



Good Agricultural Practices for Smallholder Poultry Producers

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Introduction

This Good Agricultural Practices (GAP) guide is designed to provide smallholder poultry farmers with a basic standard operating procedure to improve poultry production performance. Good agricultural practices address environmental, economic and social sustainability for on-farm processes and results in safe, quality food and non-food agricultural products.

The main objective of GAP, which is designed to complement a practical management guide, is to inform producers of basic minimum legal and ethical requirements, social responsibility, raise awareness about welfare issues and promote the implementation of good practices to decrease mortalities, improve efficiencies, productivity and profitability and contribute to the sustainable production of safe and high-quality meat and eggs that will promote the marketing of poultry products.

Glossary of Terms

Biosecurity: a set of preventative measures designed to reduce transmission of infectious diseases, parasites, pests and invasive alien species.

Antibiotic: a chemical substance synthesized or produced by microorganisms which has the capacity to prevent the growth of, or kill, other bacteria.

Antimicrobial: an agent that kills bacteria and reduces their growth multiplication.

Aspergillus: a fungal infectious disease, caused by *Aspergillus fumigatus*, in which the typical sign is gasping for breath, especially in young chicks.

Detergent: a water-soluble cleansing agent which combines with impurities and dirt to make them more soluble and is used for cleaning floors, walls, ceilings and equipment in poultry houses by foam application.

Good Agricultural Practices (GAP): these are practices that address environmental, economic and social sustainability for on-farm processes and results in safe, quality food and non-food agricultural products.

Mycotoxins: these are naturally occurring toxins produced by certain moulds (fungi) and can be found in poultry feed. The moulds grow on a variety of different crops and foodstuffs including cereals and soyabeans, often under warm and humid conditions.

Salmonella: Salmonella infection (salmonellosis) is a common bacterial disease that affects the intestinal tract of animal and human intestines. Salmonella infection is usually caused by eating raw or undercooked meat, poultry, eggs or egg products.

Stack burnt maize: characterised by brown discolouration due to the build-up of heat in the interior of bag stacks, especially when the maize is kept in polypropylene sacks.

Sub-clinical Coccidiosis: a common parasitic disease of the intestinal tract or ceca of chickens caused by single celled parasites which are commonly referred to as coccidia, where the affected birds do not show visible clinical signs of the disease but the gross lesions and the coccidia are present affecting feed absorption, feed conversion and productivity.

Site and Biosecurity

- The siting of a poultry house is based on upholding biosecurity principles.
- Biosecurity refers to measures aimed at preventing the introduction and/or spread of harmful organisms to animals (eg. viruses, bacteria, etc.) to minimise the risk of transmission of infectious diseases and safeguard the flock against most common diseases.
- Poultry houses should be sited as far away from human dwellings as possible. Ideally, this should be at least 500m. In smallholder operations where this is not possible, emphasis on constructing physical barriers such as a wall, hedge or fence are highly recommended to separate the site from human traffic.
- Avoid siting the poultry houses near a walking path or road with high human traffic such as near the main house gate to prevent breaches of biosecurity as people are the most frequent carriers of contamination.
- There should be no contact-proximity to any other poultry or backyard flocks. In many smallholder operations, this remains a challenge and there is need chose between commercial and backyard flocks. Barriers as noted above must be erected to avoid contact. The risk of spreading disease from locally adapted backyard flocks to commercial flocks is too high to ignore.
- A clean and protected water source such as a borehole should be available.
- The house should have an “all-in-all-out” system where poultry of only one age and species per site are kept.
- In many small-scale operations, the multi-age system allows for continuous production and regular and frequent slaughter or live sales (weekly/fortnightly/ monthly), giving the advantage of a consistent supply to the market and cashflows.

However, this system can be associated with ineffective cleaning and disinfection, proliferation of pathogens (disease causing organisms) leading to stunted growth and poor uniformity and eventually, high mortalities. In turn causes longer production cycles, increased feed consumption (poor feed consumption ratio), financial losses, disappointed customers and ultimately, the failure of the project.

