, or meat (layers or broilers) and recently, huge interest has grown for indigenous chickens. As such, a farmer has to decide upfront what his or her interests are.

Chicken Breeds in Uganda

- **Layers:** These are chicken breeds reared specifically for the production of eggs. Egg laying chicken breeds that can be reared include but not limited to the following:

- **Australorp Chicken:** The Australorp is a chicken breed of Australian origin, developed as utility breed with a focus on egg laying.

  The Australorp, like many breeds of chicken, comes in both bantam and standard size and multiple colours.

  The Australorp currently has three recognized colours according to the Australian Poultry Standard; black, white and blue.

- **Leghorn Chicken:** The Leghorn is a breed of chicken originating in Tuscany, in central Italy. Birds were first exported to North America in 1828 from the port city of Livorno, on the western coast of Tuscany. The leghorn chicken is mainly kept for eggs. The leghorn chickens come in mainly three colours: black, white, and brown.


- **Broilers:** These are chicken breeds reared for their meat. Below are some of the major broiler chicken breeds.

- **Brahma Chicken:** The Brahma is a large breed of chicken developed in the United States from very large birds imported from the Chinese port of Shanghai. The Brahma was the principal meat breed in the US from the 1850s until about 1930. The primary use of this chicken breed is meat though it can lay about 150 eggs a year.


- **Dual Purpose Breeds:** These are chicken breeds reared for the production of both meat and eggs. Below are some of the dual purpose chicken breeds.

❖ **Kuroilers**: A Kuroiler Chicken is a chicken breed with indigenous traits which grows faster and lays more eggs than the local chicken. This chicken breed has been introduced in Uganda. Kuroilers were first successfully introduced in India more than a decade ago. The birds are low-maintenance scavengers that thrive on household and agricultural waste. Just like the local breeds, the Kuroilers are largely kept under a free range system, where the birds are left to scratch for food with no restrictions and very little or no supplements.

The difference is that while the locals are moderate while scratching for food and may even take a rest, Kuroilers are aggressive and feed continuously. This explains why they put on weight faster than the local breeds

❖ **Plymouth Rock chicken:** The Plymouth Rock is a breed of domestic chicken from the United States. It originated in New England in the 19th century from cross-breeding of Dominiques and Black Javas. The Plymouth Rock was bred as a dual-purpose fowl, meaning that it was valued both for its meat and the egg-laying ability of the hens. It is a cold-hardy bird. The hens lay brown eggs, and continue laying all through the very cold season with decreased production.


- **Rhode Island Red:** The Rhode Island Red is an American breed of chicken. It is a utility bird, raised for meat and eggs, and also as a show bird. It is a popular choice for backyard flocks because of its egg laying abilities and hardiness. The bird's feathers are rust-colored, however darker shades are known, including maroon bordering on black. Rhode Island Reds have red-orange eyes, reddish-brown beaks, and yellow feet and legs, often with a bit of reddish hue on the toes and sides of the shanks. Chicks are a light red to tan color. The roosters usually weigh in at about 8.5 pounds (3.9 kg), the hens average slightly less at 6.5 pounds (2.9 kg). Rhode Island Reds are good layers of brown eggs. Hens lay 5–7 eggs per week. The hens lay approximately 312 eggs in their first laying season and 223 in the second.


- **Sussex chicken**: The Sussex chicken is a dual purpose breed of chicken that originated in England around the time of the Roman conquest of Britain in AD 43 that is a popular garden chicken in many countries. The Sussex chicken is an alert, docile breed that can adapt to any surroundings. They are comfortable in either free range or confined spaces and in the presence of humans, although they will mate and breed better in larger spaces. The breed frequently goes broody in the warmer months. They are good foragers and are generally vigorous and hardy as a garden fowl.


Eggs

The Sussex was bred to be a dual purpose bird and is one of the most productive breeds of poultry. They lay large eggs that are cream to light brown in colour. A person owning a hen of this breed should expect approximately 240 to 260 eggs a year (from 180 to 320 eggs), although the light and white varieties are the best choice for layers. Recently there has been an olive green coloured egg introduced to some Light Sussex breeds, although these green egg layers are very rare. In some cases, exhibition lines that have been selected for exhibition qualities rather than egg laying over many generations may produce lower eggs numbers, although there are plenty of good laying lines still available.

Meat

It is a good producer of meat and all of the varieties are a good choice to have for this purpose. The chicks mature quickly for heavy breed but the speckled is slowest to mature. The carcass is a larger leggier shape than the commercial broiler chicken, but is closer to the heritage meat

produced in the past. Cockerels that are harvested at around six months of age will be meaty with a firmer flesh than the younger broiler chicken of today.

- **New Hampshire Chicken**: The New Hampshire breed of chicken originated in the state of New Hampshire in the United States. The mature birds are a rich chestnut red, of a somewhat lighter and more even shade than the Rhode Island Reds. The chicks are also a lighter red. A dual purpose chicken, selected more for meat production than egg production. Medium heavy in weight, it dresses plump carcass used as either a broiler or a roaster.

  They possess a deep, broad body, grow feathers very rapidly, are prone to go broody and make good mothers. Most pin feathers are reddish, brownish buff in color and, therefore, do not detract from the carcass appearance very much. The color is a medium to light red and often fades in the sunshine. The comb is single and medium to large in size; in the females it often lops over a bit. While mainly raised for meat, they are also modest producers of brown eggs. Some strains lay eggs of a dark brown shell color. New Hampshire chickens are competitive and aggressive, with other chickens.

- **Naked Neck**: The Naked Neck is a breed of chicken that is naturally devoid of feathers on its neck and vent. Naked Necks are fairly common in Europe today, as well as in Africa, but are rare in North America. The trait for a naked neck is a dominant one controlled by one gene and is fairly easy to introduce into other breeds.

  Naked neck chickens are dual-purpose utility chickens. They lay a respectable number of light brown eggs, and are considered desirable for meat production because they need less plucking and they have a meaty body. They are very good foragers and are immune to most diseases. The breed is also reasonably cold hardy despite its lack of feathers. Naked Neck roosters carry a single comb, and the neck and head often become very bright red from increased sun exposure. This breed has approximately half the feathers of other chickens, making it resistant to hot weather and easier to pluck.

  Recognized color varieties include: black, white, cuckoo, buff, red, and blue in the United Kingdom and black, white, buff, and red in the United States

- **Rhode Island White**: The Rhode Island White is a breed of chicken originating in the U.S. state of Rhode Island. Despite their very similar names and shared place of origin, the Rhode Island White is a distinct breed from the Rhode Island Red. However, Rhode Island Reds and Whites can be bred together to create Red Sex Link hybrid chickens, such as the ISA Brown.

Rhode Island Whites are a dual-purpose fowl suitable for both meat and egg production. Males weigh 8.5 pounds (3.9 kilos) and hens weigh 6.5 pounds (3 kilos). They have a single variety, with pure white plumage, red wattles and earlobes, and a medium size rose comb.

2. **Housing:** It is said that by building a good housing system, one solves more than 40% of all poultry rearing problems. Chicken must be guarded from hostile weather conditions such as cold, rain, sun and wind. Safety from predators should also be considered in putting up a house unit. Snakes, rodents, foxes, dogs, mongoose and other animals are chickens' enemies. It is therefore important to confine them in modern structures. The housing unit should have perches for the chicken to roost on at night.

   A poultry shed should be sufficiently ventilated to allow in enough oxygen for the birds. Wire mesh can be used for the walls of the shed and it is vital that the number of birds do not exceed the stocking rate of the shed. Overpopulation affects the birds' health and increases disease incidences. On average, stocking rate should be 2 square feet per bird for layers and 1 square foot per bird for broilers. A traditional brooding basket can be used as a brooder for chicks either inside or outside the house. This is because chicks should be kept away from the chickens.

3. **Equipment and Facilities:** With the housing, it is also important that it is fitted with the necessary poultry equipment and facilities. The equipment and facilities are specific for different stages of the poultry project as discussed below: **Brooder:** For the brooder the following equipment and facilities are necessary:

- Heat source: The heat sources could be: brooder pots, charcoal stove, heat bulbs, among others.
- Drinkers
- Feeders
- A thin layer of litter on the floor. A farmer can either use coffee husks or wood shavings.

Normally the brooding stage is critical and may require specific facilities as discussed above. After the brooding stage, other necessary equipment include; feeders, drinkers, culling cage (for sick birds), egg crates (for layer) and so on. Based on the type and number of birds a farmer chooses to keep, he or she needs to buy sufficient equipment in advance before getting the chickens.

4. **Source of Chickens and Selection of the Breeding Stock:** For the initial starting up, a farmer may decide to either buy chicks from suppliers or hatch them him or herself. He or she may decide to naturally multiply his or her flock especially for indigenous poultry. In this case, one factor to consider is careful selection of the chickens and cocks to ensure only better qualities are passed on. Select a hen that is broody, does not abandon her eggs during hatching and looks after her chicks well. Select a healthy, strong cock and a cock should be allowed only ten hens.

   The other option is buying day old chicks. These can be purchased from breeders worldwide.

5. **Feeds**: Feeding is an important part of raising chickens. Feeds make up the major cost of production and good nutrition is reflected in the bird's performance and its products. Hence, the ability to manage feed costs and reduce feed wastage is a key component in successful poultry farming.
6. **Disease Control**: Chickens are subject to numerous diseases and parasites. In fact, diseases and parasites are the chief hindrances to success in raising poultry. Most common health problems can be avoided through preventative management; nevertheless, sooner or later every flock experiences its share of problems. If someone is not prepared to deal with these problems, he or she should not get involved with poultry. As a poultry farmer, he or she must be ever vigilant in monitoring the condition of his or her flock.

7. **Lighting:** Light is also a very important element for poultry farming. And poultry birds become very sensitive to light. Light helps the poultry birds to be productive, finding food and simulating them for reproduction. Besides light, the poultry birds also need dark period for keeping good health and producing melatonin hormone (which is very important for immune function). Almost all types of poultry birds require 8 hours of darkness period and 16 hours presence of light. Almost all poultry producer use only the natural light for lighting the poultry house.

   Darkness is helpful for some fast growing broiler species, and helps them for reducing leg disorders and build their body frame. However, poultry chicks require 24 hours light daily after hatching for finding food and water pot. Some commercial broiler poultry producers use long lighting period to encourage the bird consume more food. This results into very fast growing of broilers. Broiler poultry birds do not eat food and drink water in the dark. If the poultry birds are kept in darkness for some moment, then they will be more active in the light than continuous lighting period (and they will eat more food). This is a good practice, and it keeps the poultry birds healthy. In addition to natural lighting, a farmer can use artificial light. In small scale poultry rearing, he or she can use 14 to 16 hours of lighting period for layer poultry (where artificial lighting is needed for 4 to 6 hours daily depending on the season).

   Maintain the lighting period for layer poultry farming very carefully, otherwise they will lay eggs very soon or stop laying eggs. Use incandescent or fluorescent bulb for the purpose of artificial lighting. Fluorescent bulbs are very expensive than incandescent bulbs. But fluorescent bulbs are very energy efficient and long lasting. However, a farmer should use bulbs according to his or her choice and demand. In the case of incandescent bulbs, use a 60 watt bulb for each 200 square feet area, and use a wide reflector always to maximize the light. Clean the bulbs regularly. The farmer can use an automatic controller for maintaining a regular lighting period. Because if he or she forgets to switch on the light manually, then it can hamper the egg and meat production of his or her poultry birds.

   Always use waterproof sockets inside the poultry housing system. Maintaining a lighting period inside the poultry house in the morning is very effective than lighting in the evening. Adjust the lighting period according to the weather conditions and season. Where there is no electricity or load shedding is very high, use batteries, lanterns or solar panels for lighting the poultry house.

8. **Litter:** For successful poultry farming and getting desired production, litter management is very important. Usually the litter is used for covering the floor of the poultry housing system which may be made of concrete, wooden or earthen. Litter absorbs the moisture and dilutes the manure. It also works as the bed for the poultry birds. Rice hulls and soft wood shavings are the common materials used by the farmers around the world. Besides this, they can use some other materials for litter making purpose such as recycled newspaper, sand, dried wood fiber, chopped pine straw, peanut hulls etc. Small-scale poultry farmer also use some other materials such as hay and straw as poultry litter.

   Whatever the farmer uses, he or she should always try to use those materials which are healthy for poultry and compost well. A good litter contains about 20% to 30% moisture and a depth of about 2 to 4 inches. Ventilate the house very well, and it will help to remove moisture from the litter. High moisture in litter is very harmful for poultry health. Wet litter causes some problems like sores, and blisters on poultry birds and produce ammonia gas which hampers the respiratory system of poultry. Use aluminum sulfate or hydrated lime to reduce ammonia gas from the litter. A farmer can use the litter again and again after drying the materials properly. But he or she should not use the used litter if any disease has been detected in the poultry farm.

   After selling the poultry, remove the used litter from poultry house by machine or hand. This litter can be used as good manure in the agricultural land for crop cultivation. In some areas poultry manure and litter is very valuable and an extra source of earning cash. Dry poultry manure contains 3.84% nitrogen, 2.01% phosphorus and 1.42% potassium. In a word, poultry manure is very suitable for making soil fertile and it can be used in organic farming system.

Poultry Species and Breeds for Farming

All species of poultry are used by rural smallholders throughout the world. The most important species in the tropics are: chickens, guinea fowl, ducks, pigeons, turkeys and geese.

Chickens

Chickens originated in Southeast Asia and were introduced to the rest of the world by sailors and traders. Nowadays, indigenous village chickens are the result of centuries of cross-breeding with exotic breeds and random breeding within the flock. As a result, it is not possible to standardize the characteristics and productive performance of indigenous chickens.

There is no comprehensive list of the breeds and varieties of chickens used by rural smallholders, but there is considerable information on some indigenous populations from various regions. Most of this is based on feather colour and other easily measured body features (genetic traits).
Characteristics such as adult body weight and egg weight vary considerably among indigenous chicken populations, although reproductive traits such as the number of laying seasons per year, the number of eggs per clutch and hatchability are more consistent.

Guinea Fowls
Guinea fowls are native to West Africa but are now found in many parts of the tropics, and are kept in large numbers under intensive systems in some countries. Guinea fowl are seasonal breeders, laying eggs only during the rainy season, under free-range conditions. They are very timid, roosting in trees at night, and although great walkers, they fly very little.

Guinea fowl thrive in both cool and hot conditions, and their potential to increase meat and particularly egg production in developing countries deserves better recognition. The first egg is normally laid at about 18 weeks of age, and unlike many indigenous birds (which produce a single clutch a year), guinea hens lay continuously until adverse weather sets in.

Guinea hens under free-range conditions can lay up to 60 eggs per season, while well-managed birds under intensive management can lay up to 200 eggs per year. The guinea hen "goes broody" (sits on eggs in the nest) after laying, but this can be overcome by removing most of the eggs. A clutch of 15 to 20 eggs is common, and the incubation period for guinea fowl is 27 days.

Domesticated guinea fowl are of three principal varieties: **Pearl**, **White** and **Lavender**. The Pearl is by far the most common. It has purplish-grey feathers regularly dotted or "pearled" with white. The White guinea fowl has pure white feathers while the Lavender has light grey feathers dotted with white. The male and female guinea fowl differ so little in appearance (feather colour and body weight [1.4 to 1.6 kg]) that the inexperienced farmer may unknowingly keep all males or all females as "breeding" stock. Sex can be distinguished at eight weeks or more by a difference in their voice cry.

Ducks

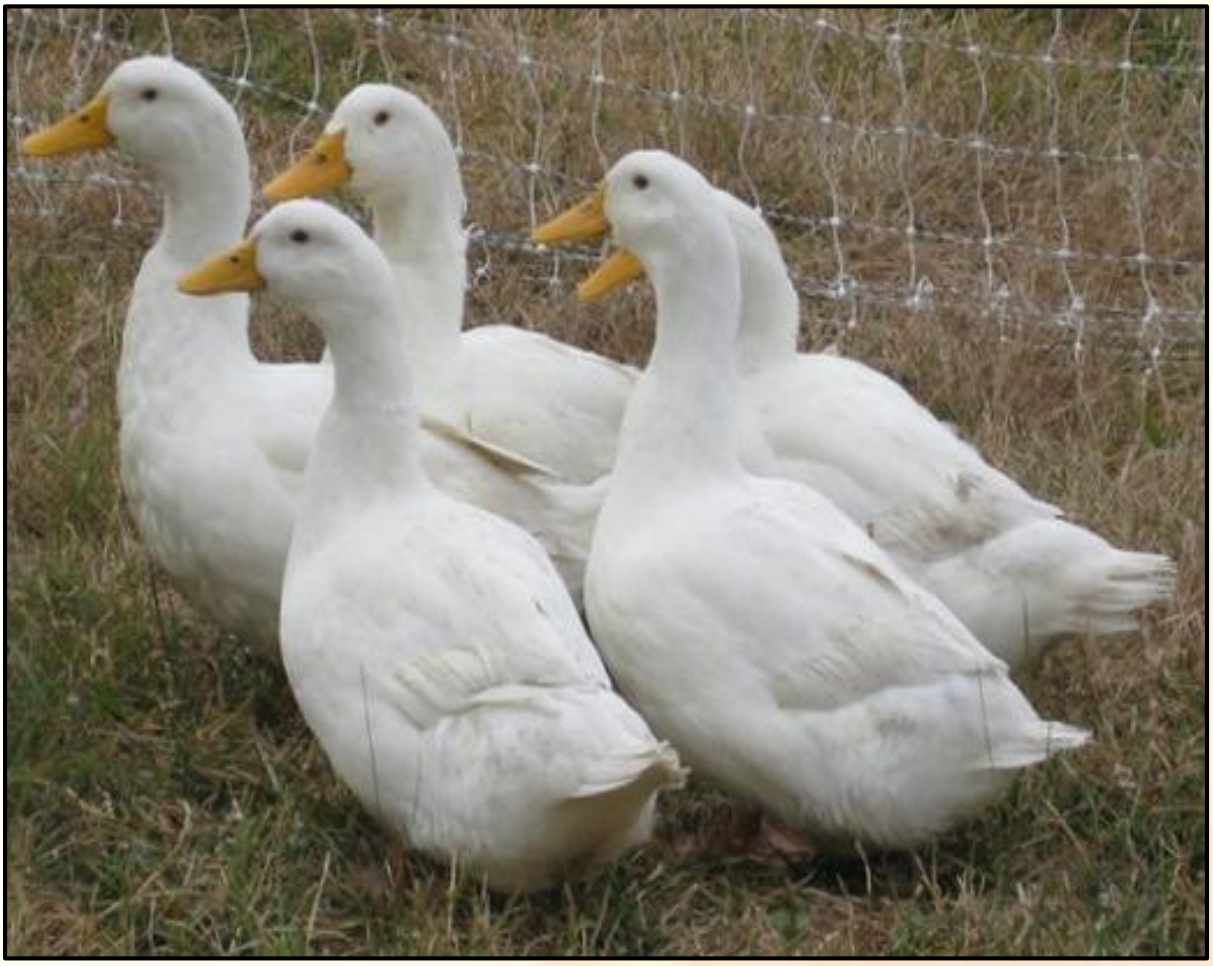
Ducks have several advantages over other poultry species, in particular their disease tolerance.

They are hardy, excellent foragers and easy to herd, particularly in wetlands where they tend to flock together. A disadvantage of ducks (relative to other poultry), when kept in confinement and fed balanced rations, is their high feed wastage, due to the shovel-shape of their bill This makes their use of feed less efficient and thus their meat and eggs more expensive than those of chickens. Duck feathers and feather down can also make an important contribution to income.

Different breeds of ducks are usually grouped into three classes: meat or general purpose; egg production; and ornamental.

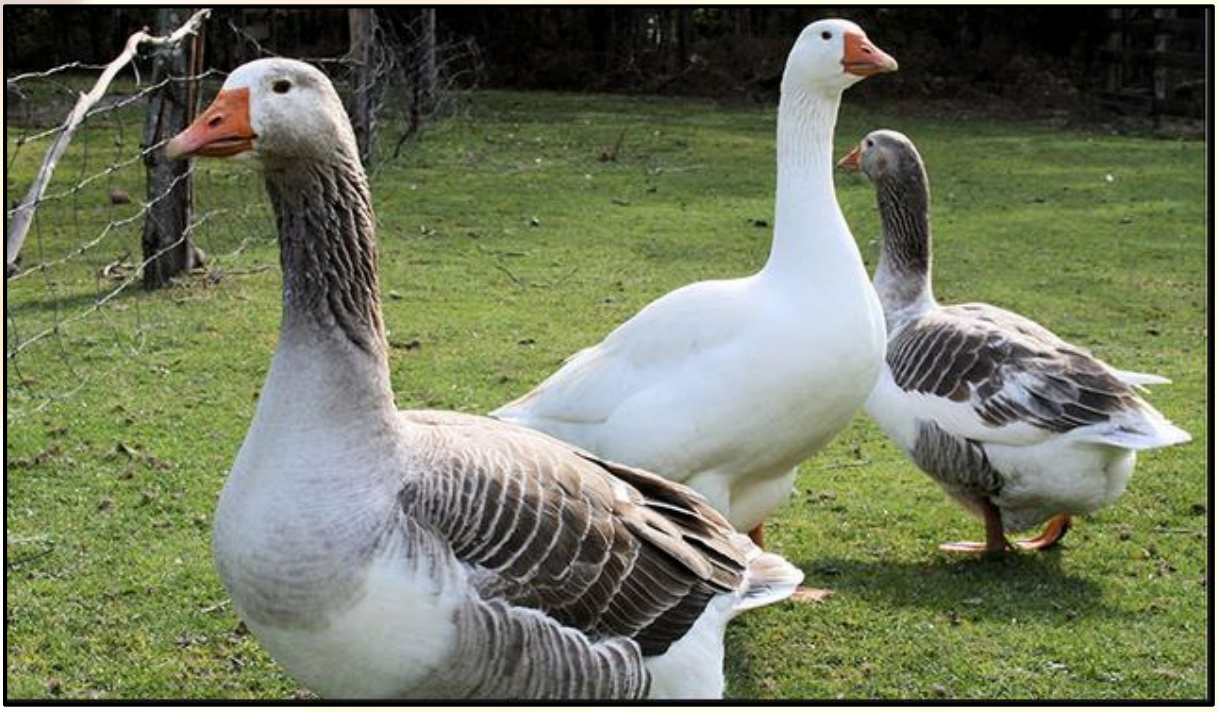
The average egg production of the egg breeds is approximately 70 percent (hen/day basis).

In most tropical countries, there are local duck breeds that have been selected to suit local conditions. They may not perform as well as improved breeds, but they do have the ability to survive and produce well under local extensive and semi-intensive systems.



Geese

Geese are less important in family poultry production, but of late they are being kept for security purposes mainly exploiting their aggressive territorial nature.



Pigeons

Pigeons are scavengers (not fed any supplementary feed) in most countries, living on the roofs of houses and treated as "pets" that do not need to be fed. They appear to prefer homestead compounds to fields. In some countries, they are eaten only for ritual purposes. They normally lay two eggs in a clutch, and the young birds (squabs) hatch after 16 to 17 days. The growing squabs are fed by their mothers on crop milk, produced in the mother's crop (first stomach). This enables young squabs to grow very rapidly. They reach maturity in three to five months at a body weight of 200 to 300 g for males, and 150 g for females. Adult pigeons are monogamous for life.

Turkeys

These birds are native to Latin America. The breeds kept by rural producers in the tropics usually have black feathers, as distinct from the white-feathered breeds that are raised intensively. Where there are no geese and ostriches, they are the largest birds in the farming system. Body weight ranges from 7 to 8 kg in males and from 4 to 5 kg in hens. They have good meat conformation, produce about 90 eggs per year and have medium to good hatchability. They are more susceptible to disease than either chicken or ducks.

Other Poultry Species Worth Considering

- **Quails** – for egg or meat production. Easy to rear in small space.


Characteristics of Quails

- Quails are very small sized bird.
- An adult quail weights between 150 to 200 grams and an egg weights around 7 to 15 grams.
- Female quails start laying eggs within their 6 to 7 weeks of age and continuously lay one egg daily.
- They lay about 300 eggs in their first year of life. After that they produce about 150 to 175 eggs in second year. Eggs production gradually decrease after their first year of laying period.
- Quail egg is very suitable for human health. It contains 2.47 % less fat than chicken egg. Many people believe that 'quail eggs help to prevent blood pressure, diabetic, pant etc.
- Quail meat is very tasty and nutritious. Fat is very low in their meat. So quail meat is very suitable for blood pressure patients.
- Eggs are very beautiful with multiple colours.
- Quails do not incubate their eggs. So a farmer has to use an incubator or brooder chickens for hatching their eggs.

Quail Housing

Housing is very important for quail farming. A farmer can follow the instructions mentioned below while making house or cages for his or her quails.

- Quail can be raised in both litter and cage systems. But quail farming in cage system is more suitable than raising them in deep litter system. In cage system, management is very easy and diseases or other problems are less.
- Make a proper ventilation system and ensure proper flow of air and light inside their house.
- 50 quails can be raised in a cage measuring 120 cm length, 60 cm wide and 25 cm height.
- Use wire net for making their cages.
- Measurement of the net would be 5 mm x 5 mm for adult quails.
- Plastic cages are most convenient for quail farming business.
- The house must have to be out of the reach of wild animals. Also prevent all types of predators

Feed Management in Quail Bird Farming

Feed management is a very critical part of commercial quail bird farming business. A well balanced nutritious feed ensures the proper growth of birds, resulting in good body weight gain in a short duration.

Make sure to have feed in small particles for better consumption.

A six month adult quail bird consumes about 25 to 30 grams of feed per day.

Quail birds require about 450 to 500 grams of feed for laying 12 eggs.

Egg Production in Quails

Presence of adequate light is highly recommended for desired egg production from quails. Provide artificial light and heat by using electric bulb or heater. Use 40 to 100 watt bulb for this purpose. Demand of light and heat varies depending on the season. If a farmer wants successful breeding and wants to hatch his or her eggs, then he or she must keep one male with every five female quails. For getting better egg production, he or she must select highly productive breeds and always keep their house dry and clean. Egg production also depends on temperature, feeding, water, care and management. To get desired egg production from quails, light play a vital role.

Composition of Quail Bird Eggs

Quail bird egg is roughly one-fifth the size of a chicken's egg and weighs around 10 grams. The eggs are spotted, with colors ranging from white to brown.

Quail eggs contain less cholesterol.

Below is a table showing nutrient content of a quail egg

Water	Protein	Fat	Carbohydrates	Total ash	Calorific value
74%	13%	11%	1%	1%	649kj/100g liquid

Raising Quail Chicks

Quails never incubate their eggs. So, a farmer can produce chicks by hatching their eggs through chickens or artificially through using incubators. Incubation period for quail egg is about 16 to 18 days. For maximum egg production, 16 hours of lighting period is required daily inside the quail house. Keep newly born quail chicks in a brooder house. Chicks need artificial heat and temperature management system for 14 to 21 days from their birth. Quail chicks become very sensitive. They can be raised in both litter and battery system. Keep in mind the following factors while raising quail chicks.

- Adequate temperature
- Sufficient light
- Proper air movement
- Density of quail chicks
- Supply of food and water
- Hygienic rearing rules

Quail Diseases

Diseases are less in quails, compared to other poultry birds. But they have to be taken good care of and managed properly, to keep them free from all types of diseases or illness. Good care and management is a must for profitable quail farming business. Generally they are not provided any disease preventive vaccines. Quail chicks cannot tolerate weather change, and sudden temperature change. So they get affected by disease, if they experience sudden temperature or weather changes. Be very careful during this period. Following diseases are very harmful for the quails.

- **Coccidiosis**: If the quails get affected by coccidiosis disease, serve them coaxial 20 by mixing with water (two grams per litter) for three days. Otherwise feed this according to the advice of a veterinarian.
- **Ulcerative Enteritis**: Mix one gram streptomycin with one litter water and serve it to the quails for three days. This will stop ulcerative enteritis disease.

Note: Before implementing any disease control measures, talk to a veterinary doctor or poultry technical officer for proper advice.

Hygienic Quail Farming Tips

To keep quails healthy and productive, follow the hygienic quail farming methods which are mentioned below.

- Always try to keep their house dry and clean.
- Ensure proper movement of light and air inside their house.
- Keep different aged quails separated from each other.
- Separate the disease affected quails from the healthy one.
- Burn the dead bird or put under soil.
- Do not allow other birds, animals or unknown persons enter inside farm quail house.
- Ensure hygienic and balanced feed supply.
- Provide adequate fresh and clean water according to their demand.

Marketing Quail Products

Quail meat and eggs are very tasty and highly enriched with nutrient elements. So there is already an established market for quail products. As quail birds and their eggs are small in size, so it is cheap in price and all types of people can purchase. So a farmer does not have to worry much about marketing his or her products. He or she can easily sell the eggs and meat in his or her local market. But it will

be better if a farmer determines his or her marketing strategies before starting this business. Because all places around the world have not the same marketing facilities.

In a nutshell, quail farming is playing an important role for fulfilling the daily family nutrition demands and earning livings. And commercial quail farming can be a great source of employment, and earning some extra income along with someone's current job or profession. Quail farming is also very entertaining and it is very easy to raise some quails. If someone intends to join this business venture, then he or she should try to visit some farms in his or her area. And finally do it.

- **Pheasants** – Ring neck or Ornamental, a challenge for the enthusiast.

Benefits of Keeping Poultry

Keeping poultry is associated with a number of benefits. Below we bring you some of these:

- Occasional consumption provides a valuable source of protein in the diet.
- Play an important socio-cultural role in many societies.
- Recycling of household scraps-poultry are good scavengers.
- Provide a major income-generating activity from the sale of birds and eggs. Thus, enhancing household income. In Uganda, the market price of an egg is Uganda Shillings 300 (this translates to Ugx 9,000/= per tray (30 eggs) and that of a fully grown cock can go for between Ugx 25,000/= to Ugx 45,000/= and a female hen can go for between Ugx 10,000/= to Ugx 20,000/=. With

such figures a farmer can easily compute how much he or she can bag home with whichever number of birds he or she has.

- Provide very good organic manure which can enrich other agricultural activities by improving soil fertility, hence leading to better yields.
- Poultry keeping uses family labour, and women (who often own as well as look after the family flock) are major beneficiaries.
- Poultry represents one of the few opportunities for saving, investment and security against risk.

Systems of Poultry Farming

Family poultry are kept under a wide range of conditions, which can be classified into one of four broad production systems:

- **Free-range/extensive system**: This method is oldest of all and has been used for centuries by general farmers, where there is no shortage of land. Under free-range conditions, the birds are not confined and can scavenge for food over a wide area. Rudimentary shelters may be provided, and these may or may not be used. The birds may roost outside, usually in trees, and nest in the bush. The flock contains birds of different species and varying ages.

Advantages of free range method

- If a farmer is selling the eggs or the chickens he or she will get a better price as people are willing to pay more for free ranged chickens and eggs. This is because the eggs and meat taste better, are healthier and are more nutritious with higher levels of nutrients and less fat.

- The cost of feed for free range chickens is less because the chickens will eat bugs and greenery when they are outside. A farmer also does not have to spend more getting them grit and rocks as they will find their own grit. Because their diet is so varied, they tend to produce more nutritious eggs.
- Another advantage to free range chicken farming when raising backyard chickens is that chickens which are free ranged will weed and debug the farmer's yard because they prefer to eat weeds and bugs to store bought feeds. If the farmer has a small garden and need manure, the chicken poop (guano) is an excellent manure source which will save the farmer on additional costs.
- Free range chicken medical costs are cheaper especially if the farmer decides to go with herbal and natural treatments for minor ailments such as lemongrass for detoxification, guava, chilies, and garlic work as antibiotics and there are leaves that can be used as anti-mite and anti-parasitic medicines such as ipil-ipil leaves.
- He or she also does not need to spend any more time cleaning up after them and the coop stays cleaner for longer.

Disadvantages of the Free Range Method

- Free range chickens will often poop everywhere so if there are areas of the farmer's yard he or she may not want to get the chicken poop, he or she will have to find a way to block the chickens from those areas.
- Free range chickens will also tend to lay their eggs everywhere which can make it difficult to collect the eggs.
- The chickens may stray into neighboring homesteads and free range chicken farming makes them more prone to predators and disease outbreaks.
- The chickens also eat up the greenery so that some parts of the farmer's yard will be bare which can make the farmer's yard more unattractive.
- Scientific management practices cannot be followed because there is no control over the birds.

- **Backyard extensive system**: Poultry are housed at night but allowed free-range during the day. They are usually fed a handful of grain in the morning and evening to supplement scavenging.

- **Semi-intensive system**: This system is adopted where the amount of free space available is limited, but it is necessary to allow the birds 20-30 square yards per bird of outside run. Wherever possible, this space should be divided giving a run on either side of the house of 10-15 square yards per bird, thus enabling the birds to move onto fresh ground.

Advantages of the Semi Intensive Method

Advantages of this system are:

- Low investments and higher returns.
- Significant savings in feed costs.
- Better meat quality, the meat being lean and fat free compared to broilers grown in confined cages.
- Better returns to the entrepreneur.

Disadvantages of the Semi Intensive Method

- ◊ Losses may be encountered by birds of prey and from failure to find eggs laid in bushy areas.
- ◊ The poultry run requires a considerable amount of fencing which can turn out to be costly.

❖ **Intensive system:** In this system the birds are confined to the house entirely, with no access to land outside, and it is usually adopted where land is limited and expensive. There are three types of intensive systems:

(a) ***Deep litter system***: In this system the poultry birds are kept in large pens up to 250 birds each, on floor covered with litters like straw, saw dust or leaves up to depth of 8-12 inches. Deep litter resembles to dry compost. In other words we can define deep litter, as the accumulation of the material used for litter with poultry manure until it reaches a depth of 8 to 12 inches. The build-up has to be carried out correctly to give desired results, which takes very little attention.

Advantages of Deep Litter System

- **Safety of Birds:** Birds on rage of even in a netted yard can be taken by wild animals, flying birds, etc. When enclosed in deep litter intensive pen which has strong wire netting or expanded metal, the birds and eggs are safe.
- **Litter as a source of food supply:** It may come as surprise to learn that built-up deep litter also supplies some of the food requirements of the birds. They obtain "Animal Protein Factor" from deep litter and some work indicates that this could learn that birds obtain sufficient of this to enable to suitable feed ration to be prepared with only a vegetable protein such as groundnut meal included in the feed. The level of vitamins such as riboflavin increases up to nearly three-fold.

According to experiments conducted. The combination of this and the Animal Protein Factor is necessary to good hatchability of eggs and early growth of chickens.

- **Disease control:** Well managed deep litter kept in dry condition with no wet spots around water has a sterilizing action. The level of coccidiosis and worm infestation is much lower watered kept on good deep litter than with birds (or chickens) in bare yards and bare floor sheds particularly where water spillage is allowed.
- **Labour saving:** This is one of the really big features of deep litter usage. Cleaning out poultry pens daily or weekly means quite a lot of work. With correct conditions observed with well managed litter there is no need to clean a pen out for a whole year; the only attention is the regular stirring and adding of some material is needed.
- **The valuable fertilizer:** This is a valuable economic factor with deep litter. According to McArdle and Panda, 35 laying birds can produce in one year about 1 ton of deep litter fertilizer. The level of nitrogen in fresh manure is about 1%, but on well built-up deep litter it may be around 3 per cent nitrogen (nearly 20% protein). It also contains about. 2 per cent phosphorus and 2 per cent potash, its value is about 3 times that of cattle manure.
- **Hot weather safeguard:** This is an important feature in a hot climate. The litter maintains its own constant temperature, so birds burrow into it when the air temperature is high and thereby cool themselves. Conversely, they can warm themselves in the same way when the weather is very cool. Accordingly, it is a valuable insulating agent.

Disadvantages of the Deep Litter System

- The cost of constructing a deep litter house is high.
- Requires large quantity of litter, adding to the production cost.
- Wastage of feeds by birds.
- Cannibalism and pecking of eggs are common practices in layers under this system.
- If in anyway there is a disease outbreak it spreads faster in deep litter system.
- Difficult to detect unproductive birds in deep litter system.

(b) ***Slatted floor system***: wire or wooden slatted floors are used instead of deep litter, which allow stocking rates to be increased to five birds/m^2 of floor space. Birds have reduced contact with feces and are allowed some freedom of movement.

Advantages of the Slatted Floor System

- No chance of litter borne diseases.
- Easy collection of droppings.
- Avoid wetting of litter during the rainy season.

(c) ***Battery cage system***: This is usually used for laying birds, which are kept throughout their productive life in cages. There is a high initial capital investment, and the system is mostly confined to large-scale commercial egg layer operations.

In the battery system each hen is confined to a cage just large enough to permit very limited movement and allow her to stand and sit comfortably. The usual floor space is 14 X 16 inches and the height, 17 inches. The floor is of standard strong galvanized wire set at a slope from back to the front, so that the eggs as they are laid roll out of the cage to a receiving gutter. Underneath is a tray for droppings. Both food and water receptacles are outside the cage.

Many small cages can be assembled together; if necessary it may be multistoried. The whole structure should be of metal so that no parasites will be harbored and thorough disinfection can be carried out as often as required.

Provided the batteries of cages are set up in the place which is well ventilated and lighted, is not too hot and is vermin proof and that the food meets all nutritional needs, this system has proved to be remarkably successful in [lie tropical countries. It may be that as it requires a minimum expenditure of energy from the bird, which spends its entire item in the shade, it lessens the load of excess body heat. The performance of each bird can be noted and culling easily carried out. Pullets, which are more often used than birds of over one year, should be placed in the cages at least one month before they are expected to lay.

The feeding of birds in cages has to be carefully considered, as the birds are entirely dependent on the mash for maintenance and production. To supply vitamins A and D, cod liver oil, yeast, dried milk powder are useful/ and fish meal or other animal protein, and balanced minerals and some form of grit must be made available.

As in each cage there will be only pullets so one can never expect fertilized eggs, hence the vegetative eggs will be there, which can be preserved for a longer time than fertilized eggs at ordinary room temperature but can never be used for hatching purposes.

Advantages of the Battery Cage System

The battery cage system is associated with some of the following merits:

- Allows to rear greater number of birds per unit of area.
- Facilitates correct maintenance of records of birds.

- Helps in identifying poor producers and prompts culling.
- Controls vices of poultry like cannibalism and egg eating.
- Helps in production of clean eggs and removing stress factor.
- Allows easy control of parasitic disease like coccidiosis and worm infestation.
- In this system, one can take prompt steps to control feed wastage.
- Layers put in the cage system proved to be having more egg production than in deep litter system.
- Feed efficiency and egg weight were better in caged birds than the laying flock under deep litter system.

Disadvantages of the Battery Cage System

Below are some of the demerits of the battery cage system:

- Difficult to ensure proper ventilation to birds especially under very dense conditions.
- Incidence of leg problem, fatty liver syndrome, cage layer fatigue, flies and bad gases in the house will be on the increase.
- The handling of manure may be a problem.
- The investment per pullet may be higher than in the case of floor operations.

- **Folding unit System:** This system of housing is an innovation of recent years. In portable folding unit's birds being confined to one small run, the position is changed each day, giving them fresh ground and the birds find a considerable proportion of food from the herbage are healthier and harder. For the farmer the beneficial effect of scratching and manuring on the land is another side effect.

  The disadvantages are that food and water must be carded out to the birds and eggs brought back and there is some extra labor involved in the regular moving of the fold units. The most convenient folding unit to handle is that which is made for 25 hens. A Floor space of 1 square foot should be allowed for each bird in the house, and 3 square feet in the run, so that a total floor space to whole unit is 4 square feet per bird, as with the intensive system. A suitable measurement for a folding house to take 25 birds is 5 feet wide and 20 feet long.

ESTABLISHING A POULTRY FARM

There are two alternatives for flock establishment. The farmer can either: **Rear day-old chicks** or **buy started pullets**.

REARING DAY-OLD CHICKS

The farmer can buy day-old chicks to rear, or breed his or her own chickens. If he or she buys, the chicks must be vaccinated against Mareks disease.

Day-old Chick Quality

What does "**day-old chick quality**" mean? Traditionally, it has been defined as the combination of hatchability and three-day mortality. There is actually no single definition: this concept is more or less subjective.

To try to define it properly, let's split the wording in two parts: one can state that:

- The "**day-old chick**" (DOC) is the newly-hatched chick (Gallus gallus). It can be considered in the hatchery, and until the farm where it will be housed and fed to provide a broiler chicken, a laying hen, or a breeding cock or hen. According to some countries like France, "one-day old-chick" can actually last longer than 24 hours, e.g., until 72 hours of life in the French law;
- **Quality** can be defined as "a set of product's characteristics that confer to it the ability to address needs, should they be expressed or implicit".

One must ensure the best chick to target the best final chicken. Chick quality covers all the parameters which directly relate with the ability of the chick to generate a profit.

But what about the hatching success: what kind of role does it play in the whole chick quality? Is a maximum hatchability rate the best and unique indicator for viability, growth, and best return on-investment? What about other possible criteria? For instance, it is well recognised that there is a great correlation between the bodyweight at 7 days of age and at slaughter. Let us have a look backwards at all steps by starting in the breeding farm, focussing on possible means to check the quality of the chicks and ways to improve it.

Breeder Flock

There are numerous husbandry and pathological conditions that may impact egg production and/or quality and consequently affect the day-old chick quality:

- ◊ Unsuitable lighting programme;
- ◊ Unbalanced diet: it has direct impact on hatchability and chick quality;
- ◊ Physical and microbial quality of the diet;
- ◊ Pathogens with direct effect on egg production: infectious bronchitis, egg drop syndrome, avian encephalomyelitis, Newcastle disease, Marek's disease, etc.

◊ Pathogens with indirect effect, by debilitating the general state of health: infectious laryngotracheitis, swollen head syndrome, mycoplasma, infectious coryza, E.coli, etc.

In addition to preventing diseases occurrence in the breeders themselves, an integrated vaccination regime is also aiming at transferring a passive immunity to the progeny through the egg yolk, to protect them for their first two to four weeks of age: infectious bursal disease, chicken anaemia, reovirus, and encephalomyelitis. Such passive immunity is crucial in protecting the chick, while the young bird is completing the maturation of its own immune mechanisms. We should keep in mind that the amount of maternally-derived antibodies transferred to the progeny is directly proportional to that of the hen. The transfer rate is approximately 50%. The higher the antibody titre in the hen, the higher the quantity of antibodies transmitted to the chicks and the longer this passive immunity lasts.

The hygiene of eggs laid is crucial. When the egg is laid down, its inside temperature decreases from the hen's body temperature (41°C or 106°F) to the temperature prevailing in the nest box: by cooling down, its content will retract, and this process can draw into the egg any outside contamination. To avoid this, first minimise the rate of floor eggs, because they are heavily contaminated, hatch badly and produce the most rots in the incubators; should the farm reduce floor eggs by 1%, the hatchery contamination will drop by 10%; secondly, ensure that the nests are always clean; lastly, collect the eggs as frequently as possible (e.g., every hour, and starting as early as possible in the morning) to get them onto a tray as quickly as possible. In addition, the shell cuticle has to dry, as it will tighten and limit bacterial penetration.

Handling the Hatching Eggs

An egg is quite robust. But as it contains a developing germinal disc, and later a developing embryo, it is very sensitive to "adversities," such as:

❖ **Temperature:** too low, too high temperatures must be avoided, as variations in temperatures as well. During egg storage in the breeding farm, the environment must be set at around 16°C and 75% humidity. Eggs are put in storage for up to 14 days (depending on the strain and the age of the breeder hens) before being transported to the hatchery for incubation. This storage procedure has been recently questioned, as it may decrease hatchability rate from 89% after a 4-day to 72% after a 14-day storage, for instance; incubating the eggs for 6 hours at 37.5°C before starting the

cooler 14-day storage can boost this rate back to 82%, in this example. Other workers have shown that a short storage time (3 days versus 18 days) results in a better relative growth at 7 days of age;

- **Bacteria and fungi:** they can induce rots (and a decreased hatchability rate), or a poor chick quality through yolk sac infection or "brooder pneumonia" (aspergillosis). It is linked to the hatchery hygiene, but also to the cleanliness of the egg at collection;
- **Micro cracks in the shell:** Poor quality egg can be due to micro cracks in the shell, inducing dehydration and embryonic death;
- Incorrect storage position;
- **Exposure to chemicals:** some of them can penetrate the egg, and be toxic to the embryo, whereas others, such as disinfectants can block the pores of the egg shell;
- **Excessive handling:** it can induce micro cracks in the shell.

Incubating the Embryonated Eggs

During the first week of incubation, the organs and basic membrane systems (amnion, allantois and yolk) are formed. Rotation of the eggs is the most critical factor during this period, as it stimulates gas exchanges through the chorioallantois.

The climate control of incubators must be flexible. Depending on the strain of breeders, week of lay (inducing a given egg size), duration of storage and shell thickness (inducing higher or lower moisture losses), the incubation programme must be adjusted by changes in temperature, ventilation and relative humidity.

Optimal parameters are usually provided by the breeding company. Incubation temperature is the most critical environmental factor, not only for hatchability but also for post hatch growth. Embryo temperature is deducted from the eggshell temperature by using an infrared fever thermometer for instance. It can be stated that the average eggshell temperature must be set at around 38°C (100.4°F) during the first 2/3 of incubation, and it should not exceed 38.5°C (101.3°F).

A too cold temperature during incubation will induce small sized chicks, because they will use their nutrients resources first to survive, instead of growing and developing.

A too high temperature during incubation will induce small sized chicks as well, because of dehydration, and a too fast yolk utilization. The DOCs will also show bloody navels.

An adequate humidity (55%) will not only remove the metabolic water, but it also plays an important part in the heat supply in the first nine days of incubation, and in the heat removal from the egg afterwards. The larger the egg, the larger the chick body mass, the higher the amount of heat produced.

Key factors:

- During the first two thirds of incubation: water loss from incubator;
- During the last week of incubation: ventilation to remove carbon dioxide and heat produced in excess by the embryo. A common rule is 6.8 m^3 per hour. The target is to ensure 21% oxygen and 0.3% carbon dioxide in the outside air.

There is a huge variability in practices concerning the time between hatching and placement of the DOCs. In general, an early placement, and consequently an early feeding is the rule to increase the yolk absorption.

Heterogeneity in the incubating eggs (i.e., derived from different parent stocks) must be taken into account, as:

- Eggs from old breeders hatch earlier than those from young breeders;
- Within a single flock age, chicks from smaller eggs hatch earlier than those from larger eggs;
- Chicks from older hens seem to tolerate longer periods between hatch and placement than chicks from younger flocks. Small chicks have a proportionally smaller residual yolk.

A common rule is to pull the hatch when 5-10% of the chicks are still wet behind their neck. The chicks are held in a room where a temperature of 24°C or more, and a relative humidity of 50%, have to be ensured. Dehydration has to be prevented.

Sample dead-in-shell embryos, hatcher fluff, and chick tray liners for salmonella monitoring on every hatch. Hatchery environment may be sampled twice weekly.

At hatch, or more and more frequently by in ovo route at 18 days of incubation, numerous vaccinations can be carried out, given the easiness to mechanically handle DOCs in boxes, or eggs,

respectively. In addition, there are far less risks of failures in vaccine administration at the hatchery than at the farm level.

Receiving the Chicks in the Farm

At arrival in the farm, several "tricks" are available to assess the quality of the purchased chicks.

Purchase Conditions

Check the accompanying documents to know the number of the originating breeder flocks. The best situation is one unique breeder flock, but it is actually quite rarely the case. Avoid, if possible, multiple origins, and especially breeding flocks of different ages (leading to a heterogeneity in the chicks).

Check the transportation conditions themselves from the hatchery to the farm:

- Transportation period: ensure that the chicks are being transported during the coolest parts of the day,
- Transportation length and time: the time spent in transportation can be a significant factor leading to dehydration and yolk depletion,
- Cleanliness of the transportation truck,
- Environment in the transportation truck: ventilation system; the internal truck's temperature must be set at around 21-24°C (70-75°F).

These immediate information have to be sent back to the hatchery for improvement request, if necessary. On the opposite, do not forget to congratulate the hatchery for sending good quality chicks!

Immediate Physical Examination

Weigh a representative number of chicks (e.g., two chick boxes): the average bodyweight should be at around 40 grams (to be compared to the breed's standards), with the lowest possible weight heterogeneity. A good and uniform size is obtained when chicks did hatch from eggs weighing at least 48 to 50 g, on average.

By direct inspection, the chicks must be:

- Dry and clean, with clear and bright eyes.
- As homogeneous as possible according to: size, quiet, alertness and exploratory behavior.

- Without deformities: toes, feet and legs must be straight, without lesions or swelling.

A "**dark**" coloration on the neck is the evidence that the chick recently hatched.

Check the navel of some chicks: it must be sealed and clean, i.e., free from adhering dried yolk, shell and membranes.

Record the number of dead DOCs upon arrival (to be compared to standards).

IN SUMMARY

Obtaining a quality day-old chick is characterized by a chain of successive, and related events:

- The laying of embryonated eggs,
- The collection of the embryonated eggs,
- The incubation of the laid eggs,
- The transfer of the eggs from the incubation trays to the hatcher,
- The hatching of the chicks,
- The handling of the hatched chicks, including placing them into boxes, possibly vaccinating them (e.g., by spray), and putting them in a truck,
- The transport until the farm,
- The handling of the chicks in the farm at receipt (environment, density, water and feed availability, etc...).

In every step, failures can affect the final quality of the chick obtained: technical failures (temperatures or ventilation breakdowns), insufficient hygiene at any step of the chain, low quality of the originating eggs (due to the breeder chickens or the breeder farm).

Everyone involved in one step should keep in mind this long succession of events, and integrate the fact that his/her work is part of this chain.

Management of Chicks in a Brooder

Raising brooder chickens is the first step in poultry production. The period from hatching until the chickens no longer require supplementary heat is called the "***brooding period***". Day old chicks are purchased from a supplier and are supplied in a delivery box. These chicks are then raised in a brooder for approximately three to four weeks, where after they are further raised either for egg production as layers, or for meat production as broilers.

What a brooder is?

A ***brooder*** is a safe, dry, uniformly warm, draft-free place where chicks spend the first weeks of their lives. In fact, the device or equipment used for providing artificial heat to baby chicks is known as a ***brooder***.

Diligently and carefully managed brooding of chicks is crucial to their long-term health and survival. Farmers express frustration with low survivability in chicks, which may stem from poor stock, chronic but not debilitating disease in the breeder flock, inadequate brooding husbandry, or shipping stress.

Chicks are most vulnerable to disease and cold when very young, so the utmost care and attention should be given to husbandry and sanitation to prevent losses during brooding. To increase the potential for success start with good vigorous stock from a reputable breeder. If possible, purchase chicks from a local breeder to avoid the stresses of shipping. While overnight shipping is an acceptable and generally humane means of transporting day-old chicks, postal delays and exposure to cold temperatures are not uncommon, and stress these young, fragile creatures. With good stock and detailed attention to their care early in their lives, chicks can grow into healthy, hardy birds that will have few, if any, health problems.

Requirements for Brooders

- **Floor space**: Overcrowding and lack of feeder and drinker space can cause some chickens to grow slowly. Hence provide enough space for the feeders and drinkers. At age one to four weeks, 20 birds need floor space of approximately 1.0 m^2.

- **Feed**: The chickens should have unrestricted access to feed and water. In the first week, the feeders that are used must be shallow. Upon introducing the day-old chicks in the brooder, Provide them water first (at 27°C, or 80°F); it can be sweetened to bring immediate energy. Then add feed. There is no doubt regarding the need for carbohydrates, but there is a requirement for amino acids as well. The residual yolk is used up slightly faster in DOCs that have immediate access to feed than those which are temporarily deprived.
- **Water**: One brooder chick will drink up to 80 ml of water in one day. Provide 10 mm drinking space per chicken, thus 100 chickens will need 1 000 mm of drinking space. The water needs to be replaced twice daily. It should always be fresh and clean.
- **Light**: If the brooder is well lit, the chicks are encouraged to eat from day one of age. For this, natural daylight may be used, as well as electrical light, or paraffin lanterns for the nights. Light affects the growth rate of chicks, so never keep them in the dark. Even if the farmer has to dim the lights to control cannibalism, the light should still be bright enough for him or her to see what is going on in the brooder. A rule of thumb is that dimmed lighting should be at least bright enough to barely read a newspaper.
- **Ventilation**: Fresh air is important to prevent disease, which develops easily in hot, humid conditions. However, precaution has to be taken against draughts.
- **Health**: Wet litter must be avoided (use a 100 mm thick layer of dry, clean, chopped litter).
- **Heat**: Warmth is essential during the first three to four weeks of the chicks' life and therefore the importance of brooding. Natural brooding, when the hen rears her own chicks, is only suitable for very small-scale poultry production units. The farmer can use brooder pots, electrical light or paraffin lanterns to provide heat. Set the inside temperature at the right level. There is a direct influence of temperature upon feed intake and growth. The DOC body temperature is at about 40°C (104°F). The chicks' thermoregulation system has not yet fully developed: chicks are homeothermics, i.e., they must have a constant body temperature. In addition, they cannot adapt to extreme ambient temperatures. They are consequently highly susceptible to chilling, or to wind. Conversely, from two weeks of age onwards, the chickens are becoming poikilothermics, i.e., the body temperature is able to adapt to varying temperatures. To know whether the temperature conditions inside the farm are accurate, look at the DOC spreading in the brooder area: are they uniformly spread? To ensure optimal ambient temperature in the farm, the brooders have to be switched on 24 hours prior to chicks' arrival.

Setting up a Brooder

Establish the brooder in a room or barn that is protected from the elements, free of drafts, and safe from predators. In addition to larger, more obvious predators (such as dogs and cats) secure the brooder from smaller predators such as rats and snakes.

The brooder must be kept uniformly warm. The temperature at the floor needs to be maintained at 90ºF or slightly higher, and temperature under the brooder at 95º F 2 to 3 inches from the floor. Standard brooding temperature during the first week is about 29-32°C (85-90°F); DOCs born to young breeders (less than 30 weeks of age) are usually smaller in size: this may be compensated by a warmer brooding temperature at start (32 to 33°C, or 90-91.4°F); it should be gradually reduced to 24-27°C (75-80°F) by the time they have fully feathered (around 21 days of age). The recommended final temperature until slaughter age should be set at 18-21°C (65-70°F).

Provide ventilation, allowing fresh air to circulate in the brooding area, but protect the chicks from drafts.
The size of the brooder will depend on the number of chicks to be raised at a given time.

It should be round. If the brooder is square, round out the corners by adding semicircular pieces of material (cardboard, wood, or sheet metal) secured in each corner. This reduces the likelihood of chicks piling into corners and suffocating the birds at the bottom.

If the brooder has been used before, disinfect it before introducing a new flock. Several weeks before any chicks arrive, the building, brooder, and other equipment associated with the chicks should be thoroughly cleaned and disinfected to prevent any contamination from pathogens that may be present from previous flocks, other livestock or wildlife.

The floor should have a small thin of layer. Bedding in the brooder needs to provide an absorbent, non-slippery surface for the young chicks. Most producers use readily available pine shavings in a layer 3 to 4 inches deep. The pine oils in pine shavings have the advantage by reducing mold growth. Other options include rice hulls, ground corncobs, shredded newspaper or finely chopped straw (if it is changed often).

Hardwood shavings and peanut hulls should not be used because they can become moldy. Avoid sawdust because chicks may eat it and become impacted in their crop or gizzard. Large particle litter, like woodchips, is not useful for bedding because it is not as absorbent as smaller particle litter.

Be attentive to the chicks when they are first introduced to the brooding enclosure. If a farmer sees his or her new chicks eating the bedding, he or she may choose to cover the bedding with newspaper or paper towels for the first couple of days, until they are eating their food well enough on their own. The farmer should not use slick materials to cover the bedding as these may lead to leg injuries known as splay legs.

How long should chicks stay in the brooder?

Chicks should stay for between three (3) to four (4) weeks in the brooder when they have fully developed feathers and no longer need artificial heat.

Heat (how does the farmer tell the variation of heat in the brooder)

Theoretically, chick brooder temperature is measured with a thermometer placed 2 inches (5 cm) above the brooder floor (and at the outer edge of a hover), but the poultry farmer should not need a thermometer. He or she should just watch the chicks, and adjust the temperature according to their body language.

Chicks that are not warm enough - due either to insufficient heat, or to draftiness - crowd near the heat source, peep shrilly, and may have sticky bottoms or outright diarrhea. In an effort to get warm

while they sleep, the chicks will pile up and smother each other. Piling is most likely to occur at night when the ambient temperature drops, so in cold weather check the chicks before going to bed, and if necessary, increase the heat overnight.

Chicks that are too warm move away from the heat, spend less time eating, and as a result grow more slowly. They pant and try to get away from the heat source by crowding to the brooder's outer edges, perhaps smothering one another. If the brooder is hot enough to raise their body temperature above 117°F (47°C), chicks die.

Happy chicks that are warm and cozy wander freely throughout the brooding area, emit musical sounds of contentment, and sleep sprawled side by side to create the appearance of a plush down carpet. The sight can be dramatic to someone who has never seen chicks resting comfortably.

Brooder Management Tips

Some management tips that will help a farmer to be successful are the following:

- **Be quiet and careful**. Noise and sudden movements can stress chicks.
- **Visit the brooder often**. Are the chicks eating and drinking? Are their drinkers clean?
- **Remove wet or hard baked litter**. Put dry fresh chopped grass or wood shavings in its place.
- **Remove weak or distressed chicks from the brooder**. If the farmer cannot cure them, he or she should kill and burn them.
- **Cleanliness, tidiness and no strong smells are the signs** of a well-managed brooder.
- If rats can get into the room despite all precautions, **cover the brooder with 13 mm wire netting at night**.
- **Keep records of the mass of the chicks and of feed used**. Weigh them every week in groups of 5 or 10 in a bucket or a basket.
- **Keep feeders and drinkers clean**. Chicks will get into their feed and water containers, so the water will get droppings in it. This means that for the first week or two these containers should be cleaned out several times a day and filled with fresh water and food.
- **Prepare for the end of the brooding period**. At four weeks of age, chicks have grown enough feathers to keep themselves warm. They do not need any more artificial heat. During their fourth week (third week in hot weather) the farmer can raise the heater a little each day. At the end of the fourth week it can be removed altogether.

❖ From four weeks of age broiler chicks are managed differently from layer-type chicks.

BUYING STARTED PULLETS

What are pullets?

Pullets are young hens, especially those less than one year old.

Obtain vaccinated started pullets 5-8 weeks of age from a reputable hatchery/grower. Started pullets are at a higher initial cost, but it is simpler and easier than rearing own chickens. The farmer will avoid the cost and risks involved in brooding.

Basics on Pullets

Healthy chicks that are raised under sound feeding and management practices will produce healthy hens.

Purchasing the right type of chick is important when starting or managing a chicken coop. If you want the best type of hen for egg production purposes, choose the small-bodied commercial White Leghorn strains. There are a few commercial brown egg-laying strains available that lay nearly as well as White Leghorns and are satisfactory for small-flock production. Consider raising both some good egg-type

pullets and some broiler crosses for meat, instead of using a dual-purpose breed that is not ideal for either purpose.

When you are purchasing chicks for egg production, choose sexed pullet chicks. You do not need males unless you want fertile eggs to hatch; they consume feed and take up space that you could more profitably use for hens.

You may be excited for the pullet to become mature so it can begin production, but it is better to delay the sexual maturity of pullets. This will allow them to grow better before egg production.

Increasing day length triggers early sexual maturity of the pullet.

If you have a small flock, consider starting chicks during the dry season because you will require less heat in order to brood them.

How to select the best pullets

Healthy pullets should look alert and be reasonably active most of the time, generally on the lookout for food. Pullets should not be hunched up, drowsy or even asleep during the day this is a sure sign of something being wrong.

Eyes should be clean and not have any bubbles in the corners. When picked up, a bird should not be wheezing or coughing. If in doubt, put an ear close to their beak and listen for a minute. Birds with respiratory problems should definitely be avoided.

The upper and lower beak should meet in the middle and should not be crossed over. Toes should be straight. Bent toes are a deformity that is usually inherited and whilst birds with these are good pet birds, the farmer should not breed from birds with such deformities.

Check legs and feet for raised scales (scales sticking out at 90 degrees) which indicates Scaly Leg Mite, a particularly uncomfortable problem for chickens.

Feathers should not be missing unless a bird is going through a moult (in which case a farmer should not really be buying them as the moult is a very stressful and demanding time for them). Missing

feathers can indicate bullying in the flock which does occur but often an unwell bird can lose her position in the pecking order if she is not in the best of health and get bullied as a result.

The farmer should not be afraid to ask whether to inspect the birds he or she is planning to buy. This will give him or her an idea of their temperament and give him or her the opportunity to inspect them for lice. Lice are like skin coloured miniature grains of rice that can be found on feathers and skin. They are fast moving and will crawl away as they are exposed to the light. They are not a huge problem and treatment is quite simple but if they are heavily infested it might be an idea to look elsewhere if the birds do not look in top condition. Some Fowl Mite can look like tiny specks of dirt around the vent area.

Are Your Pullets Productive?