Avoid multi-age sites as much as possible and where practiced, recognise the risk and place birds a minimum of 20m away from another age and species and never in the same house.

- A changing room should be built at the entrance to the site where practical to do so. Where this is not possible due to the size of the operation, people should shower at the site and change clothes before entering the poultry house. Clean gumboots and overalls must also be available for anyone entering the house. Where the provision of overalls is not possible, a set of clothing dedicated to working in the poultry house must be available.

- Visitors should be discouraged from entering the poultry house and should be shown the facilities from outside if necessary.
- A visitor's book should be available at the farm entrance or in the poultry house.

Houses

- Space: Adult broilers need 0.1 square metres per bird (or 10 birds per square metre), while commercial layers require 0.125 square metres per bird (or 8 birds per square metre). For example, 100 broilers should have a poultry house of 2x5m (10 square metres) while the same space will only house 80 commercial layers.
- Cages or raised cages can also be used. These are easier to use for new farmers although they are becoming less popular for large scale operations across the world due to animal welfare concerns.
- A perimeter fence to control movement of people and animals is recommended with a 'Keep Out' sign on the gate or on the door to minimise transmission of diseases from persons coming close to the poultry houses.

Footbaths

- A footbath must be put at the base of a gated and lockable entry to the poultry site. It is recommended to set the footbath up on a solid surface, such as concrete, bricks, or cement blocks to prevent mud around the footbath area. Mud quickly pollutes the footbath, making it useless in providing protection.

If vehicles need to enter the site and where wheel baths are often not practical at a smallholder level, then the lower third of a vehicle must be sprayed, making sure that all surfaces that are in contact with the ground are well soaked in disinfectant. These measures are designed to remove contaminants and reduce the risk of introducing diseases into the poultry unit.

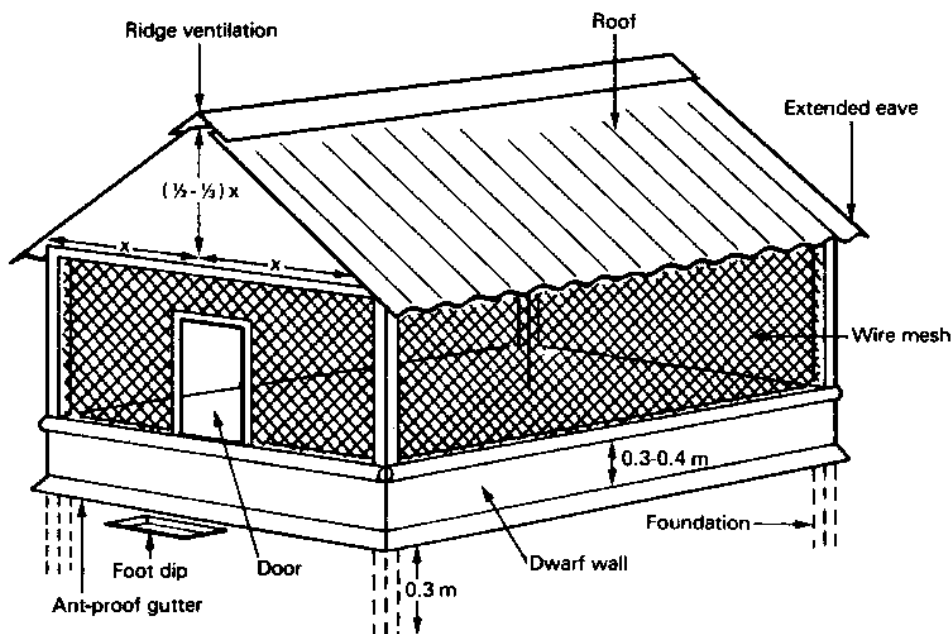
- The size of the footbath depends on the site and the likelihood of mud accumulating during rainy weather. Two footbaths of 50cm x 50cm x 7cm high placed in series or side by side are recommended. One should be filled with clean water and the other with disinfectant. Plastic or concrete containers can be used as footbaths.
- To maintain the effectiveness of disinfectants, it is best to place a foot scrubber next to the footbath to physically remove dirt and other debris prior to using the footbath. Organic matters like dirt will quickly deactivate disinfectants.
- The types of disinfectants generally used are phenolic compounds, iodine/iodophors, chlorine compounds, quaternary ammonium compound and oxidising compounds. Follow the manufacturer's directions for mixing and dilution of these disinfectants.
- Put fresh disinfectant into the footbaths every 1 to 3 days depending on the level of dirt.