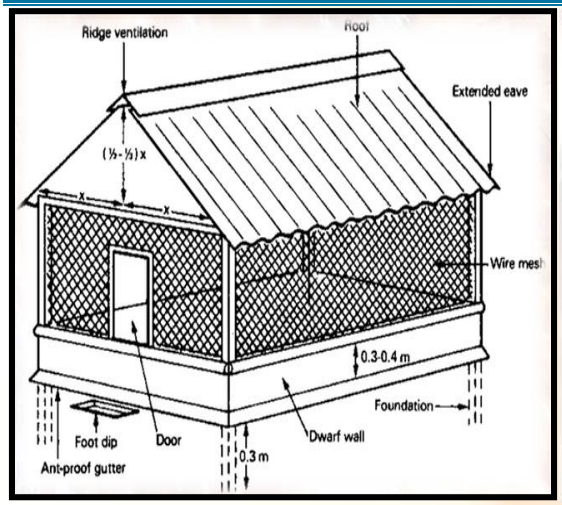
If your pullets are well taken care of, they can start laying eggs when they are between 16 and 24 weeks old. When they begin laying, they will need extra nutrition, so be sure to choose the right feed for hens.

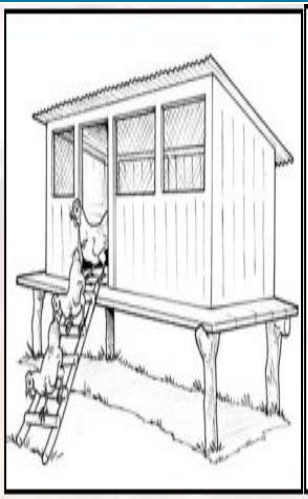
Here is how to tell if your pullet is a laying hen:

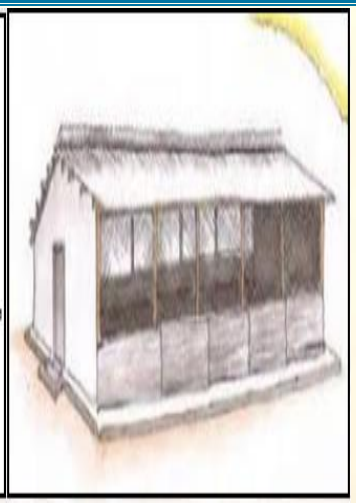
- The chicken will be between 16 and 24 weeks old
- It will appear to be full grown with clean, new feathers
- The chicken's combs and wattles will be swollen and look red
- The hen's pelvis bones will begin to separate. You can tell if this has happened by cradling the hen and holding its feet so it cannot kick you, then place your hand gently on its rear end, and see if three prominent bones feel close together. If so, it will be a few more weeks until she begins to lay eggs.

If your pullet is ready to start laying eggs, make sure to give her some privacy. It's vital to have nest boxes in place before the first egg arrives. Line them with straw, wood chips, dried grass, or shredded paper to make sure the eggs stay clean.

POULTRY HOUSING







Suitable poultry housing is very important for successful poultry farming business. Poultry birds can be raised in both free range and indoor production systems. In case indoor production system, it is very crucial to manage the environment. Poultry need accurate management and environment for better production and welfare. Whether the poultry raised in indoor or outdoor system, make sure the well management, ventilation, lighting, temperature and litter condition. For a small scale poultry production, portable houses are best and this is an organic method. But for sustainable commercial

poultry production, planned and proper designed poultry housing is very essential to keep the poultry birds healthy and productive. And this will increase the farming production and income.

Classification of Poultry Houses

Poultry houses are classified as below:

Temporary poultry house

Sometimes even chicken owners with the best intentions find themselves struggling to properly house their hens and newly hatched chicks. If a farmer finds him or herself running short on room, he or she can construct a temporary home for his or her birds that will provide them with protection from predators and elements until he or she is able to get a regular chicken coop built.

When the farmer wants to construct a temporary, safe home for his or her chickens, he or she can benefit greatly from taking advantage of whatever resources he or she already has at hand. He or she should look around his or her property for a sturdy structure that could be used to provide shelter, ideally a shed or garage that has sturdy walls as well as windows or another source of ventilation. Find an existing building or pen that is sturdy enough to keep out predators and protect his or her birds from winds, rain, extreme heat and even snow. Even a sturdy dog house or kennel-style dog run can be converted into a small, short-term shelter for his or her birds. Just remember that a farmer needs about 4 square feet of space per large chicken he or she plans to house.

Once the farmer has located a suitable basic structure to make his or her temporary chicken coop out of, he or she will need to customize it a little bit. He or she must make sure it has a roof of some kind to prevent his or her birds from escaping and predators from entering. If the structure does not have a roof, for example, if he or she is using a chain-link style dog kennel, he or she can construct one by attaching sheets of plywood to the top of it to create a roof.

Clean out the makeshift coop thoroughly and place nesting boxes with built-in roosts inside the coop so that the birds have a safe place to sleep. Fill the nesting boxes with hay or straw bedding. The farmer should make sure that feeders and waterers are placed inside the coop.

A farmer can build a temporary chicken coop from scratch. He or she can build a box by nailing together five sheets of plywood for four walls and a roof, and cut a door on one side to allow the birds

access to the outside. The farmer can also use four (or more) fence posts to create a run. He or she can place the posts in a square or rectangular shape, and then run wire fencing around the posts to create a fenced in enclosure. He or she can place plywood sheets over the top of the enclosure to create a roof.

Baby chicks can be safely housed in virtually any type of large tub. The farmer should just make sure to place the tub in a safe, dry location that is free of predators (i.e., inside his or her home, barn, and garage, etc.). Put feed, water, bedding and a heat lamp inside the tub to make sure the chicks will have all their needs met until they are large enough to be transitioned into a regular chicken coop.

Semi-Permanent Poultry House

Semi-intensive systems are commonly used by small scale producers and are characterized by having one or more pens in which the birds can forage on natural vegetation and insects to supplement the feed supplied. Provide at least two runs for alternating use to avoid buildup of disease and parasites. Each run should allow at least 10 to 15m^2 per hen and be fenced. A free-range allowing 40 to 80m^2 per hen is required where the hens are expected to obtain a substantial part of their diet by foraging.

A small, simple house, which allows 0.3 to 0.4m^2 per bird, and which has thatched roof, a littered earth floor and slatted or chicken wire walls on at least three sides will provide protection from rough weather, from predators at night and offer shade in the day time. The shelter should be large enough to enter to collect eggs and be equipped with nest boxes, feeders, drinkers and perches. For convenience the house should be situated so that access to each of the runs can be provided with small outlet doors.

This system is low in cost, but growth of the birds and egg production are likely to be less than with systems offering closer confinement and better feed. Losses may be encountered by birds of prey and from failure to find eggs laid in bushy areas. The poultry run requires a considerable amount of fencing.

Permanent Poultry House

The permanent poultry house is constructed from brick, clay, timber, corrugated iron sheets or any other available material.

Basic requirements for a permanent poultry housing

- **Floor** in the shed should provide space for three layers/m^2on 10cm deep litter. Density of birds per unit area is the most important basic principle in housing, as the space available determines the number and type of poultry that can be kept. For example, a deep litter house measuring 6 m by 11 m can hold 200 laying hens at a stock density of 3 birds/m^2 (3.6ft^2/bird). An ideal floor for a deep litter house is well drained and made of concrete, with a layer of heavy gravel or wire mesh embedded in it to keep out rats. This type of floor is usually costly. Wood, bamboo, bricks or large flat stones (according to what is locally available) can be used, but are harder to clean. Clay floors are cheaper, but require the application of a fresh layer of clay either between flock batches or at least annually. In areas where construction materials are cheaper than deep litter and particularly in humid regions where litter material is not available, raised floors are sometimes used. These are made of wire mesh, expanded metal, wooden slats or split bamboo, to allow the droppings to collect under the house, and should be about one meter above the ground to allow for cleaning and ventilation. Higher floors may result in an unstable building. They are supported by pillars, which are either rot-resistant or have stone or concrete footings, and which are made of such materials as wood, bamboo, oil drums and concrete blocks. Houses with raised floors on posts can be protected against rats with baffles. The baffles can be made of a metal collar, a tin can turned upside down or a metal band wound around the post, but must fit tightly to deter even the smallest rodent.

The roof and walls of the house can be made of any inexpensive local material, including bamboo slats, sorghum stalks, mud, wooden slats and palm fronds, as long as the structure is made relatively rat-proof. In colder regions, the walls should be thicker or insulated, but in warmer climates thatch can be used, although it should be replaced frequently to minimize parasite and disease problems. The inside of the walls should be as smooth as possible, to prevent tick and mite infestation and to make cleaning easier. Interior length-ways building partitions are not advisable, as they reduce cross-flow ventilation.

The roof should be watertight, and should overhang the walls by one meter if the windows have no shutters. The roof can be made of thatch, sheet metal or tiles. Thatch is usually the cheapest option and provides good insulation. It will probably have to be replaced every three years, or immediately if ticks get into it. It should be interlaced with bamboo or wooden slats to keep

predators out. Sheet metal is usually too expensive, and in hot climates must be painted with white or aluminum to reflect sun heat. However, it is easily cleaned which is an important advantage where ticks are a problem. A layer of plastic sheeting sandwiched between bamboo slats is a good seal against rain and vermin. Flattened oil drums can be used at a lower cost.
Although usually more expensive than thatch, sun- or oven-baked tiles will last much longer. Because of their weight, the frame for a tiled roof must be stronger than for other materials.

Window design depends on the local climate. Chickens need more ventilation than humans, but should be sheltered from wind, dust and rain. During storms, wood or bamboo hinged shutters or curtains made from feed sacks can cover window openings on the windward side of the house. In humid climates, window design should take as much advantage of the wind direction as possible to reduce the amount of moisture in the house. Window areas are best covered by wire mesh or expanded metal. Wooden slats or bamboo can be used, depending on available funds and materials. However, the thicker the material, the more ventilation will be reduced. Doors should be made of metal, wood or bamboo. The top half of the door could be wire mesh. Doors should be sufficiently strong to withstand being opened and closed many times a year.

- **Perches and roosts:** Chickens prefer to roost at night on perches. Perching space of 15 to 20 cm should be allowed for each bird. Birds lower in the social peck order can also use the perches during the day. The cross-section of each perch bar should be 2 to 3 cm. Their length depends upon the number of birds to be housed. The perches should be placed within a frame, and aligned parallel to the wall, and horizontally, with a sliding, removable platform called the "droppings board" about 20 cm below the perches to catch the manure droppings. The first perch bar should be placed 20 to 25 cm out from the back wall, and subsequent ones at 30 to 40 cm intervals. The droppings board should touch the back wall and extend 30 cm in front of the front perch bar, as this will allow the birds to land from their flight from the floor before seeking a perching spot.

  Droppings boards should be a maximum of 75 cm from the floor of the house, and the perch bars should be about 20 cm above the droppings board, to facilitate cleaning of the droppings board. Fowls deposit over half their droppings at night, and the use of the droppings boards thus helps to keep the floor clean. The manure can then be easily collected, dried and stored in empty feed sacks for use as an excellent fertilizer for plants requiring organic nitrogen. The area under the droppings board then becomes an ideal site for a communal nest.

- **Nest boxes.** To avoid excessive competition and minimize eggs laid on the floor, one nest should be provided for every five hens. If larger communal nests are used, at least one square meter per 50 birds should be allowed. Baskets, pots and cardboard boxes can be used for nests. Dimensions suitable for a basket or pot nest are a 25 cm base diameter, 18 cm high walls, and a 40 cm open top diameter. Nests should be situated in a secure, shady secluded place out of the sun, lined with fresh litter and kept clean. Nest boxes for individual hens should be constructed in multiple groups for larger numbers of hens. These are usually made of wood, and should measure approximately 30 cm on all sides, with a nest floor area of about 0.1 m^2.

- **Feed troughs** should provide 10cm/bird or more. Hanging adjustable feeders are ideal for up to 20 birds/feeder. In both intensive and semi-intensive systems, laying hens need constant access to food and water, and feeders should be distributed evenly throughout the chicken house. In the semi intensive system, birds scavenge during the day, mostly for protein (from such sources as insects, worms and larva), minerals (from stones, grits and shells), and vitamins (from leafy greens, oil palm, and nuts), but energy supplements such as maize, sorghum and millet are important for higher productivity and should be given.

  A good feeder should be:

  - Durable enough to withstand frequent cleaning;
  - Stable enough not to be knocked over;
  - Of the correct height and depth;
  - Bird proof (such that birds cannot get into it or roost in it); and
  - Equipped with a lip to prevent birds from spooning feed out onto the floor with their beaks.

- **Water troughs/Drinkers** should provide 10cm per adult bird. Automatic troughs, cups or nipples are ideal. For bell drinkers, less than 20 birds per bell drinker is recommended.

- **All woodwork** should be inspected for parasites such as mites, and treated with an approved pesticide.
- **Sufficient ventilation**: Ample air movement without a draft is essential. Fresh air brings in oxygen while excess moisture, ammonia or carbon dioxide are removed the stale air moves out of the house. Dampness and ammonia build-up is a sign that there is not enough ventilation. For small coops windows or vents on one side of the house usually provide plenty of ventilation. Failure to ventilate properly causes moisture to accumulate on the walls and ceiling in cool weather. Poultry can handle cold very well if they are dry. However, cool and humid conditions can create many health problems.

- **Protection (**from weather and predators). Many factors influence the type and choice of housing to protect poultry from the effects of weather and predators. These include the local climate, the available space, the size of the flock, and the management system. In extensive systems, birds must be protected from disease and predators but also be able to forage. Traditional large animal fencing using live plants is not enough protection against predators such as snakes, kites, rats, and other vermin.

A simple and effective system to deter predator birds is to tie parallel lines of string across the main scavenging area, the intervals between which measure less than the predator's wingspan; or, alternatively, a fishing net supported on poles can be spread across the side of the run where predator birds could swoop on the scavenging chicks.

Leg traps can be set for large predators. It is not necessary to set traps around all the pens, as predators tend to attack the same pen on the second night. Steel traps can be boiled in walnut hulls or cocoa pods, both to camouflage them and to prevent rust. The traps will be more effective if not touched with bare hands, as most predators have a keen sense of smell. Instead, they should be handled with a stick, rubber gloves or tongs.

Rats, mongooses and snakes are only a problem when the birds are small. Rats often come up through the earth floors, and the first signs of a rat attack may be unusually quiet chicks huddled under the brooder heater or in a corner, or dead chicks with small bloody neck scratches. Snakes will kill chicks if they can get into the brooder house. A treble fishhook in a dead bird can be left

as bait: the snake will swallow the hooks as it gulps down the bird and eventually die. Holes around doors and windows through which rats and snakes may enter should be plugged.

Coops or baskets may be used to house mother hens and chicks in order to reduce chick mortality due to predators, thieves, and rain. They also allow for separate feed and water supplementation, although the inadequate feed usually provided in coops means that some scavenging remains necessary.

Predator attack modes and control methods

Predator	Attack mode	Control method
Hawk 	• Picks up stray birds and weaklings. • Attacks birds so that head and toe marks are visible on the back. Often plucks birds.	Hunt the hawk and keep chicks away from clear swoop areas.
Rat, mongoose 	Usually take more than they eat, and stuff chicks in holes for later consumption.	If allowed, use rat poison The farmer can also use rat glue traps.
Snake 	Will swallow eggs and chicks	• Use fishhooks and any other applicable methods of killing snakes. • Plant tobacco around the poultry farm. Tobacco is very effective in keeping snakes away.
Dog, cat	General destruction	Try to catch them. Cats can control rats but wild cats and dogs are a problem.

		
Fox, jackal 	Will bite off the feathers over the back and between wings, eat the entrails and breast, and carry the bird to the den.	Roam in the early morning to kill for their young. Trapping is the best control.

To protect the birds from theft, lock the building and pens securely whenever no one is at home. Have neighbors watch for visitors while everyone is away. Some people actually have burglar alarms in their bird coops. A protective dog kept near the coop usually works well to discourage predators and unwanted visitors.

Build poultry houses to prevent possible injury to the birds. Any loose or ragged wire, nails, or other sharp-edged objects should be removed from the coop. Eliminate all areas other than perches where the birds could perch more than 4 feet above the floor. Remove perching areas such as window sills, nest box tops, or electric cords whenever possible. These extra measures could eliminate any injury to the farmer or his or her birds and may prevent damage to the coop, as well.

- **Light: Duration and intensity**: A well-lit house is essential. A dark house leads to lethargic, inactive, unproductive birds. Light is important for feeding, as poultry identify food by sight. This is especially important for intensively managed day-old chicks, which need very bright 24-hour lighting for their first week of life. Light is also an important factor in sexual maturity. An increasing light proportion in the day, as naturally occurs from mid-rainy season to mid-dry season, will accelerate sexual maturity in growing pullets, bringing them to lay sooner. If hens are already laying, the increasing light proportion will increase egg production. The opposite effect is also true: as the light proportion of the day decreases (as naturally occurs from mid-summer to mid-rainy), then sexual maturity is slowed in growing stock, and egg production is reduced in laying hens. These effects are somewhat reduced towards the equator, as the difference in the daylight proportion of a day changes less and less.

This physiological effect on poultry is important in terms of maintaining egg production in commercial flocks, and requires supplementary lighting programmes. Regular and reliable electricity supply is required for such programmes, otherwise the effect can be made worse by breaks in the light supplementation system. A slow but steady increase maximizes the rate of production. However, lighting programmes producing an effective daylight proportion in excess of 17 hours per day can have a worsening effect on egg production. A 24-hour security lighting system can have such an effect on egg production.

Birds do best in situations where there is plenty of natural light that does not raise the temperature of the house. Natural light is preferable unless regular, reliable and well-distributed artificial light can be provided. It is recommended that the interior of the house be whitewashed to reflect light. The intensity or brightness of the light is also important. Egg production will decrease at light intensities lower than five lux (the "lux" is the metric unit of light intensity and can be measured by a meter similar to that measuring light intake into a camera lens), although meat chicken will keep growing optimally at light intensities as low as two lux (not bright enough to read a newspaper). These intensities are measured at the eye-level of the bird, not near the light source. Unless supplementary lighting is spaced uniformly, there may be areas in the building insufficiently lit to allow optimum growth or egg production. Designs for layout assume that the light bulbs or tubes will be kept clean, as dusty surfaces will reduce light output.

BIOSECURITY ON POULTRY FARMS

Bio-security Defined

Bio-security refers to those measures taken to prevent or control the introduction and spread of infectious agents to or from a flock. Such infectious agents, whether they cause clinical or subclinical disease, significantly reduce the productivity, profitability, and long term financial viability of a poultry operation.

Bio-security requires the adoption of a set of attitudes and behaviours by people, to reduce risk in all activities involving poultry production and marketing.

Bio-security Measures

Below are some of the bio-security measures that can be implemented on a poultry farm:

◊ **Restrict access to the property and the birds through fencing off the area where the birds are**. Labels can also be put in place restricting access to the property. Below are illustrations of such labels.

◊ **If trucks cannot be avoided on the farm level, clean and disinfect them prior to entrance**. Spray the wheels, tires, and wheel wells prior to leaving premises. Such a label as shown in the picture below can be put in place to notify any unauthorized truck on the farm and if biosecurity checks are in place, this should be clearly stated on the label.

◊ ***At the entrance there must be a footbath which must be inspected daily (e.g. for excessive organic matter) and the contents replaced*** as required to achieve an adequate concentration of suitable disinfectant used according to manufacturers' recommendations. Foot baths should be used when entering and exiting poultry houses.

◊ **Allow only people who take care of the birds to come into contact with them**. The caretakers should not attend bird shows or events where birds are present. If visitors to property want to see the birds, be sure they wash up first and clean their shoes. Better yet, keep clean boots for visitors to wear. If the visitors have birds of their own, **do not** let them near birds at all.

◊ **Changing area**: There must be a changing area where hands washing, scrubbing of shoes, change of footwear and body clothing into well disinfected farm overall and gumboots takes place.

◊ **Game birds and migratory waterfowl should not have contact with the flock because they can carry germs and diseases**. If the birds are outdoors, the farmer should try to keep them in a screened area.

- ◊ **Taking some of the birds to a fair or exhibition? Keep those birds separated from the rest of the flock and watch them for at least 2 weeks** after the event to ensure that they did not pick up a disease.
- ◊ **New birds should be kept separate from the flock for at least 30 days before putting them with the rest of the birds**. To prevent disease, it is best not to mix young and old birds or birds from different species or different sources.
- ◊ **Do not share birds, lawn and garden equipment, tools, or poultry supplies with neighbors or other bird owners.** If these items are brought home, clean and disinfect them before they reach the property. And remember to clean and disinfect borrowed items before returning them. Never share items such as wooden pallets or cardboard egg cartons because they are porous and cannot be adequately cleaned and disinfected.
- ◊ **Monitor and inspect birds at least daily for signs of illness**. Investigate all birds with unusual signs or those unresponsive to treatment, especially those that die suddenly.

Disinfectants

What is a disinfectant?

A **disinfectant** is a chemical agent, which destroys, or inhibits growth of pathogenic microorganisms in the non-sporing, or vegetative state.

Disinfectants do not necessarily kill all organisms but reduce them to a level, which does not harm health or the quality of perishable goods. Disinfectants are applied to inanimate objects (***object that is not animate. Does not breathe, change, or live*)** and materials such as instruments and surfaces to control and prevent infection. They may also be used to disinfect skin and other tissues prior to surgery.

Criteria to consider when choosing a disinfectant

The ideal disinfectant would offer complete sterilization, without harming other forms of life, be inexpensive, and non-corrosive. Unfortunately ideal disinfectants do not exist. All disinfectants are also, by their very nature, potentially harmful (even toxic) to humans or animals. They should be treated with appropriate care. Most come with safety instructions printed on the packaging, which should be read in full before using the disinfectant. Most modern household disinfectants contain Bitrex, an exceptionally bitter substance designed to discourage ingestion, as an added safety measure.

Those that are used indoors should never be mixed with other cleaning products as chemical reactions can occur.

Often these are used in hospitals, surgeries, kitchens and bathrooms to kill infectious organisms. The choice of the disinfectant to be used depends on the particular situation. Some disinfectants have a wide spectrum (kill nearly all microorganisms), whilst others kill a smaller range of disease-causing organisms but are preferred for other properties (they may be non-corrosive, non-toxic, or inexpensive).

The following are some criteria to consider when choosing a disinfectant:

- **Cost**: The disinfectant should not be so costly.
- **Efficacy (i.e., killing efficiency against viruses, bacteria, fungi)**.Each disinfectant has unique antimicrobial attributes.
- **Degree of contamination**. This affects the time required for disinfection and the amount of chemical required.
- **Type of chemical**. It is important to understand the mode of action in order to select the appropriate disinfectant.
- **Amount of protein-containing material present**. Protein based materials absorb and inactivate some chemical disinfectants.
- **Activity with organic matter** (e.g. soap).
- **Toxicity to the environment** (relative safety to animals and humans)
- Residual activity and effects on fabric and metal.
- **Concentration and quantity of chemical**. It is important to choose the proper concentration and quantity of chemical that are best used for the disinfection of each situation.
- Solubility (i.e., acidity, alkalinity, pH)
- **Contact time and temperature**. Sufficient time and appropriate temperature, which is proportional to the degree of contamination, must be allowed for action of the disinfectant.
- Application temperature, pH and interactions with other compounds must be considered.

No disinfectant works instantaneously. All require a certain amount of contact time to be effective. Temperature and concentration of disinfectant influence the rate of killing of microorganisms. Using

the recommended concentration of disinfectants is important. The activity of many disinfectants improves markedly if the temperature is increased.

Examples of disinfectants

Below are some examples of disinfectants available on the market. Follow the directions on the label carefully for the best results. (*Note: The disinfectants listed below are manufactured and distributed by Interchemie whose permission was sought and granted for use of their products in our publications*).

Aquapure-1000

Aquapure-1000 are effervescent tablets used primarily for the disinfection of farm water. Water treated with Aquapure-1000 will be microbially safe for consumption by all farm animals.

Composition

Contains: Sodium dichloroisocyanurate 8680 mg.

Description

Aquapure-1000 are effervescent tablets used primarily for the disinfection of farm water. Water treated with Aquapure-1000 will be microbially safe for consumption by all farm animals. Aquapure-1000 tablets are also used to disinfect surfaces and equipment on farms. Aquapure-1000 tablets are effective against a broad spectrum of bacteria, fungi, spores, viruses and protozoa. The spectrum is including, but not limited to the following species: ***Bacteria***: Campylobacter spp., Enterobacter cloacae, Enterococcus faecium, Escherichia coli, Klebsiellapneumoniae, Listeria monocytogenes, Mycoplasma spp., Pasturellamulticoda, Salmonella spp., Staphylococcus aureus, and Streptococcus spp.

Fungi: Aspergillus spp., Candida albicans and Scopulariopsisbrevicaulis

Spores: Bacillus spp. and Clostridium spp.

Viruses: Adenovirus, Avipox, Rabies, Avian influenza, African swine fever, Foot and mouth disease and Hepatitis

Indications

Instructions for use:

Drinking water: Aquapure-1000 tablets are used for the provision of clean, safe drinking water for farm animals. 1 tablet per 800-1,200 litres of drinking water (4 - 6 mg/litre available chlorine). Disinfection of surfaces and equipment Aquapure-1000 tablets are used for disinfection of surfaces and equipment on farms.

Porous surfaces 1 tablet per 10 litres of water (500 mg / litre available chlorine).

Non-porous surfaces 1 tablet per 15 litres of water (350 mg / litre available chlorine).

Equipment 1 tablet per 10 litres of water (500 mg / litre available chlorine). Water should be treated with Aquapure-1000 for 30 minutes prior to use.

Warning

- ◊ Harmful if swallowed.
- ◊ Causes serious eye irritation.
- ◊ May cause respiratory irritation.
- ◊ Very toxic to aquatic life with long lasting effects.
- ◊ Contact with acids liberates toxic gas.
- ◊ Keep out of reach and sight of children.

Packaging

Jar of 60 tablets

Dexid-400

Synergistic combination

Dexid-400 is a concentrated broad spectrum disinfectant for surfaces and equipment. It is a synergistic blend of four active components with long lasting effect and a wide range of applications, including spraying, foaming and fogging.

It combines the powerful broad spectrum activity of lutaraldehyde with the soil penetrating, deterging and rapid biocidal capacity of quaternary ammonium compounds (QACs)

Dexid-400 contains:

- Quaternary ammonium compounds.
- Glutaraldehyde
- Isopropanol.
- Pine oil

Applications

- Dexid-400 is suitable for use on all surfaces including soft metals.
- Dexid-400 is biodegradable.
- Performs well in soft and hard water conditions and in the presence of organic matter.
- Dexid-400 is suitable for spraying, foaming and fogging applications

Directions of use

- Clean the surfaces with a proper detergent first, rinse and allow to dry.
- Disinfect with a contact time of at least 20 minutes.
- Areas should be rinsed thoroughly and allowed to dry before animals are returned to the area.

◊ **Animal husbandry housing and hatcheries:**

After rinsing and drying, apply Dexid-400 at 0.25% (no specific disease; 1:400) to 0.5% (disease outbreaks; 1:200) by spraying (ca. 1 l of solution per 4 m2). For fogging use 1 l + 4 l of water for 1000 m^3.

◊ **Animal transport trucks and trailers:**

After rinsing and drying, spray Dexid-400 at 0.5% (1:200).

For wheel rinses apply Dexid-400 at 0.5%.

◊ **Storage and processing rooms for feed and food:**

After rinsing and drying, apply 0.25 – 0.5% Dexid-400.

◊ **Transport equipment for foodstuffs:**

After rinsing and drying, apply Dexid-400 at 0.25 – 0.5%.

◊ **Boot dips:**

Dilute Dexid-400 at 0.5% and renew regularly (every 2-3 days; daily for best results).

Dexine-28

Introduction

Iodophores disinfectant with both detergent and disinfectant properties are widely used in cleaning and disinfection of animal farms. They are very effective against wide range of microorganisms including bacteria, viruses, spores and fungi.

Iodine inhibits protein function and is strong oxidizing agent. Iodine can penetrate the cell wall of microorganisms quickly, and the lethal effects are believed to result from disruption of protein and nucleic acid structure and synthesis.

Dexine-28 is an iodophor based disinfectant with added acids. It is a cleaner and disinfectant, Bactericidal, Virucidal, Fungicidal and Fungicidal; highly effective against major diseases of poultry, cattle and swine. It is harmless and can be used in presence of animals.

Dexid–70

Dexid-70 is a surface detergent sanitizer

Composition
Contains: Quarternary ammonium compounds70 mg.

Description
Dexid-70 is a phosphate- and odor-free, new-generation, highly concentrated detergent sanitizer, designed for use in all classes of livestock, food industry and on food contact surfaces. Dexid-70 includes two different quaternary ammonium compounds that expand its effect to a wide range of bacteria, viruses and fungi, like Escherichia coli, Staphylococcus aureus, methicillin resistant Staphylococcus aureus (MRSA), Streptococcus haemolyticus, Streptococcus pneumoniae, Streptococcus equi var. zooepiderrmicus, Streptococcus pyrogenes, Yersinia enterocolitica, Listeria monocytogenes, Rhodococcusequi, Salmonella cholerasuis, Salmonella schottmuelleri, Salmonella typhi, Salmonella typhimurium, Enterococcus faecalis (including vancomycin- resistant ones, VRE), Acinetobacterbaumannii, Brevibacteriumamoniagenes, Mycoplasma gallinarum, Mycoplasma gallisepticum, Mycoplasma hyopneumoniae, Pseudomonas aeruginosa, Enterobacteraerogenes, Klebsiellapneumoniae, Serratiamarcescens, Shigelladysenteriae, Vibrio cholerae, Bacillus cereus, Trichophytonmentagrophytes, Candida albicans, Hepatitis B virus, Herpes Simplex virus type 1 & 2, HIV-1, Avian Influenza, Infectious bursal disease (Gumboro), Cytomegalovirus, Newcastle Disease, Parainfluenza type 1, Pseudorabies virus, Influenza Type A and Vaccinia virus (Poxvirus).

Indications
Instructions for use
Cleaning of equipment: 1 litre Dexid-70 for 200 litres of water in a clean tank

Sanitation: 1 litre Dexid-70 for 200 litres of water in a clean tank.

Manual cleaning: 1 litre Dexid-70 for 100 - 200 litres of water in a clean tank.

Low pressure cleaning: 1 litre Dexid-70 for 100 - 200 litres of water in a clean tank. Use a volume of approximately 250-300 ml/m2 surface area.

High pressure cleaning: 1 litre Dexid-70 for 100 - 200 litres of water in a clean tank.

Instruments, equipment and tableware that will come into contact with food should be thoroughly rinsed with water after cleaning and disinfection. Dexid-70 works in hot and cold water and is readily biodegradable.

Warning

(a) Harmful if swallowed. In case of emergency, wash out mouth with water and give 200 ml of warm water to drink. DO NOT induce vomiting. Seek medical advice immediately.
(b) Harmful in contact with skin.
(c) Causes severe skin burns and eye damage. In case of emergency, immediately flood the eye with plenty of water and boric saline solution for at least 15 minutes, holding the eye open.
(d) Very toxic to aquatic life.
(e) Do not apply Dexid-70 in the presence of animals.
(f) Personal protective equipment such as gloves, masks and eye protection should be worn during the mixing or application of Dexid-70.
(g) Keep out of reach and sight of children.
(h) Containers should be rinsed with clean water and disposed of in line with local regulations.

Packaging

Bottle of 1 litre and jerry can of 5 litres (*as seen below*)

Dexid-200

Dexid-200 is a high performance broad-spectrum disinfectant

Composition

Contains per mi:

Quaternary ammonium compounds	125 mg
Glutaraldehyde	50 mg.
Isopropanol	130 mg.
Pine oil	3 mg.

Description

Dexid-200 is based on an optimized blend of glutaraldehyde and quaternary ammonium compounds (QACs) in aqueous solution, and combines the powerful broad-spectrum activity of glutaraldehyde with the soil penetrating, deterging and rapid biocidal capacity of QACs. It is a potent, high performance terminal disinfectant formulated for use in poultry hatcheries, livestock buildings and for disinfecting equipment, boot dips and wheel rinses. Dexid-200 has broad-spectrum activity against bacteria, viruses and fungi of importance in the effective maintenance of animal health and hygiene. It is designed as a terminal disinfectant for use after surfaces have been thoroughly cleaned and rinsed to remove all gross soil. Dexid-200 provides control over pathogenic bacteria, mycoplasma, viruses and fungi and their related diseases, such as Newcastle Disease, Swine Vesicular Disease, Avian Influenza, PRRS, Infectious Bursal Disease (Gumboro), Marek's Disease,

Avian Encephalomyelitis, Bacillus cereus, Campylobacter jejuni, Escherichia coli, Klebsiellapneumoniae, Listeria monocytogenes, Mycobacterium smegmatis, Pasteurellamultocida, Pseudomonas aeruginosa, Salmonella thyphimurium, Staphylococcus aureus, Cladosporiumcladosporioides, Geotricumcandidum, Candida spp. and Aspergillus spp.

Indications

Instructions for use:

Animal husbandry housing and hatcheries

- Clean the surfaces with a proper detergent.
- After rinsing and drying, apply Dexid-200 at 0.5% (no specific disease; 1:200) to 1% (disease outbreaks; 1:100) by spraying (ca. 1 l of solution per 4 m2). For fogging use 2 l + 3 l of water for 1000 m3.
- Following the appropriate minimum contact time (typically 20 minutes), areas should be rinsed thoroughly and allowed to dry before animals are returned to the area.

Animal transport trucks and trailers

- Clean trucks and trailers with a proper detergent.
- After rinsing, spray Dexid-200 at 1% (1:100).
- Rinse after at least 20 minutes of contact time
- For wheel rinses apply Dexid-200 at 1%.

Storage and processing rooms for feed and food

- Clean the surfaces with a proper detergent.
- After rinsing, apply 0.5 - 1% Dexid-200.
- Rinse after at least 20 minutes of contact time.

Transport equipment for foodstuffs

- Clean the trucks with a proper detergent.
- After rinsing, apply Dexid-200 at 0.5 - 1%.
- Rinse after at least 20 minutes of contact time.

Boot dips

Dilute Dexid-200 at 1% and renew regularly (every 2-3 days; daily for best results). Dexid-200 is suitable for use on all surfaces including soft metals, is biodegradable and performs well in soft and

hard water conditions and in the presence of organic matter. Dexid-200 is suitable for soaking, spraying and fogging applications.

Warning

- Do not apply Dexid-200 in the presence of animals
- Highly flammable liquid and vapour.
- Toxic if swallowed. In case of emergency, wash out mouth with water and give 200 ml of warm water to drink. DO NOT induce vomiting. Seek medical advice immediately.
- Harmful in contact with skin.
- Causes severe skin burns and eye damage. In case of emergency, immediately flood the eye with plenty of water and boric saline solution for at least 15 minutes, holding the eye open. - May cause an allergic skin reaction.
- Causes serious eye irritation.
- Toxic if inhaled.
- May cause allergy or asthma symptoms or breathing difficulties if inhaled.
- May cause drowsiness or dizziness.
- Very toxic to aquatic life.
- Personal protective equipment, such as gloves, masks and eye protection, should be worn during the mixing or application of Dexid-200.
- Keep out of reach and sight of children.
- Containers should be rinsed with clean water and disposed of in line with local regulations.

Packaging

Bottle of 1litre and jerry can of 5 litres

Dexon-100

Dexon-100 is a highly Effective and Multiple Purpose Virucidal Disinfectant

Composition

Contains:

Pentapotassiumbis (peroxymonosulphate) bis(sulphate)	35-55 %

Description

An effective cleaning and disinfection program is a crucial step in every poultry, pig and cattle bio-security program. The main purpose of a cleaning and disinfection program is to reduce the number of pathogens (disease-causing agents) in the environment. By reducing pathogen numbers, we can reduce the potential for diseases to occur in our animal flocks.

Dexon 100 is a highly concentrated Peroxygen based disinfectant. Dexon 100 is highly effective against wide range of bacteria, viruses, fungi and moulds with rapid speed to kill. It performs on all surfaces, and is highly effective in hard water, at low temperature and in the presence of organic matters.

Indications

Highly effective and multiple purpose virucidal disinfectant

- Broad spectrum
- Effective against wide range of microorganisms including viruses, bacteria, fungi and moulds
- Highly effective against important Animal diseases like Newcastle disease, Infectious bronchitis, infectious bursal disease, Marek disease, infectious laryngotrachitis, egg drop

syndrome virus, avian influenza, foot and mouth disease, porcine reproductive and respiratory syndrome virus and swine vesicular disease.

- Support in reducing the antibiotic usage in animals
- Wide range of applications
  - Hard surface disinfection
  - Aerial disinfection
  - Vehicles and equipment disinfection
  - Drinking water sanitation
  - Biofilm removal
  - Cleaning and disinfection of water system
  - Foot dip
- Biodegradable
- Safe to use in presence of animals
- Harmless to the user, animals and environment
- Non-corrosive and non-tainting at used dilution
- Active until seven days when mixed in water
- Proven results in farm biosecurity

Dosage

Applications	**Recommended dilution rate**	**Directions**
Terminal surface disinfection All surfaces, concrete, clay bricks, wood, marbles tiles, glass tiles etc.	1:100-200	Prepare fresh working solution by dissolving 1 kg into 100-200 litres of water. Use pressure washer to spray on surfaces 250-300ml/m^2.
Aerial disinfection (misting)	1:300	Use knapsack sprayer. Adjust nozzle to misty jet
Aerial disinfection (cold fogging)	1:100	Use cold fog equipment

Aerial disinfection (cold fogging)	1:20	Use thermal fog equipment and fog enhancer
Drinking water sanitation	1:1000	Dissolve 1 kg of Dexon-100 into 1000 litres of water
Water system cleaning and disinfection Biofilm Removal	1:100	Drain out all water from the system. Make 1% solution of Dexon-100 and put that solution into system and leave it for 30 minutes. Flush out the solution to drain-off points. Refill the system again with solution and leave it further 30 minutes and then drain-off. It destroys biofilms due to its high level of surfactancy with strong oxidizing power.
Vehicles and equipment disinfection	1:100	Use pressure washer
Foot and wheel dip	1:100	Prepare fresh solution and refill as solution become dirt and replace fresh one after one week

Packaging
Sachet of 50 gram and 5 kg plastic bucket

Dexophen

Dexophen is a broad spectrum heavy duty phenol disinfectant. It is effective against viruses, bacteria and parasites (including eimeria causing coccidian).

Composition
Contains:

Chlorocresol	5-10 %
Glutaraldehyde	10-15 %
Quaternary ammonium compound	5-10 %

Description
Dexophen is a highly concentrated powerful, multi-purpose germicidal disinfectant. Its broad spectrum of activity is effective against bacteria, viruses, fungi and endoparasites (including unsporulated Oocytes). Dexophen disinfects, cleans, and deodorizes in one step. It is effective in Farmyard conditions with high level of both organic (animal waste, manure, grease and grime) and inorganic contamination (mineral salts, lime scale and hard water).

Conditions for use
Instruction for use:

Dilute with water before use.

- Surface disinfection: 1 L Dexophen per 100 litres of water.
- Aerial disinfection (Fogging): 1 L Dexophen per 20-30 litres of water.
- Foot and wheel dip: 1 L Dexophen per 100-200 litres of water depending on organic challenge.

- Specific Coccidiosis challenges: 1 L Dexophen per 25-50 litres of water.

Warning

◊ Harmful if swallowed.

◊ Causes severe skin burns and eye damage.

◊ May cause an allergic skin reaction.

◊ May cause allergy or asthma symptoms or breathing difficulties if inhaled.

◊ Very toxic to aquatic life with long-lasting effects.

◊ Read the package leaflet before use.

◊ Wear protective gloves/protective clothing/eye protection/face protection.

◊ Do not breathe mist/vapours/spray.

◊ In case of inadequate ventilation wear respiratory protection.

◊ If swallowed, rinse mouth. Do not induce vomiting

◊ If in eyes, rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.

◊ If inhaled, remove person to fresh air and keep comfortable for breathing. Call a poison center/ doctor.

◊ If experiencing respiratory symptoms, call a poison center/ doctor.

◊ If on skin, take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation or a rash occurs, get medical advice/attention.

◊ If medical advice is needed, have product container or label at hand.

◊ Keep out of reach of children.

◊ Avoid release to the environment.

◊ Waste must be disposed of in line with local regulations.

Packaging

5 Liter and 10 Liter jerry can. 200 Liter drum

Intraperox

Intraperox is peracetic acid bases terminal disinfectant.

Composition

Contains:

Hydrogen peroxide	>25 %
Peracetic acid	4-5 %

Description

Intraperox is a cleaning chemical and biocidal disinfectant used in circulation cleaning and disinfectant across a diverse range of industries including livestock, dairy, food and beverages applications. It is a stable blend of peracetic acid, acetic acid and hydrogen peroxide, effective against wide range of bacteria, viruses and fungi, with rapid speed to kill.

Application areas: surface disinfection, aerial disinfection and equipment disinfection (pipelines, tanks and aseptic equipment's in dairies, breweries, wineries, beverage and food processing/packaging plants and egg processing and packaging equipment surfaces). Intraperox is highly effective in removal of biofilm and water treatment. The product is free of chlorine, non-tainting, non-staining, biodegradable.

Conditions for use

Instruction for use:

- For professional use only.
- Dilute with water before use.

- General disinfection: 1 L Intraperox per 200 litres of water.
- Aerial disinfection (fogging): 1 L Intraperox per 10 litres of water.
- Drinking water sanitation: 1 L Intraperox per 1000 litres of water.
- Water system cleaning and disinfection, biofilm removal: 1 L Intraperox per 100 litres of water.

Warning

- Harmful if swallowed.
- Harmful if inhaled.
- Harmful in contact with skin.
- Causes severe skin burns and eye damage.
- May cause respiratory irritation.
- Heating may cause a fire.
- May be corrosive to metals.
- Very toxic to aquatic life with long-lasting effects.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Avoid breathing mist/vapours/spray.
- If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing.
- Call a poison center/doctor if you feel unwell.
- If swallowed, rinse mouth. Call a poison center/doctor if you feel unwell.
- If on skin, wash with plenty of soap and water.
- If in eyes, rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
- If exposed or concerned, call a doctor.
- Keep only in original container. Keep out of reach of children.
- Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Avoid release to environment.
- Waste must be disposed of in line with local regulations.
- Read the package leaflet before use.

Packaging

20 L jerry can.

Interalkaline Cleaner. Superior Alkaline Cleaner

Interalkaline Cleaner is a blend of non-ionic, amphoteric surfactants, sodium hydroxide, chelating and sequestering agents.

Composition

Active substance:

Sodium Hydroxide	10-15 %
Non-ionic surfactants	5-15 %

Description

Interalkaline Cleaner is a blend of non-ionic , amphoteric surfactants, sodium hydroxide, chelating and sequestering agents

Interalkaline Cleaner is a Superior alkaline foaming and cleaning Detergent. It is used for pre-wash detergent in animal farm, hatcheries and in food processing areas. It is specifically designed to quickly removes organic soiling especially fats and greases. It can be used as a foamed or sprayed onto surfaces and equipment.

Indications

Instruction for use:

Mannual application Prepare a stock solution of 1-2% of Interalkaline cleaner and apply on brush or spray the solution onto all hard surface using low pressure Lance Spray onto surfaces at a rate of 500-600ml/m2 depending on the grease or organic matter situation

Immersion Cleaning Interalkaline cleaner should be used at dilution rate 1:50-100 in immersion cleaning. Parts to be cleaned are placed in the cleaning solution to come in contact with the entire surface of the parts. Immersion cleaning is preferred for parts that must be placed in baskets and

soak for 30 minutes before thorough rinse in portable water. Performances can be improved by moving the parts within the liquid.

Foaming Prepare a working solution at dilution rate of 1:20 and use foam Lance for foaming.

Warning

* Interalkaline Cleaner is classified as corrosive under EU regulation.
* Keep out of reach of children.
* Do not breathe mist/vapours/spray.
* Do not get in eyes and on skin.
* Wear protective clothing, gloves.
* Keep cool. Protect from sunlight.

Packaging

5L, 20L, 200L and 1000L packaging according to UN standard

Summary

To achieve effective disinfection you must:

- Thoroughly clean and scrub objects before applying disinfectants. Disinfectants cannot work on top of caked-on dirt and manure, so thoroughly wash surfaces before disinfecting.
- Apply disinfectants using brushes, sponges and spray units. Allow adequate contact time (follow manufacturer's instructions.)
- Dispose of used disinfectant according to local regulations.
- Use only approved disinfectant.
- Prepare disinfectant solution in correct concentration as recommended by a manufacturer.
- Apply disinfectant in the correct volume to ensure effective contact time and to cover the entire surface.
- Prepare and apply disinfectant in a safe manner.

Keep in mind: Disinfection without a proper cleaning has no effect. Increasing the concentration of disinfectant is never a substitute for thorough cleaning.

FEEDING POULTRY

Feed is one of the main important factors which should be seriously considered. Two-thirds (2/3) of the cost of production are from the feed. As a farmer, he or she must make sure that there is no wastage during feeding time and storing.

What is a feed?

Poultry feed is a kind of balanced feed which aids proper development of chicks and pullets and hence used for feeding the domesticated birds such as chickens, turkeys, ducks, geese, etc. that serve as a source of eggs or meat.

Poultry feed can be prepared from raw materials like oil cake, wheat bran, molasses, cereals, vitamins and minerals. Proteins, largely of vegetable origin, encourage the normal development of pullets and help them to lay eggs longer.

Nutritional requirements for chickens

Poultry have more specific nutritional requirements than ruminants or pigs, because they do not manufacture many amino acids, the building blocks of protein, in their gut. So, more amino acids are needed in the feed. The most limiting amino acid is methionine.

Poultry nutrition is more than just giving any available feed to the birds. Market poultry-broilers and turkeys - require proper nutrition to grow and finish out. Breeding poultry require correct nutrition to reproduce. Laying flocks require correct nutrition to be productive. As humans, we need the right balance of nutrients supplied by the food pyramid (meats, vegetables, dairy products, and fruits) on a

daily basis. Similarly, poultry require the correct balance of about five classes of nutrients (proteins, carbohydrates, fats and oils, vitamins, minerals, and water) for optimum growth, maintenance, finishing, work, reproduction, and production.

As a poultry farmer, know the nutritional requirements of the bird's function; either egg production or meat production. After determining the nutritional requirements, the poultry producer should look into the availability and cost of appropriate feedstuffs. It is also critical that the poultry nutritionist know the limitations associated with each ingredient. Some ingredients may have anti-nutritional properties which limit their usage in poultry diets.

All foods that sustain life contain nutrients. Poultry convert the nutrients into useful forms via the digestive system. Blood then carries the nutrients throughout the body. Nutrients pass through capillary walls and enter body cells to provide nourishment and energy for life processes.

Nutrients can be either dietary essential or non-dietary essential. Poultry feeds must supply the dietary essential nutrients because the body cannot produce them on its own. The body can synthesize the non-dietary essential nutrients for growth and maintenance. Poultry diets must supply daily nutrient requirements from the five classes of nutrients.

Classes of Nutrients

Carbohydrates

Normally, at least ¾ of a poultry diet consists of energy feeds. Energy feeds are the most important nutrient to maintain body temperature and exercise levels of the birds. Cereals, grain, roots, and tubers are the most important energy feeds. Examples of energy feeds are cereals like maize (corn) and its by-products (bran), sorghum, wheat and its by-products (bran, shorts, screenings), rice and its by-products (bran, polishing), cassava root meal (farina, tapioca), yam meal, yucca meal, sweet potato meal, plantain and banana meal. Roots and tubers should be soaked in water for 60 minutes or cooked before drying to remove harmful substances, and the proportion in the diet in general must be kept below 1/10.

Fat is also a good source of energy, in particular in hot climates, as the heat produced during metabolism is less than from traditional energy feeds, e.g. cereals. Sources of fat are e.g.: tallow, lard, oil cake meals, poultry fat, fish oil and restaurant fats. However, fat should only be given in small amounts, i.e. less than 1/10 of the total diet.

Proteins

Proteins are complex organic macro molecules containing carbon, hydrogen, oxygen, nitrogen, and usually sulfur. They consist of one or more chains of amino acids. Proteins are fundamental components of all body cells and include many bio-chemicals (such as enzymes, hormones, and antibodies) necessary for proper body functions. They are essential in the animal's diet for growth and repair of tissue and can be obtained from many feedstuffs such as meat and fish meals, cereal grains and legume byproducts such as soybean meal.

Proteins consist of one or more chains of amino acids that are required by the body. The breakdown of protein during digestion releases the amino acids. Blood carries the amino acids to all body parts. Single stomach, or monogastric, animals require 22 amino acids in their body. Those animals can manufacture 12 of the 22 non-dietary essential amino acids, but cannot store the amino acids in their bodies. As a result, they must get a daily dose of protein containing the other 10 dietary essential amino acids. Proteins can come from both plant and animal feedstuffs.

Plant proteins come directly, such as corn, or indirectly from plants as byproducts. Examples of byproducts include soybean meal, cottonseed meal, peanut meal, and canola meal. Note these high protein meals are byproducts of edible oil extraction from the "oil seeds". Animal protein sources are usually byproducts of meat processing and include blood meal, feather meal, fishmeal, meat, and bone meal, and poultry by-product meal.

Protein or amino acid digestibility can vary depending on the specific ingredient. In general, animal byproduct proteins are easier to digest than plant proteins. For example, poultry digestibility of cottonseed meal can be as low as 60% for certain amino acids or as high as 90% for other ingredients such as dehulled soybean meal and meat products like poultry byproduct meal. The protein content of an ingredient or complete diet is usually described as "Crude Protein". Crude protein is based on the nitrogen content of the feedstuffs; proteins contain an average of 16% nitrogen. Crude protein thus can contain not only "pure protein" but other non-protein substances such as nucleic acids (from DNA) or urea which is a nitrogenous waste product excreted by the kidneys.

Vitamins

Scavenging birds get vitamins by eating green grass, vegetables, fresh cow dung, and through sunlight. Vitamins A, B_2, and D_3 are considered very important because many problems arise when birds lack these vitamins. Sunlight and green grass or green fodder normally provide Vitamin A and

D, whereas Vitamin B may come from fresh cow dung. Vitamin B may also be added by giving e.g. Riboflavin tablets. Additional vitamins should only be given in very small quantities and purchased through drug stores or feed sellers, but this is normally not needed for scavenging poultry. Confined birds always need additional vitamins mixed into their feeds or as a minimum given some green grass, vegetables and some fresh cow dung.

Minerals

Minerals are important for bone formation, eggshell formation, and for a good health status. The most important minerals are calcium and phosphorous. To produce strong shells for their eggs, laying hens need free access to calcium (limestone or crushed shells). Adult birds are usually able to balance their intake according to needs. If a Phosphorous rich feed is added, it should be balanced with calcium, since too high levels of one may cause deficiency of the other. Examples of sources for minerals are: bone meal, crushed oyster shells, snail shells, and burned eggshells. Using bone meal or eggshells is a good way to supply calcium and phosphorus. Egg shells should always be scorched or cooked before re-use in diets to remove any disease germs.

Water

Water is often overlooked, but it is one of the most important nutrients. An animal can live without food longer than it can live without water. In a laying flock, a shortage of water for just a few hours can result in reduced egg production, so clean water should be available at all times. If the farmer does not use automatic waterers, he or she should fill the drinkers twice a day. If the drinkers are filled only in the morning, birds can run out of water by midday. A laying hen drinks about 25% of her daily water intake during the last two hours of daylight.

Water plays an important role in the body of an animal. Water softens feed and carries it through the digestive tract. As a component of blood (90% of blood content), water carries nutrients from the digestive tract to cells and carries away waste products. Water also helps cool the bird through evaporation. (Birds do not have sweat glands, so their heat loss occurs in the air sacs and lungs through rapid respiration.)

A baby chick is composed of about 80% water. Even though this percentage decreases as a bird gets older, the need for water remains. There is no precise quantity requirement for water because there

are several factors that affect the amount of water a bird needs: age, body condition, diet, temperature, water quality, and humidity. As a rule of thumb, poultry consume twice as much water as feed.

Pellets

Of late, commercial feeds are available as pellets for adult chickens or crumbles for young chickens, at a slightly higher cost. Pellets and crumbles are very acceptable but usually have little advantage over mash. They may reduce waste or wind loss, are less dusty and will not separate during transportation.

Factors Affecting the Nutrient Requirements of Poultry

The nutrient requirements of poultry are affected by a large number of factors, including:

- **Genetics** (the species; breed or strain of- bird): Different species, breeds or strains of bird have different average body sizes, growth rates and production levels and will absorb and utilize nutrients from feed with different levels of efficiency. Therefore they will require feed with different nutrient compositions. The genetics of commercial poultry is constantly changing, and as a result, so are their nutrient requirements. Consequently, breeders of commercial poultry provide information on the specific nutrient requirements for the birds they sell.
- **Age**: Nutrient requirements are related to both body weight and the stage of maturity.
- **Sex**: Prior to sexual maturity the sexes have only small differences in their nutrient requirements and males and females can usually be fed the same *compromise* diet to achieve acceptable growth rates. Differences in nutrient requirements are larger following the onset of sexual maturity and significantly different diet formulations are then required for each sex.
- **Reproductive state**: The level of egg production in hens and sexual activity in males will affect nutrient requirements.
- **Ambient temperature**: Poultry have increased energy requirements to maintain normal body temperature in cold ambient temperatures and the opposite in hot ambient temperatures. Food digestion processes produce body heat, the amount of which will vary according to the nutrient composition of the diet. This is called the **heat increment of the diet**. In cold temperatures it may be desirable to formulate a diet with a higher heat increment and the opposite in hot temperatures.
- **Housing system**: The type of housing system will influence the level of activity of the birds and therefore their energy requirements.

- **Health status**: Birds experiencing a disease challenge may benefit from an increase in the intake of some nutrients, most commonly vitamins.
- **Production aims**: The optimal nutrient composition of the diet will vary according to production aims, such as optimizing weight gain or carcass composition, egg numbers or egg size. Poultry that are raised for breeding purposes may need to have their energy intake restricted to ensure that they do not become obese.

A Ration (or Feed)

What is a ration?

A **ration** is the amount of feed that is fed to birds during a 24-hour period.

Factors to be considered in making a good feed

Factors to be considered in making good feed are:

- **Acceptability to the birds**. The ration being formulated has to be palatable enough to stimulate intake by the birds. Feed refused by the birds is worthless, since feed has to be consumed and utilized.
- **Digestibility of the feed**. The nutrients in the feed have to be digested and released into the gastrointestinal tract to be utilized by the birds. Rations with high fiber content cannot be tolerated.
- **Cost of feed ingredients**. The requirement of the birds can be met through several combinations of feed ingredients. However, when the cost of these ingredients is considered, there can only be one least-cost formulation. The least-cost ration should ensure that the requirements of the birds are met.
- **Presence of anti-nutritional factors and toxins**. The presence of anti-nutritional factors in the feed, such as anti-trypsin factor in soybean meal, affects the digestion of some nutrients by making them unavailable to the animal. Some feed ingredients may also contain toxic substances, which may be detrimental to the animal when given in excessive amounts. The inclusion of these feed ingredients should therefore be limited or eliminated from the formulation.

What composes a ration?

The feed ration must consist of feeds appropriate to the bird's anatomy. The volume and content of the dry matter of feed must correspond to the capacity of the digestive system. The ration should

include a variety of feeds (carbohydrates, proteins, minerals, and vitamins, among others). The ration's structure (feed ratio) varies with the type of bird, age; intended use (layers (eggs) or broilers (meat), and manner of feeding. Standards for planned rather than actual productivity are used.

A ration should be well composed as shown in the tables below:

Layers - Rations for Starter (Chick & Duck), Grower and Layer Birds

Item	Birds' Classification		
	Starter - Chick & Duck (0-6 weeks)	***Grower (6-18 weeks)***	***Layer (18 weeks & above)***
Maize bran	100 kg	100 kg	100 kg
SHELLS	2 kg	4 kg	8 kg
Cotton seed cake	12 kg	8 kg	12 kg
Sunflower meal	10 kg	15 kg	10 kg
Fish meal	20 kg	15 kg	20 kg
Lysine	150 grams	-	150 grams
Calcium	½ kg	½ kg	½ kg
Grow quick/magic	2 kg	1 kg	-
Egg booster	-	-	2 kg
Red salt	1 kg	1 kg	1 kg
Premix (GP)/Layer	½ kg	½ kg	½ kg
Poultry Care	8 packets	-	8 packets
Methionine	-	150 grams	150 grams
Toxin binder (Klinc feed)	½ kg	½ kg	½ kg
Sulcurb/Acidifier	½ kg	½ kg	½ kg
Gromix TY	-	100 grams	100 grams

Rations for Broiler Starter and Broiler Finisher

Item	Broiler Starter	Broiler Finisher
Maize bran	100 kg	100 kg
Shells	8 kg	8 kg
Cotton seed cake	12 kg	10 kg
Sunflower meal	10 kg	-
Fish meal	20 kg	15 kg
Calcium	½ kg	½ kg
Red salt	1 kg	1 kg
Premix (GP)	½ kg	½ kg
Poultry Care	6 packets	6 packets
Methionine	150 grams	150 grams
Toxin binder (Klinc feed)	½ kg	½ kg
Sulcurb/Acidifier (Procid)	150 grams	150 grams
Gromix TY	100 grams	100 grams

How to Mix a Ration

Follow the steps below to manually mix the birds' feeds:

- Ensure that the place to be used to mix from is clean and free from any objects that can cause feed contamination.
- Weigh separately all the ingredients that are going to be used in mixing the feeds.
- Pour the maize bran/cereal first in a heap.
- Then pour the other ingredients on top of the heap such they slope downwards in all directions.
- When all ingredients are poured in such a manner, then the whole ingredients are carefully mixed using a spade.

Note: The mixing can be done in special mixing machines or concrete mixers, or by turning the ingredients over a few times with a shovel on the floor. The mix should always be turned inwards, to ensure proper mixing.

Feed Storage Guidelines

- Store all feed and ingredients at a cool temperature (ideally below77° F although this is not possible at outside locations under hot conditions).
- Keep feed dry to prevent fungal or bacterial growth.
- Prevent rodent or insect entry into feed.
- Use antioxidants to preserve fats and oils in ingredients and feed.

DAILY, WEEKLY AND MONTHLY POULTRY ROUTINES

Daily Routines: These include: Collecting eggs, changing feed and water and spot cleaning wet areas of litter.

- Empty and scrub water containers daily, since disease agents survive well in water.
- Provide fresh feed daily; old feed can harbor disease causing mold. If the feed containers have been washed, dry them thoroughly before adding feed to prevent mold growth.
- Depending on the season, clean and replenish footbaths when they begin to look soiled (this indicates the presence of organic material). Footbath containers must be emptied, scrubbed, and refilled with disinfectant. It should be the responsibility of all who use the poultry facility to clean and replenish the footbath if it is dirty.

Weekly Routines: Weekly routines on a poultry farm include but not limited to the following:

- **Cleaning and disinfecting of commonly used equipment**. Such equipment includes: rakes, hoes, scoops, shovels and/or spades. Wash and scrub surfaces to remove organic material before applying disinfectants. Store equipment in a secure location when not in use.
- **Replace old litter with fresh bedding material** to ensure that birds are separated from organisms passed along in fecal material. Remove old litter to a compost piled. Double-bag the litter in a location that is remote from the coop.

  When does the farmer tell that the litter is old enough for removal from the house?

* *Level of wetness*: When the litter is held in the palm and mould it, when the mould crumbles then it is still fine but when it forms a mold that does not crumble easily then it is ready for removal regardless of the period it has spent in the house.
* *Recommendation from a veterinarian* during the course of treatment

- **Scrape fecal material from perches**. Examine perches for physical hazards and make repairs. Disinfect the perches.

- **Clean and replace nests and nesting materials**. Clean the inside of nests before disinfection. Add fresh nest material, if used, to a clean and dry nest to prevent mold growth.

Monthly Routines: Monthly routines include some of the following:

- **Check for mites and body lice** – treat if necessary.
- **Remove cobwebs with a broom**. Remove dust with a whisk broom. Cobwebs and dust that accumulate in corners can harbor microorganisms for long periods of time.
- If possible, **clean the containers in which feed is kept**. The timing of this should correspond with the arrival of each new feed delivery. A good idea is to keep feed in plastic or metal garbage cans with tight-fitting lids. Keep some feed containers cleaned and ready to receive new feed deliveries
- **Schedule a twice-a-year cleaning and disinfecting** that includes a thorough cleaning of the entire house followed by cleaning and disinfecting of all surfaces. This should also be performed upon the detection of a sick bird or parasites of any kind.
- **Clean transport containers immediately after use**. Clean and disinfect containers before they are stored in or near bird areas to prevent the movement of microorganisms onto the farm. Store containers in a secure area.

POULTRY HEALTH CARE AND MANAGEMENT

Key Principles of Poultry Health Management

The key principles of poultry health management are:

(a) Prevention of disease (*This area has been exhaustively covered under Biosecurity on poultry farms)*

(b) Early recognition of disease

(c) Early treatment of disease.

As much as is possible disease should be prevented. It is easier and less damaging to prevent disease than it is to treat it. However, it must not be assumed that all disease can be prevented. Inevitably, some will get past the defenses, in which case it becomes imperative that the condition be recognized as early as possible to allow treatment or other appropriate action to be implemented as soon as possible to bring the situation under control to limit damage to the flock.

Manure Management: Whatever the type of confinement, proper attention must be paid to manure management. Adult birds produce 500 g of fresh manure (70 percent moisture content) per year per

kg of body weight. To preserve its fertilizer value, manure should be dried to about 10 to 12 percent moisture content before storage. This will retain the maximum nitrogen content for fertilizer value. Nitrogen in the form of urea is the most volatile component of manure, and is lost as ammonia if moisture content is too high in the stored material. If the moisture content is too high, then the stored manure releases ammonia, carbon dioxide, hydrogen sulphide and methane, which can have serious physiological effects on humans. Some of these components are also greenhouse gases, which contribute to the global increase in ambient temperature

Poultry manure is very useful as an organic fertilizer, as animal and fish feed and as a raw material for methane gas generation in biogas plants for cooking fuel.