- Alternatives to the wheel bath include a spray race (usually expensive to install for small-scale operations), pump spray (fairly expensive) or a Knapsack sprayer (usually practical and easy to implement at a small-scale level) at the entrance.

Siting

- Poultry houses should be sited on level ground with well-drained soils so that there is no water logging during the rainy season.
- Buildings should be built in an east to west direction, in such a way that sunlight does not fall on the side walls during the hottest part of the day.
- While building a poultry house using walls of an existing building or Durawall fencing may reduce building costs, this should be avoided as much as possible. The solid wall often reduces the free circulation of air resulting in poor ventilation which may increase mortality rate due to heat stress.

Figure 1: Poultry House Design



- Preferably the open-sided poultry house should have a high roof pitch to assist natural ventilation, as this increases the movement of air by convection (hot air rising and cooler air sinking) and reduces the amount of radiant heat from the underside of the roof that sinks to the floor where the birds are living.
- The height of the house should be 2.5 to 3m from the floor to the eaves/roof.
- The roof should overhang (extended eaves) the walls by at least 0.5 to 1m to reduce direct sunlight into the house and keep rainwater clear of the walls.

- The side walls should consist of a 25 to 30 cm dwarf wall with 25mm wire mesh to the eaves to allow for maximum ventilation in the grow-out and finishing phase while making it bird and rodent proof. Wild birds and rodents want to access the feed in the house but are a biosecurity risk, especially in the transmission of Salmonella.
- The open sides of the house (usually running the length of the house) should also incorporate an adjustable roll down reinforced plastic curtain for use during brooding, cold weather and at night. Adjusting these curtains (opening and closing) provides a degree of control over temperature and ventilation inside the house. Partial or complete opening of the curtains is used to lower the temperature and closing the curtains increases the temperature.
- There should be sufficient opening on the sides of the houses to allow for good ventilation through the house.
- Floors should be constructed of smooth concrete and walls plastered to allow for easy and efficient cleaning.
- Roofing material should have a reflective surface on the outside and be well-insulated on the inside to help reduce the radiation of solar heat.

Cleaning and Disinfection

- Dry Cleaning: Remove all manure from the houses soon after sending all the birds to the abattoir. The manure pit should be located at least 1 kilometre away from the poultry operation or as far away as possible and which is at least 1 meter deep and covered with a layer of soil. This will ensure that heat is generated in the middle of the manure before putting in gardens or fields.

All equipment such as feeders and waterers should be removed from the house and cleaned separately.

- Sweep the house out using brooms.
- Wet Cleaning: Use water under high pressure or scrub with a hard boom and water to wash off all remaining debris from the house.
- Detergent: Apply an approved poultry house detergent and leave for 20 minutes before rinsing and allow to dry before the next step.
- Main Disinfection: Add an approved disinfectant that is active against poultry pathogens and sweep off excess solution. Rest the house for at least 2 weeks to kill off the pathogens as they are vulnerable outside the host.
- Final Disinfection: This is done after resting the house and the litter has been laid. This should be done at least 24 hours before the next placement of chicks. Formalin and potassium permanganate solution is recommended as a fumigant. At a smallholder level, approved poultry disinfectants can be used as a light spray.

- Where earth floors are used (although not recommended), a deep top layer of soil of at least 10cm should be removed and replaced with fresh soil and compacted before disinfection with a disinfectant that tolerates high organic matter and usually mixed with diesel.