Medication: Use only if/when necessary, and get veterinary advice. Most medications are not registered for use for layers in production. Follow label directions.

Medicate chickens for worms at 5, 10 and 18 weeks of age through their drinking water or individually. A follow up treatment may be necessary.

Dust, spray or dip the birds for body lice and mite if necessary, using an approved pesticides only.

External parasites such as lice and mites need retreatment within 10-14days to break the lifecycle and prevent re-infestation. For effective mite and some lice treatment, housing must be cleaned and sprayed with an approved pesticide.

Lighting: To maximize egg production, regulate day length with supplementary light in very cold weather. Aim for constant 15-16 hour day length.

Culling: Remove sick layers. Dry 'powdery' or blue combs and/or a 'dull' eye give a clue. Check width of pin bones in laying hens - there should be at least a 50-60mm gap. The texture of the abdomen should be soft and not overly fat or hard. Do not confuse the appearance of the abdomen during molting, with a hen that does not lay eggs permanently - birds in molt will not be laying.

Good ventilation discourages the spread of diseases and pests. In overnight houses, the provision of perches or loosely plaited bamboo mats (such as those used for sieving) placed on the floor can help to keep them dry.

The practice of keeping chickens and ducks together should be discouraged. This results in wet floors, giving rise to diseases such as Fowl Cholera. Ducks are also much more tolerant than chickens

to Newcastle Disease, and are thus often carriers of this viral disease. Adults and young stock of any poultry should be housed separately to minimize cross-infections and injuries from bullying.

Management of Free-Range Poultry

Sanitation: If the birds are housed inside, the floor should be swept daily. An outside chicken house should be cleaned every week to break the breeding cycle of the common housefly. It takes about seven days to complete the breeding cycle from fly egg to hatching of the adult housefly.

Wood ash and sand spread on the floor will discourage lice infestation. Mothballs (naphthalene) crushed with ash can also be applied to the feathers or the wings of the birds, or placed where the chickens usually take their dust baths. If the chickens are already infested with mites, the house can be fumigated (while the chickens are outside) with a rag drenched in kerosene. Lice live on the birds, and dust baths with naphthalene powder in the ash will be more effective than dust alone.

The unrestricted free-ranging of poultry is often a problem. They trespass onto neighboring fields and gardens, and are constantly at risk from predators. Confinement is often not practical because of the cost of feed and fencing, while surveillance is only feasible where the very old or very young of the household have time to help. Fencing of vegetable plots is in many cases the best option. Placing more cocks in the village might reduce the movements of the chickens, as the cocks and hens of each flock would keep more to their own territory. Cocks move within an eight-to-ten-house territory, and hens within two or three houses.

Under the free-range system, the difference between the amounts of food gathered through scavenging and the total food requirement for maximum production should be balanced with nutrients supplied from supplementary feed. To make up a properly balanced supplement, it is necessary to know the scavenger feed resource base and the composition of the crop contents. If this is not known, it is recommended that the fowls have access (using a free-choice cafeteria system) to three containers (or three compartments of a bamboo stem feeder of ingredients comprising a protein concentrate, a carbohydrate source (for energy) and a mineral source (mainly for calcium carbonate for egg shell formation for the hen).

Poultry should have free access to this cafeteria system for two to three hours in the evening to supplement the day's scavenging.

What is a Disease?

A **disease** is any abnormal condition that impairs bodily functions in an organism.

Diseases can be characterized by specific symptoms and signs.

What is a Pest?

A **pest** is an organism with characteristics that people see as damaging, or unwanted, as it harms agriculture through feeding on crops or parasitizing livestock. An animal can also be a pest when it causes damage to a wild ecosystem or carries germs. The term pest is used to refer specifically to harmful animals but it also relates to all other harmful organisms, including fungi and viruses. It is possible for an animal to be a pest in one setting but beneficial or domesticated in another.

Major Routes for Disease and Pathogen Transmission in Poultry

- **Transfer of birds from one area to another** (For instance, transfer of poultry from one farm to another).
- **Dead bird disposal**. Dead birds present a risk to the rest of the flock, due to increase of disease agents load at the farm.
- **Wild birds.** Wild birds are likely to be attracted to range areas if they have access to feed, drinking water or surface water. If those attractions are eliminated, wild birds are unlikely to try to mix and compete with the poultry flock. Such birds can carry disease causing agents to birds.
- **Feral (stray animals) and domestic animals**, including other livestock and pets (cats, dogs, etc.).
- **Insects:** These are carriers of disease agents. For example mosquitoes are carriers of fowl pox; darkling beetles are carriers of New castle disease, Bursal disease, Mareks disease, Salmonella, among others. Flies are carriers of Salmonella.
- **Rodents - rats/mice**. Rodents are carriers of disease agents contaminating feed and litter with Salmonella and fowl cholera. They also cause damage to equipment (electrical wire and plastic water pipes).
- **Feed may be contaminated** by the raw materials used, post-production and during transport, or by exposure to rodents and birds on the property. Bacteria and mould in poor quality or damaged feed may also be a concern. Wet feed permits the development of fungi and molds for example:

Aspergillus which causes pneumonia; mycotoxins. These can result into internal hemorrhages, stunted growth and immunosuppression.

- **Farm personnel and family** members living on the project site.
- Contractors, maintenance personnel, neighbors, serviceperson and visitors.
- Disease can be transmitted by, for example, hands, boots, dirty hair and clothing.
- **Transmission as an aerosol or dust**. Some pathogens travel in microscopic droplets of moisture/dust and are inhaled.
- **Water:** Water supplies may become contaminated with feces from contact with avian or other animals. Contaminated water can be a breeding ground for: Avian Influenza, New Castle Disease, Coliforms, Salmonella and other disease agents.
- **Water leakage** causes wet litter which increases the possible challenge of Coccidiosis. Damages to leg's skin allowing penetration of bacteria causing foot pad and joint inflammation.
- **Transport of litter material on and off the farm** site as well as storage of used litter on site may be a biosecurity risk.

Signs of Poultry Disease

- Chickens huddle together.
- Coughing, sneezing, rapid breathing
- Difficulty in breathing (open beak) and swelling of face.
- Discharge from mouth and nostrils.
- Dullness, no appetite, closed eyes.
- Nodular skin lesions (abnormal growth of skin).
- Paralysis (loss of muscle function) of wings, characteristic dropping of limb.
- Lameness
- White droppings
- Marked drop in egg production and increased number of poor quality eggs – soft shelled with watery content.
- Eye worm
- Purple discoloration of wattles and combs with swelling caused by abnormal accumulation of fluid. This is a common sign of Avian Influenza.
- Turned or twisted neck (***torticollis***)
- Dark red colour of head and comb

- Greenish or yellow droppings
- Bloody reddish droppings.
- Pinpoint bleeding under the skin (mostly seen on feet and shanks)
- Swollen head, accumulation of liquid in eyelids and comb

Causes of Poultry Diseases

Diseases can be caused by things that can be seen and things that cannot be seen, including bacteria, viruses, fungi, parasites, and poisons. An incomplete diet may also cause disease.

- **Viruses**: These cause diseases like; New Castle Disease, Gumboro, Avian Influenza and Duck plague. Viral diseases cannot be treated with antibiotics. Vaccines can be effective for preventing some viral diseases.
- **Bacteria**: These cause diseases like fowl cholera, Salmonella, Mycoplasma, E. Coli, and Rimerellaanatipestifer. Bacterial diseases can be treated with antibiotics.
- **Fungi**: Fungi may cause illness either by growing in the birds or by producing poisons. There are no treatments for fungal diseases but they can be treated by cleaning the environment.
- **Protozoa and Parasites**: Parasites can irritate and annoy birds, and some can transmit bacteria and viruses. Parasites are categorized as either internal or external, depending on where they live in or on the bird.

  External parasites generally bite and irritate birds but can also cause blood loss and transmit diseases. Mites, lice, and ticks are all external parasites. Flies, fleas, beetles, and mosquitoes, although they live both on and off the bird, can transmit diseases like fowl pox between birds and, they can concentrate poisons.

  Internal parasites can be very small (like coccidia) or very large (like most worms). There are treatments and vaccines for some internal parasites.
- **Poisons** like botulinum and aflatoxin are produced by living organisms (fungi and bacteria). Poisons that are made by humans, like pesticides or disinfectants, can also cause clinical signs in poultry if they eat or drink them.
- **Nutritional deficiencies** can result in signs of illness and death, especially in young birds. Once the deficit has been identified and corrected, the birds will often make a rapid recovery.

- **Environmental conditions**, especially heat, can kill large numbers of birds and are among the key causes that should be considered when there is high mortality. Heat loss is more common in confined birds than those that are free-ranging.
- **Predation** usually results in the loss of a few birds rather than whole flocks.

Common Poultry Diseases

Common poultry diseases can either be ***infectious*** (Diseases caused by pathogenic microorganisms such as viruses, bacteria, parasites or fungi) or ***non-infectious*** (Diseases not caused by pathogens, instead they are likely to have causes such as nutritional disorders, management styles such as overstocking, environmental toxins or gene mutations).

Infectious Diseases

Infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi; the diseases can be spread, directly or indirectly, from one person to another. Zoonotic diseases are infectious diseases of animals that can cause disease when transmitted to humans.

Viral Diseases

Viral diseases are the most common cause of losses, not only in large commercial flocks, but also in backyard chickens. Mostly, they do not respond to drug therapy. Treatment relies on supportive measures. Prevention and control relies on vaccination where this is effective, or by limiting exposure to infected birds. If a secondary bacterial infection is also present, antibiotics may reduce the severity of an outbreak.

(1) Newcastle Disease (ND)

This disease spreads rapidly via airborne droplets spread by the coughing or sneezing of infected birds. The virus can be carried by wild birds, through contaminated eggs, and on clothing. As mortality is often 100 percent in young chickens, New castle disease is probably the most important constraint to family poultry development. Birds of any age can be affected, although young ones are more susceptible. Mortality in older chickens is usually lower, but egg production is usually severely reduced.

The incubation period of three to five days is followed by dullness, coughing, sneezing and gasping. Rapid breathing is accompanied by a gurgling noise in the throat. The respiratory signs usually develop

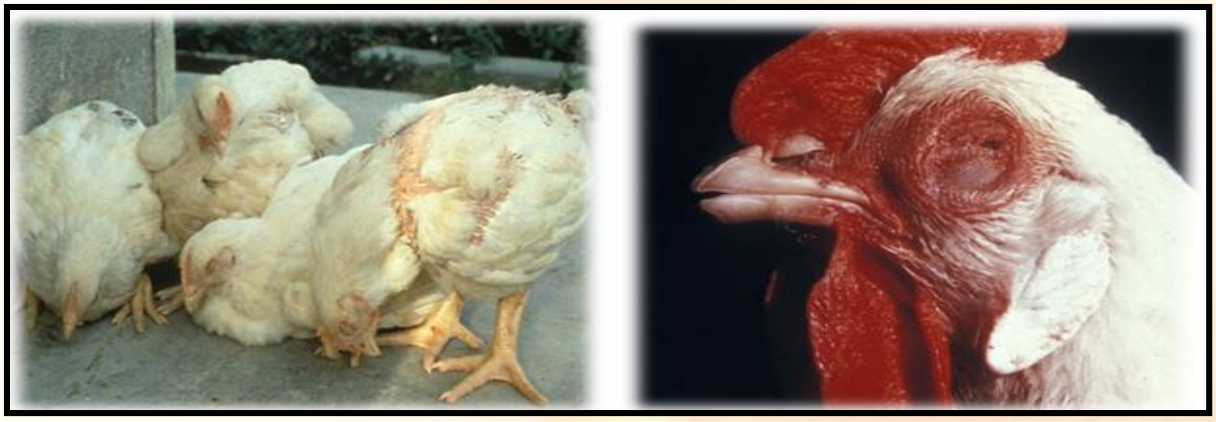
first and are sometimes followed by nervous signs, characterized by twisting of the neck, sometimes combined with dragging of wings and legs.

Depending on the environment and the degree of resistance of the birds, not all symptoms may be shown, or they may be in a mild or subclinical form. Some farmers have observed that the twisting of the neck occurs only in birds that survive. Early loss of appetite results in a greenish diarrhea. The most obvious diagnostic sign of New Castle Disease is very sudden, very high mortality, often with few symptoms having had time to develop. Diagnosis of New Castle Disease can be difficult from just the symptoms, as they are so varied, and as many other diseases share the same symptoms. For a discussion on the control of New Castle Disease, see the "New Castle Disease Control" section below. The high incidence of New Castle Disease among family free-range flocks is due to the following factors:

- The prevalence of virulent strains (velogenic, viscerotropic and pneumotropic) in tropical countries;
- Continuous contact with other domestic and wild species of birds (such as ducks and pigeons), which can carry the virus without showing the disease.
- Uncontrolled movement of birds between villages.

There is a seasonal pattern to outbreaks of New Castle disease influenced by:

- The arrival of migratory birds;
- Changes in climatic conditions leading to stress, which predisposes birds to the disease;
- Hot, dry and windy periods, which encourage airborne spread of the virus; and
- Overuse of the few supply points of water available (during the dry season), which then become heavily contaminated with the virus.



(2) **Fowl Pox**

This is a highly infectious disease caused by various host-specific strains of the pox virus. Many birds are affected by these viruses to some extent. The virus can be transmitted directly by infected birds, or be carried by mosquitoes, or other blood sucking insects. By eliminating breeding areas for these insects, the rate of spread of the virus will decrease.

The fowl pox virus attacks the skin and the surface of the mouth and throat. Depending on its location, pox is referred to as either skin pox or wet pox. Skin pox forms wart-like sores, which eventually enlarge and form masses of yellow, dirty crusts. In about a week, these scabs darken and fall off. Wet pox forms cheesy masses in the mouth, nose and throat, which interfere with eating and drinking. Antibiotics may be administered to prevent bacterial infections but the best method of control and prevention is by vaccination of day-old chicks.

This virus is capable of surviving for a long time in infected material, such as scabs and litter. Such material should therefore be incinerated.

(3) **Marek's Disease (MD)**

This disease usually affects birds two to five months old and causes lymphoid tumors. Symptoms vary according to the position of the tumors. Usually the nerves are affected and spastic paralysis occurs either in the legs, wings or neck. The virus of MD can remain infective for many months in litter or dry feathers. MD is prevented very effectively by vaccinating day-old chicks. Buy only vaccinated chicks.

(4) **Avian Influenza (AI)**

Avian influenza (AI) is a highly contagious disease of birds which can be devastating for poultry farmers, both backyard and commercial. AI is caused by a virus which occurs commonly in healthy waterfowl, but can cause severe disease in turkeys and chickens. Flocks that are confirmed positive for AI are depopulated and buried onsite. Sometimes farmers are paid for depopulated birds, but it may be only a portion of the true value of the birds, and can result in severe economic loss for owners and producers of the diseased poultry flocks.

Because of the structure of the commercial poultry industry and the events which many non-commercial or hobbyist poultry people attend, there is considerable movement of poultry and individuals associated with poultry. Whether a farmer's poultry interests are large or small, he or she needs to exercise caution when coming in contact with another poultry person or their birds. The AI virus is most often transmitted from one infected flock to another flock by infected birds, people or equipment. AI infected birds secrete virus via nasal secretions and feces. Moving infected birds would naturally result in transferring the virus to the new location. If infected birds are moved through an auction, or "swap meet", then the virus can be transferred to multiple new locations.

People most often spread viruses via contaminated clothing and/or boots. AI can live in manure for up to 105 days, so it could easily be spread from one farm to another on soiled boots or clothing.

Equipment used on multiple farms, that is contaminated with infective feces or nasal secretions can spread viruses to multiple new locations. A major problem with stopping the spread of AI is that apparently healthy birds can be infected and transmitting the virus to other birds before exhibiting any

clinical signs or symptoms. This is why one of the best ways to prevent this disease is to avoid contact with other poultry.

Symptoms and Diagnosis of Avian Influenza

There are two forms of AI in poultry, one is highly pathogenic or severe, and the other is low pathogenic or milder. The symptoms of AI are varied depending on the form of AI present, the species of bird infected, and other diseases present in the infected birds. All cases of AI infection require laboratory confirmation. The most common symptoms seen in infected chickens and turkeys include: depression and decreased activity, decreased feed consumption, decreased egg production, coughing, and sneezing, wet eyes, huddling, and ruffled feathers.

Birds infected with the severe or hot form of AI may have edema or accumulation of fluid in the comb and wattles, blueness of the head area, and severe production drops. Severe cases will show bleeding under the skin in the shanks and high mortality. The less severe form may not be as dramatic as the severe form, but it is still important to eradicate low pathogenic AI. Countries that have chosen to "live with" the milder form of AI have seen the virus become more pathogenic, or hot, after circulating through millions of birds. Any form of AI should be considered very serious. That is why laboratory diagnosis is important.

Prevention is the Key.

Preventing the introduction of AI and other viruses onto the farm should be the goal of all producers. Preventing the introduction of AI into a farmer's flock is not difficult to do if he or she follows some "***common sense***" guidelines.

- Avoid taking birds to (or bringing birds home from) all shows and exhibits during an AI outbreak.
- All avian species can be carriers of AI. All flocks should be fenced or confined, in order to avoid contact with any wild birds, especially waterfowl.
- Introduce new stock only from sources the farmer is sure are AI free and particularly not from areas in or near an AI outbreak zone.
- "Keep a spare pair." Buy a pair of inexpensive rubber boots, and wear them only on own premises, to avoid 'tracking in' disease.
- "Give germs the brush off!" Use a long-handled brush to scrape off manure, mud or debris from tires, equipment or boots, and then disinfect.

- "Disinfection prevents infection!" Mix a solution of three parts bleach to two parts water, and use it liberally to clean rubber boots and equipment brought onto the farm. If visitors do not want their vehicle tires sprayed with disinfectant, ask them to park outside the gate. Other disinfectants that work against AI virus and should be mixed according to package labels.
- "Make visitors take cover." Do not be shy about asking visitors or customers to disinfect their footwear or better yet, provide guests with disposable shoe covers, or footwear worn only on the farmer's place.

(5) **Gumboro Disease (Infectious Bursal Disease, IBD)**

Infectious bursal disease (IBD, Gumboro) is an acute, highly contagious viral infection in chickens manifested by inflammation and subsequent atrophy of the bursa of Fabricius, various degrees of nephroso-nephritis and immunosuppression. Clinically the disease is seen only in chickens older than 3 weeks. The feathers around the vent are usually stained with feces containing plenty of urates.

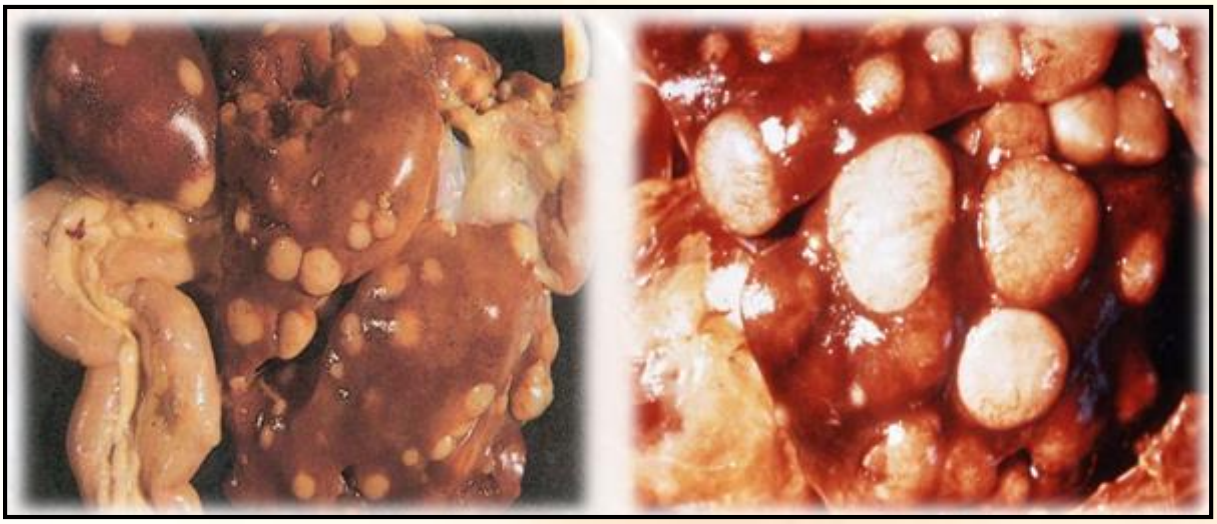
The period of most apparent clinical symptoms and high death rate is at the age of 3 - 6 weeks. IBD could however be observed as long as chickens have a functioning bursa (up to the age of 16 weeks). In chickens younger than 3 weeks, IBD could be subclinical, but injured bursa leads to immunosuppression. Also, diarrhea, anorexia, depression, ruffled feathers, especially in the region of the head and the neck is present.

Images of birds suffering from gumboro diseases

(6) **Lymphoid Leucosis**

This disease is normally found in chickens more than four months old. They pick it up in the first few weeks of their life, or from the mother which, if affected, passes leucosis through the egg. The tumors develop slowly; birds become sickly, pale and thin, and often have an enlarged abdomen.

There is no known effective treatment for leucosis, nor are there any vaccines available. Affected birds should be culled from the flock.

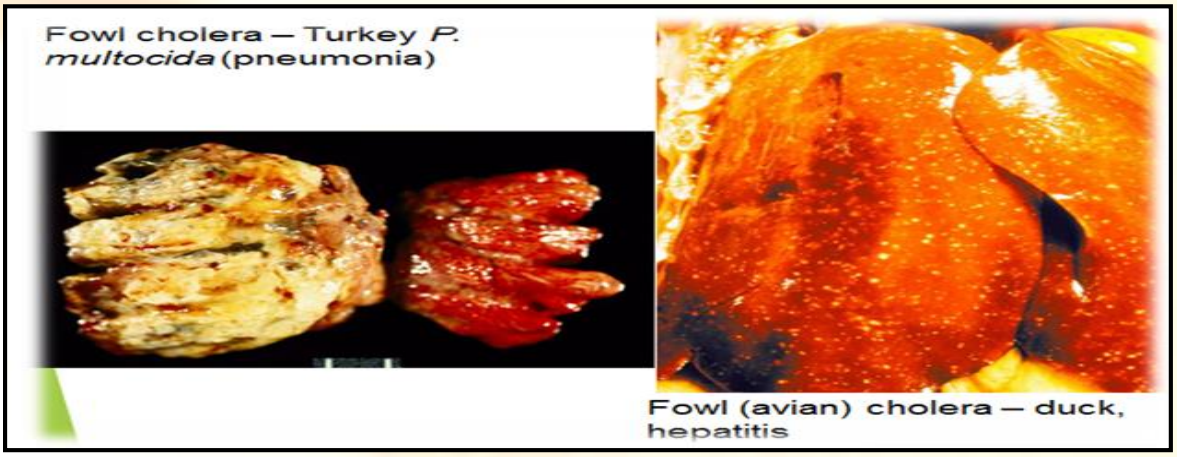


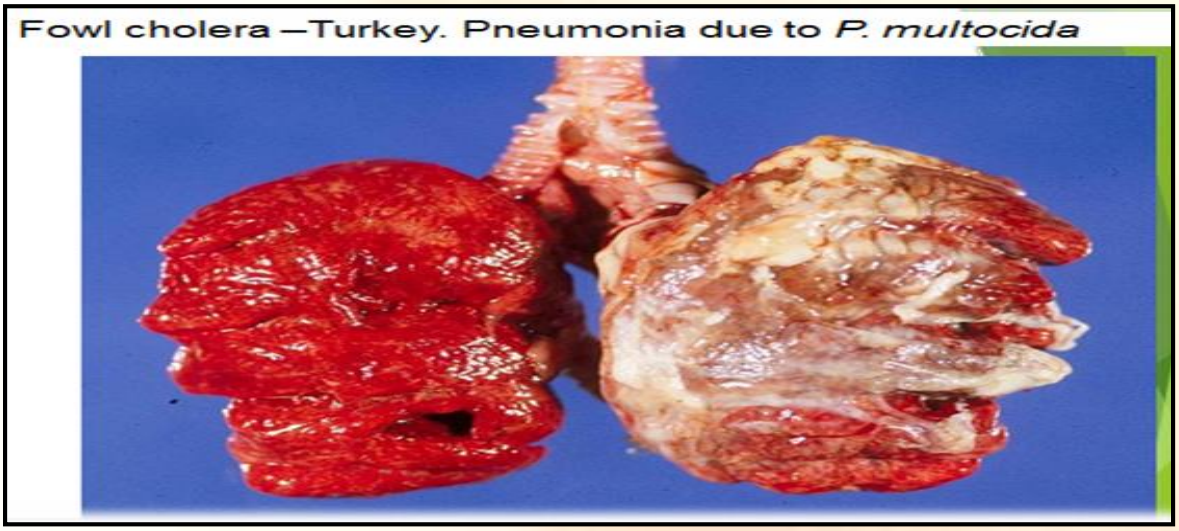
(7) **Mycoplasmal Diseases**

Mycoplasmas are not classified as bacteria or viruses, but as Pleuro-pneumonia-cocci-like organisms (PPLO). These are primarily associated with Chronic Respiratory Disease (CRD), a complex syndrome caused by Mycoplasma gallisepticum in partnership with bacteria (often E. coli), fungi and viruses (often Infectious Bronchitis). M. gallisepticum can be transmitted through the egg. Multi-age flocks, nutritional deficiency and water deprivation are important factors in the epidemiology of the disease in rural poultry flocks.

Bacterial Diseases

(8) **Fowl Cholera (Avian Pasteurellosis)**





This is a contagious septicaemia (caused by Pasteurellamultocida) that affects all types of fowls. It is often transmitted by wild birds or other domestic birds, and spreads by contamination of the feed or water and by oral or nasal discharges from infected birds. The incubation period is four to nine days,

but acute outbreaks can occur within two days of infection. In some cases, birds die within a few hours of showing the first signs, which vary depending on the form of the disease. The respiratory form is characterized by gasping, coughing and sneezing, while in the septicaemic form there is diarrhea with wet grey, yellow, or green droppings. In the localized form, the signs are lameness and swelling of legs or wing joints.

In acute cases, the head and comb change colour to dark red or purple. If the infection is localized in the region of the ears, a twisted neck (torticolis) can sometimes be observed. In chronic cases, the comb is usually pale, with swellings around the eyes and a discharge from the beak or nostril. Fowl Cholera is common everywhere among free-range village flocks, because they are comprised of different species and are in continuous contact with wild birds.

(9) **Pullorum (Bacillary White- Diarrhea)**

This is an egg-transmitted disease (caused by Salmonella pullorum) that spreads during incubation or just after hatching. White diarrhea can be seen from three days to several weeks of age. The chicks refuse to eat, keep their heads tucked in and their wings hanging down. They huddle together and make a peeping sound. Mortality in the acute form ranges from 20 to 80 percent, and in the chronic form is around five percent. In the chronic form, the signs are a marked swelling of the hock joints, poor feather development, lack of appetite and depression.

(10) **Fowl Typhoid**

Fowl typhoid is caused by Salmonella gallinarum, and commonly affects adult fowls. When it occurs in young birds, the signs are similar to those of S. pullorum. The incubation period is four to five days, and two days later the birds become depressed and anorexic. The colour of the comb and wattles becomes dark red; the droppings become yellow and the birds close their eyes and keep their heads down. Usually the affected chickens die within three to six days. Pullorum and fowl typhoid complex are both prevalent under free-range conditions.

(11) **Avian Salmonellosis (Paratyphoid)**

Salmonella infections may affect all domestic poultry, although adult birds often do not show any symptoms. Salmonella bacteria may also contaminate hatching eggs, which results in diarrhea, depression and death in young chicks. Paratyphoid is highly infectious and can be transmitted by mice,

rats, other birds and/or through contaminated feed. Symptomless adult birds constitute a human health risk if meat and egg hygiene are not adequate

(12) **Colibacillosis**

This is the common name for a large variety of diseases, including yolk-sac infection of chicks, reproductive disorders and peritonitis in layers, and septicaemia (blood poisoning) in growers. They are all caused by the bacterium Escherichia coli, which is found in the intestines of all warm-blooded animals

Affected birds can be treated with antibiotics. To prevent further spread of this organism, disinfect the premises and the pens with a commercial disinfectant, and provide good drainage.

Fungal Diseases

As all domestic poultry, wild birds, other animals and humans can be infected by fungi, take great care when handling infected birds. Transmission occurs by inhaling fungal spores from sick birds, contaminated litter or feed.

(13) **Aspergillosis**

The most common fungal disease in birds is Aspergillus fumigatus, which causes pneumonia or enteritis in all age groups, especially in the presence of other infections.

Treatment is not recommended. Infected birds should be culled and burned. All mouldy litter should be removed and burned and the pens should be sprayed with 1% copper sulphate.

(14) **Candidiasis or Thrush**

Candidiasis is another common fungal disease, which is found in younger age groups of all domestic poultry. It usually affects the mouth and crop, with sour-smelling crop content. It may also cause diarrhea. It primarily affects stressed birds. Check for unsanitary conditions, overcrowding and coccidiosis. Treat with nystatin to provide effective control.

(15) **Favus**

Favus, or ringworm, also known as white comb, is a fungal disease caused by Microsporum gallinae, which is of minor importance in all fowl, especially chickens and turkeys. Affected birds have small, white, chalky deposits on the comb, which can enlarge and coalesce to form a dull white, moldy layer

that could be several millimeters thick. The disease is self-limiting, and the comb heals after several months. Typically, if the disease is limited to the comb, the health of the bird is not affected, but if feathered portions are involved, the bird may become emaciated and die. Favus is a public health concern.

Chicken Parasites

External Parasites (Ectoparasites)

Hens can also suffer from external parasites. The three most common ones are lice (fleas), scaly leg mites and ticks. These are very common in scavenging poultry.

(1) **Lice**: Lice live on the hen and lay eggs on the base of the feathers, usually around the vent. Although their presence will not kill a hen, they do cause intense irritation and the hen will be unhappy and spend much time preening. Dust bathing helps to reduce infestation but hens should be checked regularly and treated with louse powder if there is evidence of infestation. The irritation they cause can lead to reduced production.

The lice are small, clear creamy ovals and are clearly visible to the naked eye. The eggs will show as a grey powdery deposit attached firmly to the base of feathers. The farmer can quickly pluck out any feathers with a heavy egg burden and dust the hen every week for four weeks with a natural louse powder. It also helps to dust the nest boxes and even the dust baths with louse powder.

(2) **Red Mites**: A red mite infestation is debilitating and can lead to death in hens. The red mite does not generally live on the hen; it lives in the henhouse, in rotten, broken wood or roofing felt,

crawls on to the hen while it roosts and sucks its blood, leading to anemia. Check the hen house regularly for evidence of infestation and treat immediately it becomes apparent.

There are a number of products available commercially for treating red mite, including powders and sprays. Prevention is better than cure. When something does appear to be wrong with a hen seek advice immediately from an experienced keeper or breeder, or from a vet. Bear in mind that the cost of employing a vet is likely to be more than the bird is worth in purely monetary terms. Only a farmer can decide whether he or she is willing to pay that price.

(3) **Ticks**: a heavy infestation can produce severe anemia and, in extreme cases, death due to blood loss. Argaspersicus is particularly dangerous, being the vector of several blood parasites such as the haemoprotozoa and microfilaria. Avian malaria infection is much higher among exotics and cross-breeds.

Internal Parasites (Endoparasites)

The more important internal parasites are:

(1) **Helminthes (worms)**: these are common in scavenging poultry, especially nematodes and cestodes. Worms are a major cause of lowered egg production of scavenging poultry in Uganda, the most commonly found being Round Worm, Caecal Worm, Tracheal Worm and Tape Worm.

(2) **Protozoan diseases**: Under protozoan diseases we have:

(a) **Coccidiosis:** Coccidiosis is one of the most common diseases of poultry. It is caused by a number of species of protozoa called coccidia. Fowls, turkeys, ducks and geese are all affected. However, coccidia are host-specific, so fowls are not affected by duck coccidia and vice versa

The disease usually affects birds over three weeks of age. The symptoms include ruffled feathers, drooping wings, pale combs and diarrhea, sometimes streaked with blood. Most losses occur in young birds, but adult birds can also be affected. Large numbers of chickens may die suddenly without apparent symptoms.

The coccidia live in the intestine or caecum of the bird and pass out through the droppings. They become infective in damp surroundings and are spread from bird to bird when infected droppings are eaten. Coccidia may survive for long periods in the litter.

Good management will help prevent serious outbreaks of coccidiosis. If birds are denied access to droppings, the life cycle will be broken. This is achieved when birds are raised on wire. Damp litter around water troughs will allow coccidia to become infective.

Medication in feed is often necessary to prevent outbreaks of coccidiosis. Young birds raised on the ground should be routinely treated with a coccidiostat. As the wet season provides ideal conditions for coccidia to become infective, medication is recommended at that time.

(b) **Blackhead**: The protozoon that causes this disease is Histomonasmeleagridis. Both young fowls and turkeys are affected by this protozoon but turkeys are far more susceptible and are more likely to contract this disease when run with poultry than when run on their own. Histomonads live largely in the caecum (blind gut) and invade other organs from there. Symptoms of blackhead include a drooped and huddled appearance, dark colouration of the head, shrunken comb and wattles and yellowish diarrhoea.

Living in the caecum places the histomonads in contact with the caecal worm (Heterakisgallinae) and the eggs of the worm become infected with the protozoa. Blackhead is transmitted when birds eat droppings containing these infected worm eggs.

Drugs are available to treat blackhead. To prevent re-infection, control caecal worms at the same time with good management. Turkeys and fowls should not be run together.

(c) **Trichomoniasis:** Trichomoniasis is caused by Trichomonasgallinae. It is a disease of the upper digestive tract. It has been found in pigeons, doves and kites but may invade hens and turkeys if they drink infected water or eat infected feed. Affected pigeons will go off-feed, appear ruffled, become emaciated and die, with a green yellow fluid dripping from the beak.

Non-Infectious Diseases/Disorders

Nutritional Disorders

A well-balanced diet is essential for maximum growth, production and health of a poultry flock. The components of a diet are energy, protein, vitamins and minerals. They must be present in the correct proportions. Nutritional problems occur when the overall dietary amount is inadequate, or when the components of the diet are not balanced.

Feed is used by the bird first for maintenance (normal body functions) and second for growth and/or production (i.e. meat or eggs). An inadequate diet will lead to a decline in growth of young birds or a drop in egg production in laying hens.

Dietary requirements vary with age, sex and laying status. For instance, a six-week-old chick requires 1% calcium and 20% protein whereas a layer requires 3.6% calcium and 16% protein.

- **Protein**: The protein component in a diet can come from an animal source, such as meat meal or fish meal, or a plant source, such as soybean meal. Dietary protein is used by the bird to build its own protein (muscle) and/or egg protein. A protein-deficient diet will lead to poor growth and low egg production.
- **Energy:** The most common sources of energy in poultry diets are cereal grains, such as maize, wheat or sorghum, which are high energy foods. An energy-deficient diet will result in depressed production and a loss of condition. A diet excessively high in energy will cause birds to become fat and will reduce their feed intake. When feed intake decreases, birds may suffer from a deficiency of protein and vitamins, which complicates the problem.
- **Vitamin deficiencies**: Vitamins are required only in small amounts but are essential for growth and production. All good quality commercial feeds will contain the required amount of vitamins and this will be stated on the label. However, vitamins can be destroyed by the action of heat and water, and may break down during prolonged storage. Feed should, therefore, be stored in a cool, dry shed and bought in small amounts to avoid long storage. Soluble vitamin supplements are available, which can be added to the drinking water to correct deficiencies. Alternatively, food rich in a particular vitamin can be provided. In tropical climates, where birds tend to eat less, it may be necessary to increase the vitamin content of the diet.

The table below shows Sources, functions and symptoms of deficiency of vitamins

Vitamin	Source	Function	Symptoms of deficiency
Vitamin A	Green leaf material	Vision, growth reproduction, maintenance of mucous membranes, growth of cartilage in bones.	**Young birds** - Listlessness, ruffled plumage, pale combs, wattles, beaks and shanks. Pustules in nasal passage, mouth; lameness. **Adult birds** - Decreased production and hatchability of eggs. Watery discharge from nostrils and eyes. Pustules in nasal passage and mouth. Emaciation and weakness.
Vitamin D	Synthesized by the bird by the action of light on the skin. Fish liver oils	Necessary for absorption of calcium in the diet. General calcium metabolism and maintenance of bone structure.	**Young birds** - Rickets (leg weakness), soft beaks and claws. Poor growth. **Adult birds** - Decreased production and hatchability of eggs. Soft-shelled eggs. Fragile bones.
Vitamin E	Cereals, vegetable oils	A wide range of biological functions.	**Young birds** – Poor coordination, unsteady gait "crazy chick disease" (rapid contraction and relaxation of head and leg muscles). **Adult birds** - Reduced hatchability of eggs. Degeneration of testes in males.
Vitamin K	Green leaf material	Required for blood	Young and adult birds - Increased bruising and bleeding.
Vitamin B_1 (Thiamine)	Cereal grains, soya bean meal	A wide range of biological functions.	Young and adult birds - Decreased appetite and weight loss. Leg weakness and muscle paralysis. "Stargazing" (head retracted and legs thrust forward).
Vitamin B_2 (Riboflavin)	Green plants, yeast eggs, milk	Essential for growth and tissue repair.	**Young birds** - Poor growth. Toes curled inwards, clubbed down. **Adult birds** - Decreased hatchability of eggs.

- **Minerals**: A wide range of minerals are required by poultry. They are available in good quality commercial feeds. Calcium and phosphorus, in particular, must be supplied in balanced proportions. Young birds require a ratio of calcium to phosphorus of 1:1; however, laying birds require a ratio of 5:1. Commercial layer diets have calcium incorporated in the mix; otherwise, extra calcium can be supplied by using shell grit or limestone.

  If young chickens are given layer feed, the high calcium content can reduce the growth rate and delay sexual maturity. A deficiency of calcium in the diet can also cause a reduction in the growth rate, as well as rickets in young chickens. In layers, it can cause fragile bones or thin-shelled eggs. A phosphorus deficiency can also cause rickets in chickens.

Toxicities (Poisoning)

- **Aflatoxins**: **Aflatoxins** are poisons produced by certain strains of the fungus Aspergillusflavus. Tropical conditions are ideal for the growth of fungi and contamination of feed is fairly common. These poisons affect the liver and the immune response to some diseases, such as thrush and coccidiosis, may be reduced.

  Ducks, geese and turkeys are very susceptible. It is a very difficult condition to diagnose as there are no specific clinical symptoms to show the presence of the poisons.

  By providing fresh food daily and removing any uneaten food, the chance of this fungus growing is reduced.
- **Salt**: Salt poisoning, caused by common salt, is usually found in birds fed food scraps. The symptoms are increased drinking and diarrhea. Salt poisoning usually affects young birds.
- **Ammonia:** High humidity may cause high levels of ammonia to be present in poultry sheds. This is easily detected by smell and, if not removed, may lead to respiratory problems and sometimes, severe conjunctivitis (ammonia burn).

  If the litter in the shed is kept dry and clean and the shed is well ventilated, ammonia should not be a problem.
- **Lead**: Symptoms of lead poisoning are loss of appetite, drowsiness, paralysis, convulsions, diarrhea and sudden death. Check the area for old paint products, motor oils, old batteries and buckshot.
- **Plants**: The seeds, fruit or leaves of some plants are poisonous at all times or at a specific stage of growth. Poisons can be found in some garden plants and weeds, including oleander

(Neriumoleander) leaves, green potatoes, rhubarb leaves, white cedar (Meliaazedarach) fruits, paddy's lucerne (Sidarhombifolia) leaves and some fungi. Cases have been recorded in some countries of poultry being killed by poisonous seeds in purchased grain.

A diagnosis of plant poisoning requires careful recording of symptoms, presentation of sick or freshly-dead birds, evidence that suspect plants or their fruits or seeds have been eaten and specimens of the suspect plants.

- **Botulism (Limber neck):** Botulism is caused by the toxins (poisons) produced by the bacterium Clostridium botulinum, which may be found in animal carcasses, decaying plant matter, stagnant pools and spoiled food.

  Fly-blown material is particularly toxic because the toxin is concentrated in the maggots.

  Birds affected by botulism show paralysis, loose feathers and extreme weakness.

  To control an outbreak, contact with possible sources of toxin should be eliminated. In particular, sick birds should be removed and all carcasses should be burned.

  Water fowl showing early symptoms may be treated by placing birds in clean, running water and feeding wet bran mash.

- **Pesticides**: When poultry are treated for parasites, care must be taken to follow exactly the dose and instructions on the container because improper treatment can be potentially harmful to birds. Some chemicals used for treatment may appear in the eggs or meat of the birds and may persist for some time. In such cases, a period must elapse after treatment before meat or eggs are consumed. This is the 'withholding period' which is indicated on the container and must be observed. Birds should not be killed for eating during this period and all eggs laid should be discarded.

When poultry are allowed free range, particularly in an orchard, they may be exposed to a variety of pesticides, which are being used on the trees. Some of these pesticides are likely to be toxic to the birds or, even if not affecting the birds themselves, may be taken up and concentrated in the meat or eggs. If the content of a pesticide is high in the meat or eggs, their consumption is dangerous and as such, their sale is illegal. Usually, there is no information on the container of such pesticides about possible effects on poultry or necessary withholding periods. The only safe

course is to prevent poultry from places where pesticides are used. Drift of pesticides to poultry must also be avoided.

Disorders of the Egg Tract

During peak production, a hen can lay one egg every 23 - 26 hours. To make an egg, the yolk is shed into the oviduct; then, as the yolk travels down, the other parts are added. When the shell is complete, the egg is laid.

- **Egg-bound**: A hen is described as egg-bound when an egg lodges in its oviduct and it cannot expel it. This can be caused either by a larger than normal egg, or when the muscles used in laying eggs are weak. The egg can be removed by inserting a lubricated finger into the cloaca and using the other hand to squeeze the egg out. If this fails, the egg should be broken with a sharp object and all the pieces of the shell removed.

  Holding the bird over a pan of hot water may relax the muscles of the oviduct and facilitate the removal of the egg.

  After the egg is removed, the bird should be allowed to recover in a separate coop to prevent other birds from pecking the cloaca. This can be done only in a small flock. In a large flock, an egg-bound bird should be culled.

- **Prolapse:** When a hen lays an egg, the lower part of the oviduct is momentarily averted through the cloaca. Normally, the hen can retract the oviduct after laying. Prolapse occurs when the hen cannot retract the oviduct and a part of it remains outside the body.

  This condition is most common in overweight, older hens and in early laying pullets of low body weight. Other birds will peck at the red protrusion and cannibalism usually follows. It is unlikely that a bird with prolapse will recover and it should be destroyed.

- **Egg peritonitis**: The egg yolk provides a good medium for bacterial growth and may sometimes become infected while it is still inside the bird. Infection may occur while the yolk is moving down the egg tract or when a yolk fails to enter the oviduct and is shed into the body cavity.

  Prolific layers may die without warning, or may gradually become ill when affected by egg peritonitis. There is no viable commercial treatment for this disorder. However, valuable birds may be treated with antibiotics if the disease is diagnosed early.

Vices in Chickens

(a) **Cannibalism:** It is a natural part of poultry behaviour for birds to establish a social hierarchy by pecking one another. Sometimes, an injured or weak bird or a stranger bird may be excessively attacked by all the other birds. A bird exhibiting a bleeding area is particularly likely to attract an attack. It may be pecked to death if it is not rescued.

Such cannibalism is often aggravated by overcrowding. It is therefore important to provide adequate space to the flock. Nutritional deficiencies have also been implicated in cannibalism, along with boredom and irritation from external parasites. Lights that are too bright may make birds nervous or highlight a bleeding or red area, leading to more frequent pecking.

Cannibalism may be prevented to some extent by providing birds with a distraction, such as a cabbage or carrot hung from the ceiling. If the problem becomes out of control, the only solution is de-beaking, which involves cutting off a part of the beak to prevent birds from causing injury to one another.

(b) **Egg eating**: Egg eating usually begins when birds eat already broken eggs. Once a few birds acquire the habit, it spreads rapidly through the flock.

Factors which lead to egg breakage encourage egg eating, such as inadequate nesting facilities, failure to collect eggs frequently, insufficient nesting material and inadequate diet resulting in soft and thin shelled eggs. Correcting these problems will reduce the number of broken eggs. However, it is difficult to break the habit of birds and it is best to cull those that begin to eat eggs. De-beaking may be the last resort.

Disease Control in Flocks

Non-Medical Disease Control

The most economical and effective means of preventing non-viral diseases is improved management and nutrition, of which the most important aspects are hygiene, housing, flock structure, and young chick care and feeding.

Hygiene

The following simple hygiene measures can help in disease prevention:

- Droppings, feathers and dead birds are sources of pathogens and should be removed from overnight housing and the free-range compound, and then properly disposed of. This will also reduce the incidence of external parasites.
- New arrivals to the flock should be isolated. Birds bought or received as gifts should be quarantined in a basket or cage for at least 15 days; if they remain healthy, they can then join the flock.
- All new arrivals should be treated for ectoparasites and endoparasites as well as vaccinated on arrival if possible.
- Sick birds should be isolated or slaughtered promptly, and dead birds buried.
- The litter in the poultry house should be turned frequently and changed if wet.
- Overnight security baskets should be put in the sun to dry properly or suspended near a fire during the rainy season.
- Feeders and drinkers should be cleaned frequently.
- Broken pots used as drinkers should be heated over a fire before refilling.
- The poultry house or basket should be regularly disinfected every two months.

Housing

Simple improvements and maintenance can be carried out when the poultry house is not in use. Important factors in good housing are:

- **Ventilation**: if poultry baskets are used for overnight housing, they should not be covered with cloths or sacks. Huts, coops and baskets should not be placed near dunghills or pit latrines.
- **Proper spacing**: overcrowding should be avoided, and numbers of poultry should be restricted to the space available. Weaned chicks and growers should be kept in separate overnight housing. Laying and brooding nests should be left undisturbed.
- **Separate species**: it is better to keep only one species of poultry but if this is not possible, the species should be housed separately overnight to avoid the spread of disease.

Flock Structure

Of all the common free-range poultry species, chickens are the most susceptible to disease. Ducks, geese and guinea fowl are often symptom-less carriers of chicken diseases, or have mild forms of them. This represents a common source of infection in chickens, while the opposite is rare.

Therefore in mixed flocks special attention should be paid to the health of chickens. Separation into different species and age groups may not be possible, but simple devices such as creep cage-baskets may be used as a temporary measure for procedures such as vaccination of chicks or special feeding.

Feeding

The importance of nutrition in flock health is well known. Birds should be fed well to boost their immune system. This in turn reduces incidences of diseases that come as a result of nutrient deficiencies.

Medical Disease Control

Simple medical control measures appropriate for free-range village flocks include:

- **Vaccination** against Newcastle Disease, Fowl Pox and Fowl Cholera. There are five (5) vaccination methods. These include**: Eye-drop method; Spray method; Drinking water method; Needle through the wing-web method and Injection method.** Note: Strictly follow the vaccination program as advised by the veterinarian. Failure to follow the vaccination schedule can result in severe loss in case of a disease outbreak in a farmer's flock.
- **De-worming** for internal parasites in a mixed flock, with a polyvalent poultry de-wormer such as Piperazine (added to drinking water). With guinea fowl, a de-wormer against Trichomonas should be used.
- **Treatment for external parasites**. Insects and other external parasites build up quickly in poultry huts, coops and baskets. There are effective traditional methods against ectoparasites. All the surfaces of the basket, coop or hut can be sprayed with a suitable insecticide, using the same type of hand-pump used for spraying mosquitoes. This procedure should only be carried out when the house is empty in the morning, and the birds should not be allowed back inside until evening. External parasites living on poultry can best be treated by adding powdered mothballs (naphthalene) and ash to the dust bath area. Ash dust is more abrasive than ordinary soil dust, and thus removes the waxy coating of the insect exoskeleton when the bird takes a dust bath. If enough of the waxy coating is removed, the insect will dehydrate and die.

Aliseryl WS

Powder for oral administration

AliserylWS offers care and cure for a farmer's animal by the highly effective combined action of broad-spectrum antibiotics and vitamins.

Erythromycin is a macrolide that acts bacteriostatic against mainly Gram-positive bacteria like Staphylococcus and Streptococcus spp. Oxytetracycline belongs to the group of tetracyclines and acts bacteriostatic against many Gram-positive and Gram-negative bacteria like Bordetella, Campylobacter, Chlamydia, E. coli, Haemophilus, Mycoplasma, Pasteurella, Rickettsia, Salmonella, Staphylococcus and Streptococcus spp. Streptomycin is an aminoglycoside with a bactericidal action against mainly Gram-negative bacteria like E. coli, Klebsiella, Pasteurella and Salmonella spp. and Mycoplasma, whereas Colistin is an antibiotic from the group of polymyxins with a bactericidal action against Gram-negative bacteria like E. coli, Haemophilus and Salmonella. The vitamins in Aliseryl WS have different functions and are essential for the proper operation of physiological functions. For example, vitamin A, B-vitamins and vitamin C are essential for an optimum immune response, vitamin D is essential for growth,

Composition

Erythromycin thiocyanate	35mg
Oxytetracycline hydrochloride	50 mg
Streptomycin sulphate	35 mg

Indications:

Aliseryl WS is a highly effective combination of broad spectrum antibiotics and vitamins. The product stimulates egg production, increases growth, improves feed conversion and is used as vitamin supplement during periods of diseases and stress. It is effective against gastrointestinal, respiratory and urinary infections caused by colistin, oxytetracycline, erythromycin and streptomycin sensitive microorganisms, like Bordetella, Campylobacter, Chlamydia, E. coli, Haemophilus, Klebsiella, Mycoplasma, Pasteurella, Rickettsia, Salmonella, Staphylococcus and Streptococcus spp. In calves, goats, sheep, poultry and swine.

vitamin E is important to maintain host defense mechanisms and vitamin K is essential for the maintenance of normal blood coagulation. Infections often occur when the defense mechanism of animals is impaired, e.g. by stress situations like change of environment or transport and marketing. Supplementation of the animal's feed with antibiotics and vitamins in these stress situations has been shown to be advantageous.	**Dosage:** For oral administration. Poultry and swine: Prevention: 1 kg per 2000 liters of drinking water for 5 - 7 days. **Withdrawal times:** Eggs: 1 day. **Packaging:** Sachet of 30 and 100 g and jar of 1000 g.

Coloxan WS The synergistic antibiotics combination of Doxycycline Hyclate&ColistinSulphate. It is used for the treatment of respiratory and gastrointestinal infections caused by micro-organisms susceptible to doxycycline and colistin. Coloxan WS is the synergistic combination of doxycycline, a broad spectrum antibiotic with bacteriostatic activity against Gram-positive and Gram-negative bacteria, chlamydias, rickettsiae and mycoplasmas, and colistin, an antibiotic with bactericidal activity against primarily Gram negative bacteria (Salmonella spp., E. coli,	 **Indications:** Treatment of respiratory and gastrointestinal infections caused by micro-organisms susceptible to doxycycline and colistin. Infections of the upper respiratory tract and air sacs (coryza, CRD, infectious sinusitis), E. coli infections, salmonellosis (typhose, paratyphose, pullorose), cholera, aspecific enteritis (blue

Haemophilus). Following oral administration, doxycycline is completely and rapidly absorbed in the gastrointestinal tract, after which it diffuses into tissues due to its lipophilicity. Colistin is retained by the gastrointestinal tract where it performs its action. Colistin and doxycycline work synergistically to inhibit cellular protein synthesis of pathogens.

Composition per gram powder:

Doxycycline hyclate	100 mg.
Colistinsulphate	1 200 000 IU
Excipients	ad 1 g

Withdrawal times:

7 days

Packaging

Coloxan WS is available in sachets of 100 gram and jars of 1000 gram.

comb disease), chlamidiosis (psittacosis) and septicaemia.

Side Effects

Discoloration of teeth in young animals or hypersensitivity reactions may occur. Digestive alterations may appear, such as intestinal dysbiosis, accumulation of gases or mild diarrhoea.

Dosage:

For oral administration.

Chickens and turkeys:

1 kg per 2000 liters of drinking water for 4-5 days.

Amprocox WS

Powder for oral administration

Absolutely powerful and complementary combination of antiparasitic agents and vitamins against coccidiosis

Amprocox WS offers the combined action of amprolium hydrochloride, sulfaquinoxaline, Vitamin A and Vitamin K3 to treat coccidiosis effectively. Amprolium hydrochloride is an anticoccidial with activity against Eimeria spp.

Side effects:

At high dosages in laying hens egg-drop and in broilers growth inhibition and polyneuritis can occur. Other side effects may include crystalluriaanaemia, leucopenia and

and sulfaquinoxaline is a sulfonamide with a activity against a broad range of Gram-positive and Gram-negative bacteria, including Eimeria maxima, Eimeriabrunetti and Eimerianecatrix. The combination of these active pharmaceutical ingredients with vitamin A and vitamin K3 promotes the efficient and safe prevention and treatment of coccidiosis by supporting physiological processes, like the maintenance of healthy epithelial tissues and mucous membranes, good vision and blood coagulation. Amprocox WS is highly effective for the prevention and treatment of coccidiosis and prevents intestinal bleeding due to coccidial infections in calves, sheep, goats and poultry.

Composition per gram powder:

Amprolium hydrochloride	**200 mg**
Sulfaquinoxaline	**150 mg**
Vitamin A, retinol acetate	15 000 IU.
Vitamin K3	5 mg
Excipients ad	1 g

Indications:

Prevention and treatment of coccidiosis in calves, sheep, goats and poultry.

thrombocytopenia.

Dosage:

For oral administration.

Poultry:

20 g per 20-40 liters of drinking water for 5-7 days.

Withdrawal times

For poultry meat: 14 days

Packaging:

Amprocox WS is availa

Dimoxan WS

The ultimate synergistic combination of Amoxycillin & Colistin antibiotics. Used for the treatment of respiratory, urinary and gastrointestinal infections caused by microorganisms susceptible to amoxicillin and colistin in calves, goats, poultry, sheep and swine.

Dimoxan WS offers a combined, synergistic action of amoxicillin, a broad spectrum semi-synthetic antibiotic with bacteriostatic activity against many Gram-positive and Gram-negative bacteria, and colistin, anpolymyxin antibiotic with bactericidal activity against Gram-negative bacteria such as Salmonella and E. coli. After oral administration, amoxicillin is well absorbed and widely distributed in the body. Amoxicillin acts by inhibiting bacterial cell membrane synthesis. Colistinsulphate binds to the cell membrane of Gram-negative bacteria and compromises the membrane integrity. The cell membrane disrupting activities of colistin and amoxicillin work synergistically to disrupt the cell structure of pathogens, giving excellent bactericidal properties.

Composition per gram powder:

Amoxyicillintrihydrate	200 mg.
Colistinsulphate	1 200 000 IU.
Excipients	ad 1 g.

Withdrawal times:

Indications:

Treatment of respiratory, urinary and gastrointestinal infections caused by micro-organisms susceptible to amoxicillin and colistin in calves, goats, poultry, sheep and swine. These micro-organisms include Campylobacter, Clostridium, Corynebacterium, E. coli, Erysipelothrix, Haemophilus, Pasteurella, Salmonella, penicillinase-negative Staphylococcus and Streptococcus spp.

Side effects:

Animals can experience hypersensitivity reactions, renal dysfunction, neurotoxicity and neuromuscular blockade.

Dosage:

For oral administration.

Calves, goats and sheep:

Twice daily 5 gram per 100 kg body weight for 3 – 5 days.

Poultry and swine:

For meat: 8 days **Packaging:** Dimoxan WS is available in sachets of 100 gram and jars of 1000 gram.	1 kg per 1000 – 2000 liters of drinking water for 3 – 5 days. Note: Before adding to the drinking water make a pre-solution of 1 kg Dimoxan WS per 20 liters of water with a temperature of 40 °C

Limovit WS

The highly effective combination of Oxytetracycline and vitaminsagainst gastrointestinal, respiratory and urinary infections.

Limovit WS offers the combined action of oxytetracycline, a broad-spectrum antibiotic and vitamins which are essential for the proper operation of several physiological functions and which will help reducing disease stress.

Oxytetracycline is part of the tetracycline family of antibiotics and is active against a wide range of Gram-positive and Gram-negative bacteria and atypical organisms like chlamydiae, mycoplasmas, rickettsiae and protozoan parasites. Oxytetracycline inhibits the reproduction of bacteria by preventing protein synthesis. It is a widely used antibiotic because of its advantageous antimicrobial properties and the absence of major adverse side effects.

Indications:

Limovit WS is a highly effective combination of a broad-spectrum antibiotics (Oxytetracycline) and vitamins. The product stimulates egg production, increases growth, improves feed conversion and is used as a vitamin supplement during periods of diseases and stress. It is active against gastrointestinal, respiratory and urinary infections caused by oxytetracyclin sensitive micro-organisms, like Bordetella, Campylobacter, Chlamydia, E. coli, Haemophilus, Mycoplasma, Pasteurella, Rickettsia, Salmonella, Staphylococcus and Streptococcus spp. in calves, goats, sheep, poultry and swine.

Side effects:

No undesirable effects are to be expected when the prescribed dosage regimen is followed.

The vitamins in Limovit WS have different functions. Vitamin A is involved in immune function. B-vitamins are essential for an optimum immune response against infections and Vitamin C influences immune responses as well. Vitamin D is essential for growth, vitamin E is important to maintain host defense mechanisms and vitamin K is essential for the maintenance of normal blood coagulation. Infections often occur when the defense mechanism of animals is impaired, e.g. by stress situations like change of environment or transport and marketing. Supplementation of the animal's feed with antibiotics and vitamins has been shown to be favourable when preventing and treating a wide range of gastrointestinal, respiratory and urinary tract infections. Limovit WS offers this ultimate combination of a broad-spectrum antibiotic and essential vitamins to provide care and cure your animals of gastrointestinal, respiratory and urinary infections.	**Dosage:** For oral administration **Poultry and swine:** **Prevention:** 1 kg per 2000 liters of drinking water for 5 - 7 days. **Treatment:** 1 kg per 1000 liters of drinking water for 5 - 7 days. **Withdrawal times:** Meat: 7 days. Eggs: 1 day. **Packaging:** Sachet of 100 g and jar of 1000 g

Amprolin-300 WS

Amprolium&Sulfaquinoxaline& Vitamins water-soluble powder

Powder for oral administration

Composition

Contains per gram powder:

Amprolium hydrochloride	300 mg
Excipients ad	1 g

Description

Amprolium is a coccidiostat (antiprotozoal) used for the treatment and prevention of coccidiosis in calves, sheep, goats, chickens (broilers and breeders) and other fowl such as turkeys, with activity against Eimeria spp., especially Eimeriatenella and Eimerianecatrix. It is a thiamine (vitamin B1) analogue and its pharmacological effect relies on competitive inhibition of thiamine uptake.

Amprolium competitively inhibits the active transport of thiamine in isolated second-generation schizonts of Eimeria spp. and in host intestinal cells. Upon ingestion of amprolium, the coccidia experience thiamine deficiency and starve from malnutrition.

Contra indications

The use of amprolium is prohibited from a laying age onwards. Do not administer to poultry whose eggs are intended for human consumption. Do not administer to animals with impaired hepatic and/or renal functions. Do not administer to turkeys before the age of 8 to 10 weeks.

Side effects

Over dosage of amprolium can suppress weight gain in broilers and cause polyneuritis. Long-term administration of amprolium in high doses may result in thiamine (vitamin B1) deficiency in the host. To treat amprolium overdose, thiamine should be administered parenterally or orally.

Dosage

For oral administration:

Calves, sheep and goats:

Preventive: 1 g per 60 kg body weight through drinking water or milk for 21 days.

Indications Amprolin-300 WS is indicated for coccidiosis caused by coccidia susceptible to amprolium (Eimeria spp.) or gastrointestinal infections for which it is therapeutically or prophylactically indicated to administer amprolium in calves, goats, sheep and poultry. **Packaging** Sachet of 100 g and jar of 1000 g. **Withdrawal times** For meat: Calves, goats, sheep: 3 days. Poultry: 3 days.	Curative: 1 g per 30 kg body weight through drinking water or milk for 5 days. **Poultry:** **Preventive**: 1 kg per 5000 liters of drinking water for 1 - 2 weeks. **Curative**: 1 kg per 1250 - 2500 liters of drinking water for 5 - 7 days. Note: Mix Amprolin-300 WS daily with fresh water or milk. Not intended for hens producing eggs for human consumption. In severe cases curative treatment may be followed by preventive treatment.

EGG PRODUCTION MANAGEMENT

Factors Affecting Egg Production

Typically, a layer's production cycle lasts just over a year (52-56 weeks). During the production cycle many factors influence egg production; therefore, the cycle must be managed effectively and efficiently in order to provide maximum output and profitability. The following factors influence egg production.

(a) **Breed:** The breed of the laying bird influences egg production.

(b) **Mortality rate**: Mortality rate may rise due to disease, predation or high temperature. The mortality rate of small chicks (up to eight weeks of age) is about 4 percent; that of growers (between eight and 20 weeks of age) is about 15 percent; and that of layers (between 20 and 72 weeks of age) is about 12 percent. The average mortality rate of a flock is from 20 to 25 percent per year.