Litter

- Fresh litter is recommended for each new batch of chicks. Reusing litter is not recommended as some pathogens may survive from the previous batch of birds.
- Use chopped wheat straw, cotton seed hulls (dry and free from moulds as they are usually prone to aspergillus contamination), wood shavings or soft *Hyparrhenia* grass (thin thatching grass) cut into 3 to 5 cm pieces. **Never use saw dust.**
- Litter should be put to a depth of at least 7 to 15cm. Always choose the type of litter which is non-abrasive to the skin and with good absorption properties.
- Remove all wet bedding and replace with dry litter.
- Avoid introducing salmonellae/aspergillus or other pathogens by careful attention to the source and storage of the material both before and after delivery to the farm.

Pre-heating the Brooding House

- In winter, pre-heat the house for 24 hours before the arrival of chicks. Ensure the temperature is between 28 to 30° Celsius (34°C for layers) at chick level and evenly distributed throughout the house.
- Always have at least 2 thermometers that show the maximum and minimum temperatures per poultry house. Investing in a thermometer no matter the size of the operation is a must even though chick behaviour can also be monitored.
- Monitor chick comfort by observing the chick behaviour and regulate the temperature accordingly. When observing a broiler house, chicks should be distributed evenly across the house or brooding area. Chicks that are cool can be seen huddling together (even next to the side wall) and will tend to sit in feeder pans. Chicks that are hot will move away from the brooders and furnaces, pant, and will stretch out on the litter in an effort to cool themselves.
- Check temperatures regularly, particularly during the early hours of the morning as this is when outside temperatures are at their lowest.
- It is recommended that temperature record charts be maintained.

Drinking and Feeding Equipment

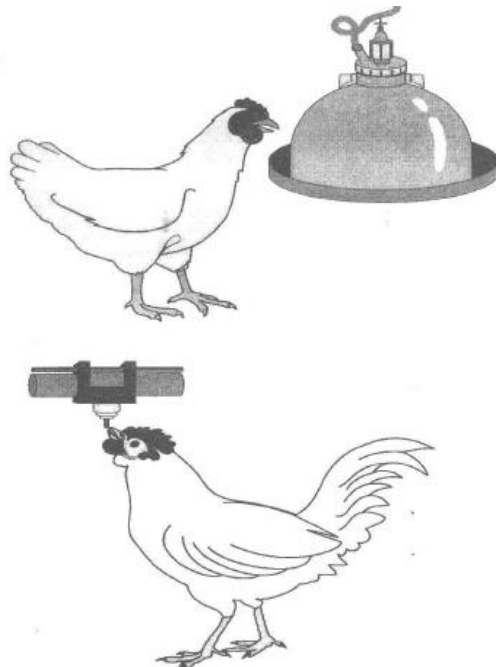
- Chicks:
 - 3 Chick drinking fonts (3 – 4litres) are suitable for 100 chicks up to 7 days old.
 - Chick feeding trays are used at 3cm space per bird or 3 round feed trays (height of 40mm and diameter of 400mm) per 100 chicks up to 7 days old.

- Always have extra paper to put feed on the floor for the first 3 days as this encourages the chicks to eat and makes the feed more readily available.
- **Growing and Adult birds:**
 - Drinking equipment can either be automatic or manual equipment. Use 1 automatic bell drinker for 100 birds or usually 8 – 12litre water fonts for 50 birds from 7 days to the end of the cycle.
 - One standard tubular feeder (12kg feed capacity) for 50 birds from 7 days old to the end of the cycle

Table 1: Equipment Requirements

		Age of Birds	
		1 – 7 days	7 days – end of cycle
Drinking	Option 1 - Manual		8, 10 or 12litre water fonts: 2 per 100 birds
	Option 2 - Automatic	3 – 4litre chick water fonts: 3 per 100 chicks	Nipple drinker: 1 per 10 birds
	Option 3 - Automatic		Automatic drinker: 1 per 100 birds
Feeding	Manual	Chick tray: 3 per 100 chicks	Tube feeder: 2 per 100 birds

Figure 2: Bell Drinker and Nipple Drinker Height



- Feeders and drinkers should be raised to the average height of the birds’ back to reduce wastage/spillage and also for their comfort when eating and drinking.
- The source of heat for brooding depends on resources available and gas brooders, Infra-red lamps or charcoal braziers can be used.