(c) **Age:** Birds typically begin producing eggs in their twentieth or twenty-first week and continue for slightly over a year. This is the best laying period and eggs tend to increase in size until the end of the egg production cycle.

(d) **Body weight**: In general, optimum body weight during the laying period should be around 1.5 kg, although this varies according to breed. Underweight as well as overweight birds lay eggs at a lower rate. Proper management and the correct amount of feed are necessary in order to achieve optimum body weight.

(e) **Laying house**: The laying house should be built according to local climatic conditions and the farmer's finances. A good house protects laying birds from theft, predation, direct sunlight, rain, excessive wind, heat and cold, as well as sudden changes in temperature and excessive dust. If the climate is hot and humid, for example, the use of an open house construction will enable ventilation. The inside of the house should be arranged so that it requires minimum labour and time to care for the birds.

(f) **Lighting schedule:** Egg production is stimulated by daylight; therefore, as the days grow longer production increases. In open houses, found commonly in the tropics, artificial lighting may be used to increase the laying period. When darkness falls artificial lighting can be introduced for two to three hours, which may increase egg production by 20 to 30 percent. In closed houses, where layers are not exposed to natural light, the length of the artificial day should be increased either in one step, or in a number of steps until the artificial day reaches 16 to 17 hours, which will ensure constant and maximized egg production. Effective day length should never decrease during the laying period.

(g) **Feed:** Free-range hens will produce more meat and eggs with supplemental feed, but only if they are improved breeds or crossbreeds. The selection of local hens is done on the basis of resistance and other criteria rather than feed utilization for production. Fresh and clean water should always be provided, as a layer can consume up to one-quarter of a liter a day.

(h) **Climate:** The optimal laying temperature is between 11° and 26° C. A humidity level above 75 percent will cause a reduction in egg laying.

Temperature and its Effect on Egg Production

Temperature (^{0}C)	Effects
11–26	Good production.
26–28	Some reduction in feed intake.
28–32	Feed consumption reduced and water intake increased; eggs of reduced size and thin shell.
32–35	Slight panting.
35 –40	Heat prostration sets in, measures to cool the house must be taken.
40 and above	Mortality due to heat stress.

When the temperature rises above 28°C the production and quality of eggs decrease. Seasonal temperature increases can reduce egg production by about 10 percent.

(i) **Management factors**: Effective and efficient management techniques are necessary to increase the productivity of the birds and consequently increase income. This entails not only proper housing and feeding, but also careful rearing and good treatment of the birds.

(j) **Vaccination and disease control**: Diseases have an effect on egg quality. Infectious bronchitis and Newcastle disease, for example, will cause birds to lay eggs with poor quality shells and with extremely poor quality albumen. Many of the birds continue to lay poor quality eggs even after recovery. Effective vaccines should be administered.

(k) **Collection of eggs**: Frequent egg collection will prevent hens from brooding eggs or trying to eat them and will also prevent the eggs from becoming damaged or dirty.

Maintaining Fresh Egg Quality

Maintaining fresh egg quality from producer to consumer is one of the major problems facing those engaged in marketing eggs. Proper attention to production, distribution and point-of-sale phases are of vital importance in maintaining egg quality.

Production Factors

The main production factors that affect quality maintenance are the following:

(a) **Breed.** The breed of the laying hen affects shell colour; for example, Leghorns produce white eggs, while Rhode Island Reds produce brown eggs. The following egg quality factors are partly inherited: shell texture and thickness, the incidence of blood spots and the upstanding quality and relative amount of thick albumen. Though it may not always be possible, a consistent policy of selection for breeds by egg producers can bring noticeable improvements to quality.

(b) **Age.** Birds typically begin producing eggs in their twentieth or twenty-first week and continue for slightly over a year. This is the best laying period and eggs tend to increase in size until the end of the egg production cycle. Birds lay fewer eggs as they near the moulting period. In the second year of lay, eggs tend to be of lower quality.

(c) **Feed.** Egg quality and composition derive primarily from what a layer is fed. In terms of taste, for example, eggs laid by hens fed on fishmeal will have a "fishy" taste. The type of feed will also influence the shell of an egg and the colour of the yolk. Layers must be kept away from certain plant foods if egg colour defects are to be avoided. These may include cottonseed meal and the foliage of the ***sterculiaceae*** **and** ***malvaceae*** such as mallow weed.

Regular access to fresh or high-quality dehydrated green feed helps birds to produce eggs with a uniform yellow yolk. Yellow maize, alfalfa meal, and fresh grass provide good pigment sources for a normal yellowish-orange yolk colour.

(d) **Management.** Good general management of the laying flock can improve egg quality. If birds are treated correctly and not put under conditions of stress they will produce properly.

(e) **Disease control.** Diseases have an effect on egg quality. Infectious bronchitis and Newcastle disease, for example, will cause birds to lay eggs with poor quality shells and with extremely poor quality albumen. Many of the birds continue to lay poor quality eggs even after recovery. Effective vaccines should be administered.

(f) **Handling/collecting eggs.** Frequent collection is essential each day in order to limit the number of dirty and damaged eggs and also to prevent the hens from eating the eggs. Careful handling is necessary in order to avoid breakage.

(g) **Laying house.** The number of dirty eggs produced can be reduced significantly by providing good housing and clean nests for the layers. Cleaning and hygiene operations should be carried out frequently.

BROILER MANAGEMENT

Factors Crucial To Successful Broiler Projects

The following factors are very crucial if a farmer is to have a successful broiler chickens' project:

(a) **Housing**: The first requirement for growing broilers is adequate housing. Because broiler production is essentially a chick-brooding operation, the house should contain equipment so that such factors as temperature, moisture, air quality and light can be controlled easily. It should also provide for efficient installation and operation of brooding, feeding, watering and other equipment.

(b) **Be ready**: Do all necessary cleaning of houses and equipment several days before the chicks are scheduled to arrive. All equipment should be in place and brooders should be checked at least 24 hours ahead of time. Feed should be in place before chicks arrive. Chick guards also should be in place if they are used. Small feeder trays or box lids are often used to feed baby chicks until they are large enough to eat from bigger feeders.

Keep accurate records of feed consumed and delivered, mortality, vaccination dates and medications given. The flock supervisor needs this information. It will also be very useful to the farmer.

If a problem occurs, notify the veterinary doctor/personnel. He or she will help in identifying and solving the problem, possibly by getting birds to a diagnostic laboratory if disease is a possibility. If the trouble is not disease, the flock supervisor/manager will know what channels to go through to attempt to solve the problem.

(c) **Planning**: The expected delivery date, time, and number of chicks should be established with the supplier well in advance. This will ensure that the appropriate brooding set-up is in place and that chicks can be unloaded and placed as quickly as possible. Placements of broiler flocks should be planned to ensure that differences in age and/or immune status of donor parent flocks are as small as possible. This will minimize variation in final broiler live weights. One donor flock age per house is ideal. If mixed flocks are unavoidable, keep similar parent flock ages together. Avoid

mixing chicks from parent flocks under 30 weeks of age with chicks from parent flocks over 40 weeks of age.

(d) **Chick handling**: Chicks should be delivered to the broiler farm as soon as possible after hatching and fed immediately. They must be provided with the correct environment and brooding conditions, which should be managed to meet all their nutritional and physiological requirements. This promotes early development of feeding and drinking behavior, and optimizing gut, organ, and skeletal development to support body-weight gain throughout the growing period.

(e) **Stocking Density**: Stocking density is ultimately a decision based on economics. Stocking density influences bird welfare, broiler performance, uniformity, and product quality. Overstocking increases the environmental pressures on the broiler, compromises bird welfare, and will reduce profitability. Quality of housing and the environmental control system determine the best stocking density. If stocking density is increased, ventilation, feeding space, and drinker availability must be adjusted.

(f) **Vaccination**: Vaccination prepares the bird against field challenges caused by specific pathogens by exposing birds to a safe form of the infectious organism (antigen). In today's environment correct vaccination procedures are an essential part of managing broilers. An appropriate vaccination program should be developed in consultation with a veterinarian, taking into account the local disease challenges.

(g) **Disease investigation**: Disease investigation requires knowledge of what to expect at what age and how to detect what is abnormal for the flock. It is important to be familiar with the normal production parameters or standards for the breed. When health problems are seen or suspected in broiler flocks, veterinary advice should be sought immediately. It is helpful to keep up-to-date with local and regional health concerns in order to be aware of any potential disease challenges.

(h) **Welfare**: Good broiler welfare is complementary to good commercial performance. Well cared-for birds will more closely meet target kill weights and are less liable to downgrading in the processing plant.

(i) **Feeding:** Correctly balanced nutrient levels, together with the use of feed ingredients with higher levels of digestibility, will help to minimize the effects of heat-related stress. Providing optimum feed form (good quality crumble and pellet) will minimize the energy expended to consume feed and thereby reduce the heat generated during feeding. Optimum feed form will also improve feed acceptability and help feed intake occur during cooler periods of the day or at night. Providing an

increase in the amount of feed energy derived from feed fats or oils (rather than carbohydrates) during hot weather has been shown to be beneficial due to reducing the heat produced when the diet is metabolized.

(j) **Water:** Water is an essential nutrient for broilers. It is used for heat removal, digestion and formation of body tissues. Broilers should consume approximately 1.5-2.0 times as much water as feed on weight basis. A decrease in water consumption is known to substantially reduce feed consumption, which in turn can adversely affect feed conversion ratio. Prominent poultry farmers acknowledge the importance of providing an adequate supply of water, but improper water consumption can often occur if detailed management is not exercised during the daily operation.

The water should be of good quality because poor water quality can adversely affect bird performance. Water is not totally pure, and it contains substances that influence its quality. These substances include bacteria, nitrogen and minerals.

(k) **Records**: Complete records are necessary. Broiler production is as much a business as the service station on the corner of the town. Records are necessary for computing taxes, for checking flock performance, for determining profit or loss, for determining returns on investment, for locating excessive costs, and for establishing a manure management plan. The time a farmer spends keeping records on which to base management decisions will be one of the best investments a farmer makes.

(l) **Experience and know-how**: Do not be content to follow a routine. Anyone can follow cookbook instructions. The farmer should learn all he or she can about physiological functions, nutrition (feed and water), ventilation, and stress factors of the broiler chick. By doing so, he or she will understand in greater detail and as such he or shewill be more successful in producing broilers.

The farmer should also learn as much as he or she can about the market he or she intends to supply. Know what the market wants, the challenges other producers face in getting the broilers into market channels. The farmer should keep learning as long as he or she rears broilers.

(m) **Waste/Litter management**: Keeping litter dry is a critical part of overall management on every poultry farm. Litter conditions influence bird performance, which in turn affects profits of the broilers. Dry litter helps control ammonia levels, provides a healthy flock environment, and reduces condemnations due to hock and footpad burns and breast blisters.

MANAGING PEOPLE ON THE POULTRY FARM

To effectively manage a labor force, an employer must be concerned about productivity and also about people. Some farmers are always looking for ways to improve production and ensure the long-term viability of the business. Others operate deteriorated farms and seem to have little interest in increasing yield, or in recycling profits into the operation. A manager's attitude toward farm productivity, especially toward product quality, can strongly influence worker output. Performance is often enhanced when employees believe they are contributing to a valuable product and are part of an effective team.

The connection between employee productivity and farm profitability is direct and obvious. Not as apparent, but just as vital, is the association between concern for worker needs and profitability. How employees' needs are met has a direct bearing on their performance. Focusing on productivity alone may lead to a reduction in worker output.

A concern for worker needs means attending to their well-being, as both individuals and employees. Courteous and consistent treatment, job security, fair pay, and safe working conditions are important to employees. When those needs are ignored, worker dissatisfaction may impede productivity.

Trust is another important contributor to productivity. Trust builds gradually, as managers and employees learn they can count on each other. Even after workers' trust has been won, management must continually nurture such trust if they are to retain it. The flow of trust cannot be turned on and off like irrigation water.

Management generally expects personnel to (1) consistently produce high quality work on a timely basis; (2) take their responsibilities seriously, at times even going beyond the call of duty; (3) show concern for the welfare of the farming operation and for other employees; and (4) represent the farming enterprise well within the community.

Employees hope, in turn, that management will (1) value their feelings and opinions; (2) provide positive feedback for work well done; (3) meet the agreed-upon terms and conditions of employment; (4) be consistent and courteous; and (5) provide a work environment where they can develop their potential over time (in terms of skills and earnings).

UNDERSTANDING LABOR MANAGEMENT

Effective labor management demands a clear understanding of its principles and familiarity with its tools. Managers deal with a complex web of interrelated elements. For instance, the wage scale advertised may affect the quality of applicants you recruit; the qualifications of those ultimately hired will in turn determine the amount of on-the-job training needed.

People mistakes may be quite costly. A new worker on a kiwifruit plantation fertilized too close to the plants with a highly concentrated formulation that burned the foliage. Many plants died. The quality of the fruit that did grow was so poor as to be unmarketable through normal channels. Yet another worker mistakenly milked a penicillin-treated cow into the main tank. The good milk in the bulk tank was contaminated and all of it had to be discarded.

These blunders could have been avoided by selecting knowledgeable, skilled personnel, or by providing better orientation, training, management and supervision. Tapping motivation, building effective personal relationships, establishing and carrying out a constructive disciplinary process, and encouraging worker input in decision making are all part of labor management.

There are a number of options available for solving people problems. If we are comfortable using only a few management tools, we may be limited in our response to a challenge. Some, for instance, attempt to use *training* to solve most any adversity, such as tardiness, misuse of tools, and conflict on the job, whereas others believe that most every difficulty can be solved with *pay*.

When labor management principles are properly understood, the more likely a manager will choose the right set of tools and apply them correctly to deal with a given challenge. Time and effort spent on improving management competence pays off. Once the foundation is laid, new skills are easier to acquire. Also, tools developed for use in one area may serve well in others. For example, a detailed *job analysis* may be used during the selection process. The same analysis may yield data to establish pay differences, fix performance parameters, and help tailor a training program.

An overview of human resource management is presented in the table below. The list in the left column shows external constraints that are placed on the workplace, the center column lists labor management tools and practices, and the column to the right lists potential results or outcomes.

Influences and Constraints	Practices, Decisions and Tools	Results
Tradition	Organizational structuring	Productivity
Competitors	Job design	· quantity
Laws	Recruitment	· quality
Labor market	Selection	Waste
Technology	Orientation	Breakdowns
Union contracts	Training and development	Satisfaction
Individual differences and skills	Supervision	Motivation
	Performance appraisals	Absenteeism
	Compensation	Turnover
	Benefits	Strikes
	Safety and health	Grievances
	Organizational development	Litigation
	Discipline	Injury and illness
	Research and evaluation	Workplace violence

I like to think of the *tools* in the middle column as filters or magnifiers affecting the *results* column. In the absence of effective human resource management practices (the middle column), external *influences* may have a pronounced effect on productivity and other sought after results. For instance, an employer might choose to hire the first twenty applicants who show up for a citrus-picking job without testing their skills. By so doing she forgoes the opportunity to use a selection filter to hire more productive workers.

Let's briefly examine the elements within these three columns before moving on to the importance of purposeful action.

(1) External influences and constraints

The external influences and constraints are explained in more detail below:

- **Tradition:** Tradition represents the way things have been done in the past. Some traditions ensure stability. Others may reduce creativity.
- **Competitors:** The techniques used by competitors can influence farm practices. Like tradition, competitors may provide a positive or negative influence.
- **Laws:** Laws at the federal, state, province, municipality, or other local level regulate almost every aspect of labor management. When well thought out, such laws can extend important protections and benefits to a large number of workers. Many laws have been passed without sufficient study, however, and the time spent in compliance can be onerous. Unfortunately, some believe that simply following the law will guarantee that they are managing properly. This book is intended for

an international audience, and is focused on effective human resource management practices, more than on what is legal or not. Because laws do change frequently and are so different from one nation to another, make sure to always consult with a qualified local labor attorney before implementing the suggestions found here.

- **Labour Market:** The labor market generally deals with relationships between the supply and demand of workers on the one hand and with wages on the other. Generally, a shortage of workers will drive wages up.
- **Technology:** Labor law constraints and potentially unpredictable labor markets tend to encourage mechanization. Technology may change the nature and number of jobs but is unlikely to diminish the importance of labor.
- **Union contracts:** Agricultural enterprise managers desire freedom to manage, while unions want to restrain possible abuses of such freedom. Furthermore, unions often fight to improve economic outcomes for employees (wages and benefits). Beside issues of economics, unions also attempt to protect worker dignity and improve working conditions. Unions may give employees a greater voice in some types of decision-making. The opposite can also be true. Perhaps the single most important predictor of unionization is the quality (or lack of) two-way communications between management and employees. One poor supervisor can have a negative effect on the whole organization. Other factors that may also play a key role on whether employees will join a union include: (1) perceived costs for joining vs. expected returns (e.g., cost of union dues vs. increases in pay), (2) personal feelings towards unionization (e.g., workers who identify with management, prefer merit over seniority, and value individual initiative are less likely to want to join a union), and (3) feelings toward a particular workplace and a particular union.
- **Individual differences:** Individual variations affect almost every aspect of human behavior, including labor productivity. An effective manager considers both how individual workers differ and how workers may react similarly to a given situation.

(2) Labor management practices

Productivity is a result of worker *ability* (the "can do") and *motivation* (the "will do"). Farmers have a number of tools that can help them influence both of these factors. These include:

- **Organizational structuring:** A number of frameworks exist for getting jobs done, including by *function* (e.g., irrigation, tractor driving), by *product* (e.g., dairy, crops), and by *geographical location*.

- **Job design:** Some jobs are designed so that workers can take responsibility for a product from beginning to end. Others tend to promote specialization. In the process of designing jobs, farmers can also prepare job analyses, job specifications, and job descriptions.
- **Recruitment:** Recruitment involves attracting enough qualified applicants to fill the staffing needs of the farm. Generally, the larger the applicant pool, the greater the chances that the group contains a qualified applicant.
- **Selection:** Workers with a sufficient ability, knowledge or skill are selected from the applicant pool and hired to carry out the required jobs. Promotions and transfers are also selection decisions.
- **Orientation:** During orientation periods, newly selected and promoted employees are exposed to the requirements of their new jobs. In addition, workers learn about the company's philosophy and its written and unwritten rules.
- **Supervision:** Supervisors are responsible for directing and facilitating the performance of one or more employees. Some important supervisory skills include communication, delegation, training, performance appraisal, discipline, and conflict resolution.
- **Performance appraisal:** Employees have a need to know how they are doing, and what they can do to improve. Performance appraisal is the process of evaluating employee performance and communicating the results to the worker.
- **Compensation:** Pay may be designed in terms of *wage structures* or *incentives*. Wage structures establish pay differentials between jobs—and usually within a job, too. Incentives are designed to reward employees for performance or other valued outcomes.
- **Benefits:** Some benefits are mandated by law (e.g., workers' compensation). Optional benefits may include farm produce, paid vacation and sick leave. Once offered, optional benefits may also be regulated by law.
- **Safety and health measures:** Safety and health management involves (1) promoting safety, (2) correcting hazards, (3) training employees, and (4) tying safety to other management actions (e.g., performance appraisals, discipline).
- **Organizational development:** Elements of organizational development that promote sound communication and decision-making skills include assertiveness training, role definition, leadership skills, conflict resolution, team building, empowerment, coaching, effective meetings, and techniques based on group dynamics.

◊ **Research and evaluation:** Research and evaluation help farmers credit specific results to particular management actions. Farmers can assess where adjustments in management direction are needed.

(3) Results

External influences interplay with management action to bring about specific results. These results are a measure of management effectiveness.

- **Production:** Production can be gauged in terms of both quantity and quality. For example, gallons of milk, flats of tomatoes, and boxes of grapes are examples of quantity measures. Indicators of product quality may include somatic cell counts (high counts in dairy cows may indicate health problems such as mastitis), bacterial counts in milk, color or size of fruit, and degree of marbling in meat.
- **Motivation:** Motivation can affect production, satisfaction, and a host of other outcomes. On the way home one worker may stop to fix a broken irrigation ditch, and another may drive past it. While employees may come to the farm with different degrees of enthusiasm, there is much a farmer can do to affect a worker's on-the-job motivation.
- **Waste:** Waste may be gauged by such measures as the percentage of fruit or vegetables that do not meet grade, calf mortality, scrap metal, and leftover seed or fertilizer that cannot be reused.
- **Breakdowns:** Breakdowns of farm machinery and equipment can have deleterious effects, especially in the middle of harvest or other high labor-intensive periods.
- **Satisfaction:** Satisfaction is a measure of how well the employer's or workers' needs are being met. Sources of employee dissatisfaction may include pay, job design, handling of promotions, interpersonal conflict and supervision. Expressions of employee dissatisfaction may include reduced output, strikes or union activity, absenteeism, or turnover.
- **Grievances:** Grievances are employee complaints. When an effective mechanism is provided for management to hear grievances, early problem solving and increased mutual respect may develop.
- **Litigation:** If grievances are not attended to and solved early on, they may result in litigation. If no one in-house will hear workers' complaints, they may find someone outside the organization who is more sympathetic.
- **Injury and illness:** Injury and illness may arise from unsafe and unhealthy work environments. Examples of injuries include slag in the eye (from welding), muscle strains, and ruptured disks.

Work-related illnesses may flow from unprotected exposure to chemicals or heat, or from excessive stress in the workplace.

(4) Purposeful Action

Understanding and concern without action can be like planting and cultivating without harvesting. It is not always easy to confront employees with their poor performance, listen to their difficulties, act as an effective mediator to reduce conflict, or take an unpopular yet principled stand in the face of adversity. But purposeful action - carrying out a plan to obtain a specific result - may help you turn challenges into opportunities.

Action is not always the best choice when dealing with human behavior; many difficulties seem to disappear simply with time and patience. Other problems, however, only fester if they are not faced squarely.

OBSTACLES TO ACTION

What hinders us from taking action or reaching objectives? The benefit may not seem worth the effort. Or, we may doubt that the effort will yield the desired result. Two additional challenges may include lack of self-esteem or inability to focus. Finally, action may not be effective because of faulty planning, evaluation, or correction measures.

- **Insufficient payoff:** A price must be paid to meet most objectives. We typically weigh that price against the value of the outcome. At times, goals require efforts or financial resources that are simply not available without forgoing other desired objectives. It is easy to act when minimal effort will yield large positive results. More challenging objectives usually demand a correspondingly greater effort. Achieving long-term goals requires discipline and perseverance in spite of difficulties. It helps to be able to relish the actual process of achievement - even when progress is slow.
- **Likelihood of success:** Will action really bring about the desired outcome? Managers may doubt, for instance, that confronting employees with their poor performance will result in improved production. Perhaps such action will simply confirm an enemy and further reduce output. Before taking action in doubtful situations, managers may want to consult a more knowledgeable employer, friend, or human resource management professional—or perhaps attend a seminar or course on management techniques.

- **Lack of self-esteem:** Some managers may avoid action because they lack confidence in their ability to succeed. People who have reaped the rewards of attaining a difficult goal are more likely to believe in their ability to achieve again. Success, or lack of it may become a self-reinforcing cycle. Current theories of self-esteem suggest that although everyone encounters failure at times, the main contributor to self-esteem is coping with, rather than avoiding, difficulties.

- **Lack of focus:** One of the major tasks in pursuing a difficult goal is avoiding distraction. People can use a number of devices to help stay focused on the goal: reading material related to the objective; setting aside specific time for contemplating the subject; or posting a visual reminder, such as a photograph or note in a prominent place.
- **Faulty planning, evaluation, and correction:** You have probably heard the saying, "an unwritten goal is simply wishful thinking." Although somewhat exaggerated, this remark emphasizes the need for careful planning, evaluating, and correcting. Planning may involve establishing goals and sub-goals and scheduling a logical sequence of events. Regular appraisal of progress that has been made is part of the evaluation process. Finally, correction may encompass dealing with challenges, failures (including going off course), or contingencies (the "what ifs").

  Though taking appropriate action when managing a work force is critical, speed is not always essential. There is a balance to be found somewhere between premature, hasty action and doing nothing. Some decisions require more time and careful planning before being implemented; other situations call for immediate reaction. Often, steady plodding will move an organization further towards positive changes than fast, yet short-lived, efforts.

  Action alone, without consideration for worker needs and productivity or without understanding the dynamics of labor management, may yield mixed results.

Summary

The three essential ingredients of effective labor administration are (1) a concern for productivity and people; (2) an understanding of human resource management; and (3) purposeful action. Labor management may suffer if any of these are absent.

A concern for both employee needs and worker productivity is fundamental to effective management. In the long run, labor management must benefit both farmer and worker.

A key understanding is that (1) workers differ in both ability and motivation and (2) farmers can manage much of that variation. There are numerous labor management tools that farmers can use to temper challenges or improve results. Managers must avoid the tendency to rely on a limited number of tools.

Impulsive or overly cautious action can worsen personnel challenges. It helps to have a plan with timetables, and to incorporate ways of evaluating progress toward goals. Perseverance is often better than uncoordinated bursts of effort. A lack of management intervention may cause producers to forgo control over long-term profitability and other desirable outcomes.

PAYMENT SYSTEM ON A POULTRY FARM

When determining what the farm will pay for wages and salaries, it is important to understand the economic conditions of the region in which the farm functions, the volume of potential employees and the legislative requirements in place. When determining what to pay, first consideration is placement of the role organizationally which can be determined through job evaluation/classification. The second consideration is the job relevant skills and experience the applicant possesses which may impact their placement in the salary range upon hire.

Deciding what to pay

They are many situations in which you will be faced with deciding what to pay an employee.

- A new hire
- An existing employee due for an increase
- An existing employee moving into a new role
- A valuable employee who is considering leaving because of compensation
- Market conditions
- Scarce skill

It is important to ensure that the approach taken is guided by the compensation philosophy and is applied consistently. Ensuring that established guidelines are followed will prevent offering a compensation package so tailored to a person that the organization is jeopardized by having too heavy a financial burden or that flexible arrangements actually hinder the critical work from being completed. It takes a carefully crafted balance between the organizational needs and the individual considerations to arrive at the optimal compensation structure.

COMMUNICATING TO WORKERS

Good staff communication is essential to business success. At the most basic level, employees who do not know what is expected of them seldom perform to their potential. “You can tie back almost every employee issue - attendance, morale, performance, and productivity to communication,” says Fred Holloway, an HR adviser in Medford, Oregon.

And yet, human nature being what it is, workplace communication is rarely adequate and could almost always be better. The good news is that you do not have to be an extrovert, or even particularly nurturing, to foster healthy communication at your farm. You simply need the will to improve it. Mostly, you need to be honest, show respect to employees, and work on building trust, without which employees tend to put up a filter and what you say does not matter.

Below are some of the habits and practices that engender good communication, and offers tips on conveying your message effectively:

- **Create the culture:** Above all else, to the extent possible, strive to be transparent and straightforward about the challenges of your business and even about your company's financials. Such candor fosters trust and understanding. "Your employees know you make more money than they do," says Bloomington, Illinois, HR consultant Rick Galbreath. "What they don't understand is that you take more risk. They won't be able to understand the risk until they understand the business."

  Schedule informal communication. The simplest way to put yourself (and your managers) in the mindset to communicate, says Galbreath, is to put it on your calendar. In addition to the scheduled activities below, he recommends spending 15 minutes each day, more if you can spare it, on "nontransactional conversation" with underlings. By nontransactional, Galbreath means exchanges that don't have a specific purpose, like a request to do something.

  Meet one on one. Informal confabs with the people who report to you, held at least biweekly, serve as excellent occasions to check on their progress as well as identify problems before they blister, and so can be a powerful motivational tool. Galbreath also recommends occasional (once or twice a year) skip-level meetings with individual employees two or more levels down. Besides making sure the boss is not isolated at the top, skip-level meetings are a morale booster. "People

are very complimented that a boss two levels up wants to talk with them," says Galbreath. "They're often turned into retention interviews."

Meet in groups. A brief team huddle at the start of the day or the shift is a good way to discuss the goals, challenges, or operating plan for the day. A huddle should be just that, conducted standing in an open space; it should not last more than 10 or 15 minutes. (Pass-down memos, stored in a network folder, can be used to report the events of one shift to the next.) Then, every quarter, a large-group or companywide meeting can serve as a sort of state-of-the-business update, says Galbreath.

The meeting should last about an hour and include a question-and-answer session. If the company culture discourages searching questions, they can be submitted anonymously in advance, says Galbreath. Finally, occasional "lunch and learn" gatherings are good for a less formal discussion of the farm, for introducing new products and strategies, or for most any other ancillary subject you want to broach. (They are not- places to discuss essential topics or conduct core training.)

- **Make Sure Your Message is Heard:** The ways in which you communicate can often be just as important as the substance of that communication. We address the right medium in the section "In Person, or in Writing?" here are a few other strategies for getting your point across.

  Evaluate your own abilities: By merely being aware, you can play to your strengths and mitigate weaknesses. Sometimes a single trait can encompass both strengths and weaknesses. A dominant, confident individual, for example, can probably run a good meeting and offer his own opinions while keeping people focused. On the other hand, someone who is too dominant might discourage creative input from others.

  Sharpen your message: People normally remember only three to five points from any communication. So keep it short and sharp. This is especially true if your message is being delivered by e-mail or memo. Your conclusions or main points belong at the top as bullet points. An elaborate setup is counterproductive. Readers discern condescension when a big setup attempts to spin bad news, and when one introduces good news, they stop reading before they get to it. Keep the paragraphs short and the whole document to no more than a page.

If forced to go long during a meeting, try to keep the audience engaged with a compelling moment every few minutes. Give the audience a giggle, or an 'aha,' or something that is going to engage them at a deeper level than just listening.

Recognize good work: If your message is always negative, it will not be heard. **Balance criticism with compliments:** Do this two ways: Thank employees personally for their efforts, and hold up their behavior as an example to the organization.

Prepare for meetings: Whether your meeting is one on one, or in a group, plan what you are going to say and how you will say it. It is important to tailor the delivery to its audience. If for instance, you brought in an employee who likes direction and formality, and if you presented none of that, they would take your communication as less valid, because it is not what they are accustomed to.

Understand unspoken signals: Body language, for example, can undermine a spoken message. Slouch while disciplining a staff member, for instance, and your demeanor might be read as uncertainty, or as a lack of interest in the problem you are trying to fix. Even where you hold the meeting can be suggestive: Calling an underling into your office, for example, emphasizes your hierarchical advantage and could affect the dynamics of your conversation; visiting an employee in his office (on the farm), on the other hand, emphasizes collegiality and could result in more open discussion.

Follow up: When a message needs reinforcement, follow up afterward with a memo, or note that recapitulates the conversation.

Listening to Your Employees: Successful communication is a two-way street. If management is doing all the talking, employees tend to tune out. What's more, the people doing the real work of the company often have the best suggestions for improving it and are often the first to see danger approaching.

Create formal feedback mechanisms: Establish a mechanism for input, such as a suggestion box or a hotline. Ensure anonymity if necessary.

Take input seriously: Otherwise, employees will see through the window dressing, which can actually make things worse. Just because someone gives you a suggestion does not mean you have to implement it. But if you do not, you ought to offer some kind of explanation.

Check management attitude: Employees will keep quiet if they perceive that the company/farm culture and management discourage, if even subtly, risk taking, or show downright hostility to questions. According to one recent study, if employees do not think company managers and their policies are fair, all the staff feedback in the world will not create a good employer-employee relationship.

Reward feedback: Employees have difficulty weighing the immediate risks of speaking up against the uncertainty of being recognized and rewarded for the contribution. Managers, might tailor their reward systems so that employees share more directly in the cost savings, or revenue streams they help create by volunteering ideas.

In Person or in Writing? Choosing the medium for a message depends on your office culture. E-mail is increasingly acceptable, even for conveying important information. But there are exceptions. As a general rule, anything that requires development of an interpersonal relationship with an employee requires face-to-face communication. That includes first-time instruction, coaching, counseling, significant delegation, conflict resolution, and, especially, delivering bad news.

Urgent matters, too, are best handled in person. Written messages are often read with divided attention, or even ignored for a while; to ensure full and immediate focus on a matter, deliver the message orally.

Finally, recognize that words on a page or screen lack the context, tone, and nonverbal cues that help people understand your meaning in person. When in doubt, talk face to face.

There is ready market for chicken and chicken products across Uganda and in the East African community and the world at large. This is why irrespective of other factors, chicken prices have risen from an average Shs 7,000 two years ago, to around Shs 10,000/= for hybrids and Shs 15,000/= to 40,000/= for local chicken.

The ultimate goal of every poultry farmer is to make great sales at each harvest and unfortunately, a lot of poultry farmers get stuck at this point. They spend months raising and feeding birds; and when it is time to sell, they do not achieve much results. Not because there is a shortage of demand for their products; but because they have not really paid attention to the sales and marketing aspects of their business.

A poultry farmer should not be too caught up with the operational aspects of his or her business so much that he or she now neglects the sales aspect.

Marketing Techniques

Below are some marketing techniques poultry farmer can use to increase sales and expand his or her income from his or her poultry business.

(a) **Bypassing the middlemen**: Most poultry farmers rely on middlemen to help sell their products. They sell in bulk to other people who in turn sell to the consumers. If a poultry farmer wants to sell faster, then he or she should sell both in wholesale quantities and resale quantities. He or she can sell in retail quantities if he or she has his or her own sales outlet. He or she should look for a good location to rent a store and then use it to stock products from his or her farm so that in addition to selling to wholesalers, he or she can also sell to retailers.

(b) **Take the poultry business online**: Most people hang around the internet these days. A large percentage of people make use of the internet around the world daily and if the poultry farmer wants his or her business to thrive, he or she cannot close his or her eyes to the internet. His or her social media account is a very good place to promote his or her business and increase awareness for his or her products.

(c) **Become a supplier to schools, Hotels and Restaurants**: Write a brilliant proposal with clearly thought-out incentives that can be offered and send it to managers of hotels and restaurants. Offer to be their major supplier of poultry meat and eggs. Hotels and restaurants always have foods with

poultry meat or foods made with eggs on their menu and they have to get their eggs from somewhere. A farmer can help them to have access to a regular supply of fresh eggs without stress. Note that a lot of hotels and restaurants already have people supplying them, so he or she should think of how to outsmart these people by offering mouth-watering incentives.

(d) **Employ Marketers**: *Marketers for a poultry farm*? Yes, marketers for a poultry farm can increase a farmer's sales by more than 30%. A farmer should just employ some commission-based marketers who would earn a certain percentage from the sales they make.

(e) **Feed the Birds well**: Yes, this is a marketing idea too. When a farmer feeds his or her birds well, they produce big and good quality eggs which are what the consumers want. If a farmer wants his or her products to be top choice for consumers, then he or she will have to pay attention to the quality of products he or she generates and in poultry farming; that means paying attention to the type of foods he or she feeds his or her birds with because good food equals good eggs and quality meat. In fact, interview a wide range of customers to ensure that the method of production reflects their needs. It is the understanding of customers' preferences, not a farmer's, that will contribute to the success of his or her poultry business.

(f) **Own an Abattoir**: A farmer should not just stop at selling to other companies to package; nothing stops him or her from having his or her own abattoir too where he or she can package and brand his or her own products for sales and supply.

(g) **Promote and advertise the products**: A farmer should engage in advertising and promotions. People mostly buy products they know or have heard about and when a farmer advertises his or her products, it helps to increase awareness and subsequently, demand for his or her products. Some of the methods of promoting poultry products include:

- Offering the non-rural public opportunities to learn how chicken production occurs on the farm.
- Describe and label the products by their quality characteristics.
- Provide samples to potential customers.
- Direct contact; in-person visits; phone follow-up.
- Participate in promotional initiatives.

(h) **Carry out marketing research**: Another way by which a farmer can increase sales of his or her poultry products is by carrying out marketing research regularly. When he or she does so, he or she would be able to have a clear idea of what his or her customer's want, areas where there is

insufficient supply of products and things he or she can do to improve the quality of products he or she offers to customers.

(i) **Try home delivery services**: Home delivery services work too. This is because a lot of people are often too busy to make trips to the grocery store and then a lot of people love their eggs fresh. A farmer can take advantage of this to offer home delivery services to people who prefer to buy fresh eggs or people who find it easier to order for stuffs from the comfort of their home. He or she could also serve senior citizens, the physically challenged or sick people who cannot make trips to grocery stores to buy meat and eggs.

FINANCIAL MANAGEMENT ON A POULTRY FARM

Thoroughly understanding your business' financial performance is critical for success in today's increasingly competitive agricultural environment. Accurate records and financial statements are the foundation material required to analyse the financial condition and trends of your operation.

All agricultural businesses, from small part-time farms to large commercial operations, require financial statements completed on a regular basis to track financial progress including equity, liquidity, income, and cash flow.

Financial Management Defined

Financial management refers to the efficient and effective management of money in such a manner as to accomplish the objectives of the organization.

Farm Income Statement

A **farm income statement** (sometimes called a profit and loss statement) is a summary of income and expenses that occurred during a specified accounting period, usually the calendar year for farmers. It is a measure of input and output in dollar and/or any other currency values. It offers a capsule view of the value of what your farm produced for the time period covered and what it cost to produce it.

Balance Sheet

A **balance sheet** is a summary (or snapshot) of an organization's financial position at a specific point in time. This means a balance sheet is static.

Record Keeping On a Poultry Farm

Small scale farmers are the driving force behind many African economies that rely on agriculture as the backbone. Unfortunately, most of them have nothing to show for the great contribution they are expected to make. This is due to the many challenges they face, one of them being poor financial management. To be a successful farmer in modern poultry farming, one has to be both a good producer and a good manager.

Without a clear record system, no business will be successful. The system has to be well organized in order to find information from it as quick as possible.

What is a Record?

A **record** is a thing constituting a piece of evidence about the past, especially an account of an act or occurrence kept in writing or some other permanent form.

Farm records refer to documentation of farm activities, purchases and sales carried out by a poultry farmer. Keeping these records properly and consistently helps poultry farmers assess the profitability of their poultry farms. For any poultry farmer who wants to make their poultry farming more profitable, record keeping is a must.

What is Record Keeping?

Record keeping is the activity of organizing and storing all the documents, files, invoices, etc. relating to a project's activities.

The term **record keeping** also refers to the orderly and disciplined practice of storing business records. Record keeping is one of the most important responsibilities for a farmer.

The success of a poultry business depends on creating and maintaining an effective record system, whether your business is a sole proprietorship, partnership, or corporation.

Record keeping ranges from simple manila folder filing systems to complex on-line electronic systems. Whether simple, or complex, a record keeping system must be easy to use and provide adequate storage and retrieval of records. Most importantly, the record keeping system you choose must be suited to the project's particular needs. The type, size, and complexity of your business, as well as the project's available resources, will help to determine the record keeping system best suited to you and your business.

Thus, as a poultry farmer, if he or she is able keep records of his or her poultry business. If he or she is unable to do so he or she should consider getting assistance. Farm records are the best source of historical production data. These can be supplemented and complemented by off-farm information, especially market and other technical information. However, off-farm information is not very useful by itself. Farm records are needed to make well-informed management decisions.

Benefits of Farm Records

Among the benefits of farm records include:

(a) **Crucial to making profits:** Profit is the money obtained from sales made less the money spent on poultry production. Keeping records will let the farmer know whether he or she has made a profit or loss. Even if he or she has a very good memory, he or she may not remember all the expenses and income that he or she made in the month. It is, therefore, necessary to put it down on paper.

(b) **Proper planning:** Farm records give valuable information on what worked and what did not, allowing the farmer to plan effectively for future production.

(c) Farm records help the farmer to examine his or her past decisions and the results of those decisions. With these records he or she is able to reflect on his or her decisions and assess his or her risk preferences. The information collected on past trends should help a farmer to take better farm management decisions.

(d) Farm records also provide a picture of the risks that a farmer has faced in the past. They give an indication of the risk management decisions taken and the consequences of those decisions. Such information can help identify any changes that should be made in the future regarding risk management.

(e) Records assist farmers to get loans, grants loans, grants and livestock insurance. Such information enables the lending institution decide if the farmer is credit worthy or not.

Records Kept On a Poultry Farm

There are many types of records that a farmer can keep. Deciding which ones to keep depends on an individual farmer and one's goals. But some are a must if a farmer intends to carry out poultry farming as a business.

The following records must be kept: Farm plan, Production records, Feed records, Health Records, Financial records.

Farm Plan

The first record as a poultry farmer should have is a farm plan. This shows the location of the homestead and the farm layout.

Production Records

- **Chicks**: Chicks are young birds before the growth process has started. The records for chicks may include date hatched, date moved to pullet/broiler house, feed consumption, and water consumption.
- **Pullets**: Pullets are birds growing to become layers. Certain records to be kept for these birds include feed consumption, water consumption, and light-dark hours.
- **Layers:** Layers are female birds that are in the stage of laying eggs. Records needed include feed consumption, water consumption, and egg production.
- **Broilers**: Broilers are raised to be harvested for chicken meat to consume. Specific records may include feed consumption, water consumption, weight, average daily gain, days on feed, and processing date.
- **Breeding stock**: Breeding stocks are used to produce birds to repopulate the flock. Breeding date, birds mated, and hatching date are examples of important records.
- **Mortality (death) of birds**: Every day a record should be taken of any birds that did not survive. This should be done on a daily basis to assist monitoring for any unusual animal health problems.

Template of Mortality (number of chicks that died) – Brooding Record

Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
1st								
2nd								
13rd								
4th								
5th								
6th								
7th								
8th								
9th								
10th								
GRAND TOTAL								

Feeds Records

- **Feed used**: Daily records need to be taken on the quantity of feed fed to birds.

Feed Type	Kgs Used	Cost (UGX)
Chick Starter		
Grower		
Broiler Feed		
Layers' Mash		
Other		
TOTAL		

Financial Records

Financial records must be kept of any items bought (purchases) and sold (sales), e.g. feed, veterinary costs, equipment, supplies, birds, etc.

These can be kept using an ordinary exercise book. On one page, write down all the income from eggs sold or live birds sold. If it is eggs being sold daily, make an entry every day for the quantity (number of eggs or trays) sold and cash received. On another page, write down all the costs of production. Such costs include: feed, vaccines, litter, labour costs, and transportation costs, etc.

Once correct entries for all the activities have been made, get the total of all the sales made, and all the expenses incurred. Then subtract the expenses from the sales to know the profitability.

Below is a sample template of the financial summary relating to a poultry project.

Income	**Amount (UGX)**
Value of Eggs Sold	
Value of Meat Sold	
Other Income from the Project	
Value of Chickens Eaten by Farmer	
TOTAL INCOME (A)	
Expenses	**Amount (UGX)**
Cost of Birds Purchased	
Cost of Feed Bought	
Equipment Expenses & Repairs	
Other Expenses like vaccinations	
TOTAL EXPENSES (B)	
PROJECT INCOME	**A-B**
Project incomes equals TOTAL INCOME Less (-) TOTAL EXPENSES	

Health Records

- **Vaccinations**: Specific vaccinations may be needed, depending on the bird and location of production facility. An accurate record must be kept to insure sufficient withdrawal time.

Vaccination Record

Date	Fowl Pox	Bronchitis	Newcastle	Cost
TOTAL COST OF VACCINATION				

- **Hens removed**: Periodically hens must be removed from the flock when their productivity is too low. Be sure to keep record of which bird, when she was removed, and the reason for removal.
- **Eggs produced**: Eggs must be collected and recorded daily. Be sure to include any inconsistency noticed.
- A **record of bird movements** must be maintained to facilitate tracing in case of an animal or food safety concern.

Cost of Establishing a Poultry Project

All computations are based on the assumption that a farmer is going to start with 100 birds. And the recurring costs are for a period of 6 months.

CAPITAL COST				
No.	**Particulars**	**Quantity**	**Unit Price**	**Amount (UGX)**
1	Purchase of pullets (16-18 weeks) of age	90.00	7,000	630,000
2	Purchase of cocks (1 cock for every 10 pullets) - very healthy cocks	9.00	35,000	315,000
3	Chicken house. (Housing) Floor space 0.33m2x100 birds = 33sqmeter @ 30,000/sq.ft.	33.00	30,000	990,000
4	Perches of 75mmx50mm - 18cm of space per bird. (Improvise)	1,800.00	50	90,000
5	Nest boxes (25cmx30cmx30cm) - 1 nest boxes per five birds	20.00	3,000	60,000
6	Feed troughs 10cm/bird - 20 birds/feeder	5.00	15,000	75,000
7	Water troughs (10cm/bird) - 10 birds/drinker	10.00	10,000	100,000
				2,260,000
RECURRING COST (CAPITALIZED)				
1	Concentrate (Grower Ration) for 6 months @ 0.143kg/day/bird 0.143 x 30 x 6 x 100 = 2,574 kg @ Ugx. 1,000/kg.	2,574.00	1,000	2,574,000
2	Cost of health care (Veterinary doctor visits) - 1 visit per month for 6 months	6.00	75,000	450,000
3	Transportation costs (Feeds, drugs, doctor and farm visits) - 1 visits per month for 6 months	6.00	30,000	180,000
				-
				3,204,000
	Total Project Cost			**5,464,000**
	The chicken house is assumed to be enclosed with a wire mesh to protect the birds from any external predators. Otherwise building a simple coop could take less than Ugx 200,000.			

Expected Returns from a Poultry Project

We assume that we shall not get any eggs from the birds for sale for the first one year. We assume the 100 birds is the parent stock which will be left to naturally multiply. We expect to separate the egg laying birds from the parent stock in the second year of the project.

No	Particulars	1st Year	2nd Year	3rd Year	4th Year
PRODUCTION					
1	Chicks per year from 100 birds	-	3,000	3,000	3,000
	(a) Female hens	-	2,400	2,400	2,400
	(b) Cocks	-	600	600	600
INCOME GENERATION					
1	Sale proceeds of cocks	-	18,000,000	18,000,000	18,000,000
2	Sale Proceeds of off layers	-	28,800,000	28,800,000	28,800,000
3	Sale of eggs 64 trays per day	-	186,880,000	186,880,000	186,880,000
	TOTAL	**-**	**233,680,000**	**233,680,000**	**233,680,000**
EXPENDITURE					
(a)	Grower Ration	2,574,000	138,996,000	138,996,000	138,996,000
('b)	Health Expenses	450,000	1,500,000	1,500,000	1,500,000
('c)	Transportation costs	180,000	216,000	259,200	311,040
(d)	Miscellaneous expenses	-	2,336,800	2,336,800	2,336,800
	TOTAL	**3,204,000**	**143,048,800**	**143,092,000**	**143,143,840**
PROFIT/LOSS (INCOME-EXPENDITURE)					
		1st Year	**2nd Year**	**3rd Year**	**4th Year**
	Income per annum	**(3,204,000)**	**90,631,200**	**90,588,000**	**90,536,160**

Assumptions

1. Each bird will give us 10 chicks per hatching. 3 times a year.
2. Production will be maintained for 4 years
3. 80% of the chicks are females and 20% are cocks (males).

4. All cocks to be sold off to cater for project expenses.
5. The parent stock to be maintained at 100. All the females except the parent stock to be for egg production.
6. We shall render all the female birds off-layers at the end of the year and all shall be sold off.
7. We assume that 80% of the laying birds will give us eggs per day.
8. We take an average of 64 trays from 1,920 birds per week.
9. We shall rear kuroilers or local breeds.
10. Medical expenses shall be computed at UGX 500 per bird in the second year of the project.
11. Transportation shall be increased by 1% each year.
12. We shall assume a 1% provision of the total revenue per year to cater for miscellaneous expenses.

Break-Even Analysis for a Poultry Project

One of the most important indicators of success of a poultry project is the time from starting the project till the moment when revenues of product sales equals the total costs associated with the sale of the product – it is also called **break-even point**. In other words **profit = 0**. Break-even analysis is an accounting tool to help plan and control the business (poultry project) operation.

In carrying out break-even analysis for a poultry project, there are certain terms that a farmer needs to be aware of. These include:

(a) **Break-even analysis**: Break-Even Analysis is a useful tool to study the relationship between fixed costs, variable costs and returns.

(b) **Break-Even point (B.E.P):** Break -even point is a point at which a firm does not make profit or incur losses. At break-even point ***Total Revenue (TR) = Total Cost (TC).***At Break-even point the profit is zero (0). Graphically, break-even point is where the sales revenue and total costs lines cross.

$$\text{Break-Even Point} = \frac{\text{Fixed Costs}}{(\text{Selling Price-Variable Cost per Unit})}$$

(c) **Selling Price (P):** The price at which a product is offered for sale. The selling price needs to cover the basic direct costs of running a poultry project. To make a profit a farmer also needs to add something for the indirect or fixed costs (overheads) of the project and the profit he or she wants to make to safeguard and expand the poultry project.

(d) **Break-even units (X):**

$$\text{Break-Even Units (X)} = \frac{\text{Total Fixed Costs (TFC)}}{\text{(Selling Price (P)-Total Variable Cost per Unit (V)}}$$

(e) **Fixed Costs (FC):** A Fixed Cost is a cost which cannot be easily identified or related to a cost per unit or activity of any kind for example a cost which remains constant when the production of a good or service within the organization rises or falls. Fixed costs include, but are not limited to: heating, lighting, depreciation on farm equipment, interest costs and rent. Sometimes called 'indirect' or 'standing' costs or simply overheads. Fixed costs do not depend on the number of units (e.g. number of trays of eggs sold).

(f) **Total Fixed Costs (TFC):** The sum of the fixed costs.

(g) **Variable Costs (VC):** These are costs that change when the production output changes. Variable costs include: feeds, labour, power, and fuel, veterinary, among others. Sometimes called 'direct' or 'running' costs. Variable costs vary with the number of units. For example, the more hens a farmer rears, the greater the feed cost.

(h) **Total Variable Costs (TVC):** These are the sum of the variable costs for the specified level of production or output.

(i) **Average Variable Costs (AVC):** Average Variable costs are the variable costs per unit of output or of TVC divided by units of output.

(j) **Total Costs (TC):** The sum of the total fixed costs and total variable costs. **Total Cost (TC) = Total Fixed Costs (TFC) + Total Variable Costs (TVC).**

(k) **Revenue** is the price at which the item is sold (on a per unit basis).

(l) **Profit** is the difference between total revenue and total cost.

(m) **Contribution to sales ratio (C/S ratio):** Contribution to sales ratio (C/S ratio) allows a poultry farmer to understand the level of sales need to cover all costs of the project and what level of sales is needed to start making profits.

$$\text{C/S Ratio} = \frac{\text{Contribution per Unit}}{\text{Sales Price per Unit}}$$

$$\text{Or C/S Ration} = \frac{\text{Total Contribution}}{\text{Total Sales Revenue}}$$

(n) **Total Revenue (TR):** This is the total amount of money a firm receives from selling goods or services. **Total Revenue = Price per unit x Number of units sold**.

(o) **Break-even revenue**: The sales revenue earned that would give no profit and no loss. $Break-Even\ Revenue = \frac{\text{Fixed costs}}{\text{Contribution to Sales Ratio}}$

(p) **Margin of Safety (Units):** Margin of safety measures the sensitivity of the budgeted sales volume compared with the break-even sales volume. **Margin- of Safety (Units)** = Budgeted sales volume less break-even sales volume.

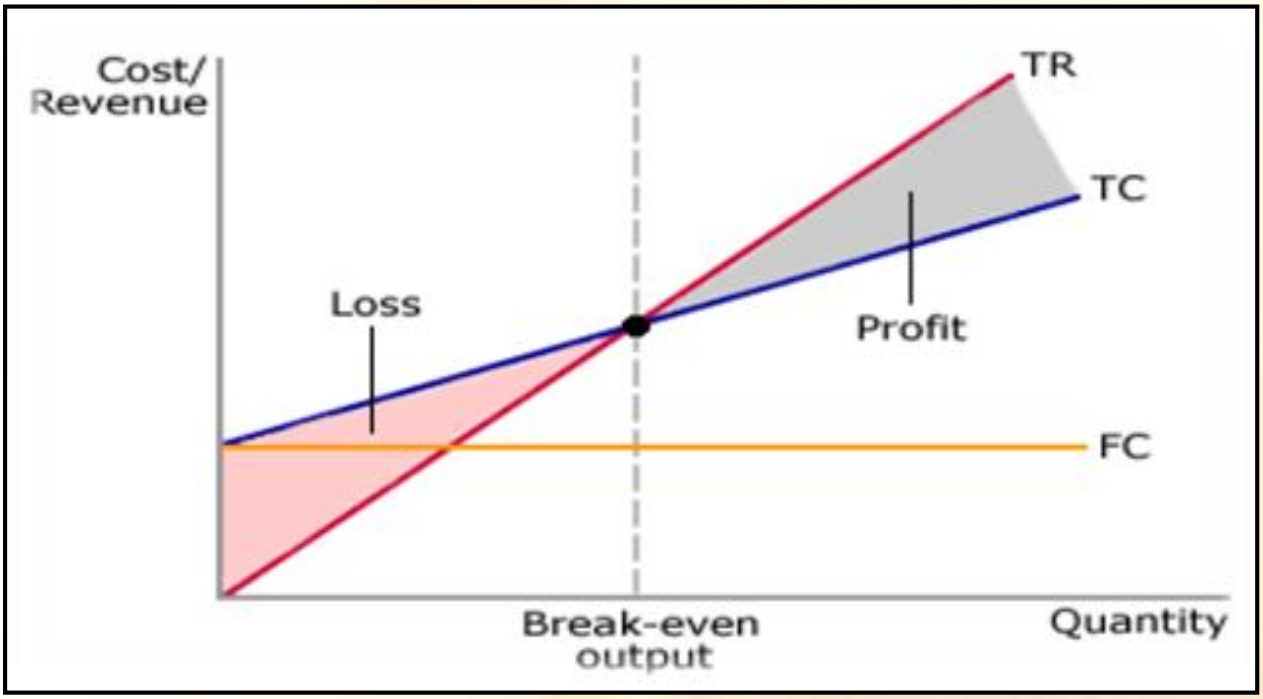
(q) **Margin of Safety (%)** = $\frac{\text{Budgeted Sales less Break-even sales volume}}{\text{Budgeted Sales Volume}} \text{x}100$

Break-Even Chart

A break-even chart is a visual representation of a business's revenue and costs at different levels of output. This is useful, as diagrammatic representation makes it easier for non-mathematical people to understand what is going on. A break-even chart displays the following details:

- Fixed costs – shown as a horizontal line
- Total costs (fixed + variable costs) – shown as a straight line sloping upwards from the start of the fixed costs line.
- Revenue (sales) – an upward sloping line starting from the origin (indicated by 0 (zero) of the graph where no output results in no revenue.

Graphical expression of the break-even chart



Interpretation

1. Where sales revenue is greater than total cost it means that profits are being generated.
2. Where sales revenue is less than total cost it means that losses are being incurred.
3. Where sales revenue equals total costs (intersection of the sales revenue line and the total costs line) it means that no profit or loss is occurring. This is the break-even point.
4. Variable costs vary directly with output, as more output is produced then more variable costs are incurred.
5. Fixed costs do not vary with output and are constant for a range of output produced. They are incurred even when there is no output at the beginning of the project. This is because they are the costs that must be incurred to support the project such as equipment and facilities, rent and interest incurred on any borrowed funds.
6. The total costs line is a representation of the combined variable and fixed costs. This is why at nil output it has a cost which represents fixed costs, and then as output increases the total cost line varies with it and in parallel with the variable cost line.
7. The margin of safety is the extra amount of sales that is expected to be generated when the budget or actual sales is compared to the break-even level of sales.

Break-Even Analysis: Pros and Cons

Benefits (Pros)

- Break-even charts provide a clear, visual demonstration of some vital financial information. They show at a glance break-even output and levels of profit or loss. This knowledge allows a business to predict its likely profit from a certain output and to plan how many units (in this case birds or eggs) it needs to produce and sell in order to reach a profit target.
- Break-even analysis is not a complex, expensive or time consuming process, and so could prove particularly useful to those starting up or running a poultry business.
- Break-even charts can be used to show the likely financial impact of changes in costs or selling price.
- Break-even can be used to model whether or not a new poultry business or poultry product would be worthwhile before committing any resources into the venture.
- Break-even charts can be used to model 'what if' situations before any real resources are committed to a business, project or poultry product.

Cons (Limitations) of Break-even analysis

- To keep break-even analysis simple, a number of assumptions are made that are unrealistic. For example, it is assumed that:
- All the output is also sold. Break-even analysis cannot cope with items that are produced but not sold.
- The total revenue and variable costs lines are linear (that is, they increase at a constant rate). In reality, both selling price and the variable costs per unit will change as output increases. Economies of scale, such as bulk buying discounts, are likely to mean that variable costs per unit will fall at higher levels of output.
- The analysis is intended to help predict the effect of changes, such as selling price. It says nothing about the effect that such a change may have on customer demand and hence on the actual level of profit or loss. This will depend on the price elasticity of demand, which is not considered in the break-even chart.
- The constant changing nature of costs and prices in the real world means that a break-even chart is unlikely to remain valid for very long.
- Finally, it is worth noting that any information gained from break-even charts or calculations is only as accurate as the information it was based upon. Collecting accurate information is expensive and time-consuming and often difficult for inexperienced poultry farmers.

Sources of Finance to Run a Poultry Farm

Finance is the lifeblood of business concern, because it is interlinked with all activities performed by the business concern. In a human body, if blood circulation is not proper, body function will stop. Similarly, if the finance is not being properly arranged, the poultry farm will stop. Arrangement of the required finance to each department of the farm is highly a complex one and it needs careful decision. Sources of finance mean the ways for mobilizing various terms of finance to the industrial concern. Below are some of the sources of finance or capital available to a business:

(1). **Loans:** A loan is a debt provided by an entity (organization or individual) to another entity at an interest rate. Loans can be short-term, medium-term or long-term. Short-term loans are bank loans for up to one year granted for a specified purpose, such as the purchase of poultry equipment or tools. Medium-term loans are those that extend for a period of 1-10 years and are mainly used for funding assets with a shorter lifespan, such as equipment or vehicles. On the other hand, long-term loans are

issued for a period exceeding 10 years and are mainly used for funding the purchase of major assets such as land, buildings or heavy-duty industrial machinery.

(2). **Intellectual capital**: "The real source of wealth and capital in this new era is not material things. It is the human mind, the human spirit, the human imagination, and our faith in the future"- Steve Forbes. Intellectual capital is just that: a capital asset consisting of intellectual material. To be considered intellectual capital, knowledge must be an asset able to be used to create wealth. Thus, intellectual capital includes the talents and skills of individuals and groups; technological and social networks and the software and culture that connect them; and intellectual property such as patents, copyrights, methods, procedures, archives, etc. It excludes knowledge or information not involved in production or wealth creation. Just as raw materials such as iron ore should not be confused with an asset such as a steel mill, so knowledge materials such as data or miscellaneous facts ought not to be confused with knowledge assets.

(3). **Equity**: A poultry farmer can start his or her poultry farm using his or her own sources of funds (or money) such as personal income, savings, etc. This is what is referred to as equity (or owner's equity).

(4). **Supplier's credit (or trade credit)**: Trade credit is a form of short-term financing common to almost all businesses. In fact, it is the largest source of short-term funds for business firms collectively.

In an advanced economy, most buyers are not required to pay for goods upon delivery but are allowed a short deferment period before payment is due. During this period, the seller of the goods extends credit to the buyer.

Because suppliers generally are more liberal in the extension of credit than are financial institutions, small companies in particular rely on trade credit.

Some people begin business using goods that have been supplied on credit. At times it is referred to as trade credit, i.e. credit that a customer gets from suppliers of goods and services in the normal course of business. The buying firm does not have to pay cash immediately on purchases made. That is, it uses the sales to pay the suppliers but remains with the profit realized on sale.

(5). **Borrowing from friends and relatives (or relying on family contribution)**: An individual seeking to start a poultry farm can also borrow from friends and/or family members. Besides, family members can also contribute towards business capital in terms of funds, sponsorship for a course to

gain skills, providing fixed assets, e.g. land, vehicles, machinery, etc. or even rendering free services to the business more so in its initial stages.

(6). **Selling of personal property (or assets)**: An individual who intends to begin a business can raise capital by selling off his or her personal property; for example land, vehicles, tools and equipment, etc. The danger with this is that there may not be ready buyers and worse still even those willing to buy may not raise the required sum of money needed by the seller.

(7). **Inheritance**: Some poultry farmers get capital (money) or property from the dead. These could either be relatives or very close friends. They can, therefore, start their own businesses using such money and/ property.

(8). **Hire purchase:** Hire purchase allows the business to use an asset without having to find the money immediately. A finance house buys the asset from the supplier and retains its ownership during the period of hire purchase agreement. The business pays a deposit and then further payments to the finance house, as stipulated in the Agreement. At the end of the Agreement, ownership of the asset is passed on to the business.

FINAL REMARKS

As we wind up this book, we wish to share a summary of what good poultry management is: Good poultry management is:

- Breeding or buying new stock every year or two, particularly chickens.
- Housing to provide protection and control of the bird's environment
- Providing a clean, dry floor, perches, feed and water troughs and adequate nest boxes.
- Feeding a complete balanced ration and providing cool, clean water at all times.
- Checking daily the health and welfare of stock.
- Practicing good hygiene and using vaccines to prevent disease.
- Using drugs and pesticides only when absolutely necessary.
- Keeping poultry sheds and surrounding areas free of vermin and snakes.
- Using adjustable ventilation controls, insulation, and shade trees to obtain internal shed temperature of 15-30^{0}C through the year.

We wish to see each farmer achieve financial independence and freedom through producing food to feed the ever increasing world population. Blessed poultry farming!