Receiving Chicks and Brooding

❖ **Animal Welfare Freedom 1**

✓ *Chicks and adult birds should have the Freedom to engage in relatively normal patterns of animal behaviour.*

a) *Manage chicks in a way that supports normal patterns of animal behaviour as described below and reduce undue stress.*

- With the constant genetic progress that is being made, the age at which the broiler bird reaches its slaughter weight continues to be reduced. As a result, the brooding period accounts for an increasing proportion of a broiler's short five-week life span. Therefore, successful brooding management is extremely important during the first 7 days that accounts for 20% of the bird's lifespan and has a pronounced effect on growth and days required to reach market weight.
- Collect chicks as early as possible from the supplier to transport during the cooler hours of the day. Avoid keeping birds in a car with no ventilation (all windows closed).
- Placing of chicks should be done in early morning hours (before the sun rises) or late in the evening to reduce stress and with a low ambient temperature.
- Quickly count the chicks on collection and check the quality of the chicks. The signs of a good quality chick are:
 - It should be active.
 - Some lively chirping and not distressed.
 - Normal size with uniformity (40g +/- 5g).
 - Absence of respiratory anomalies.
 - A properly healed navel.
 - Bright eyes.
 - Nice dry and fluffy feathers.
 - Straight closed beak.
 - Free from any physical abnormalities (eg. defective heads, twisted necks, crooked toes).
- It is good practice to weigh 10% of the chicks to get an average day-old weight and repeat every 7 days (refer to Annex 4.1 and 4.2).
- Chicks should be placed evenly throughout the house (refer to Figure 3).
- Birds should initially be placed at a density of 25 birds per square meter for both broilers and layers.
- Bird spacing should be increased rapidly such that by end of brooding (14 days in summer and 18 to 21 days in winter) birds have occupied the whole house and are at 10 to 12 birds per square meter for broilers and 8 to 10 birds per square meter for layers at 5 weeks of age. Generally, the lower the stocking density, the higher the bird weight, as overstocking lowers the growth potential of the bird.
- Assessment of crop fill at 12 and 24 hours after placement is a useful means of determining appetite development and checking that all chicks have found feed and

water. Sample 10% of chicks per brooding area for small-scale farmers (at least 10 chicks). A minimum of 80 – 85% of chicks should have crop fill containing both feed and water 12 hours after placement and 90 – 95 of chicks should have crop fill containing both feed and water 24 hours after placement.

Growing and Finishing Period

❖ Animal Welfare Freedom 2

✓ *All poultry should have Freedom from discomfort by observing the following:*

- a) *Provide adequate, appropriately dry, clean, safe housing with adequate ventilation.*
 - b) *Design and construct the house to ensure that it is free from hazards that could cause injury.*
 - c) *Prevent overcrowding of poultry by maintaining the appropriate stocking density.*
- Increase ventilation, feeding and watering space as the birds grow.
 - Remove chick trays and water fonts gradually as you replace with tube feeders and bell drinkers from day 7 to 10.
 - Equipment should be raised off the ground as birds grow and feeders and drinkers should be at the level of the back of the chick to avoid contamination.
 - Constantly remove wet litter and replace with fresh litter. Turn litter when absorption of moisture has decreased and usually every other day from the 3rd week for broilers. Litter should be maintained friable and dry.
 - Basic health surveillance should be done by the houseman at least twice a day and sick birds should be separated into an isolation/sick pen. This can be created when sick birds are noted in one part of the poultry house and ensure that they have adequate water and feed as birds in the main poultry house space.
 - Sick / hospital pen: The use of sick pen should be discouraged as these birds, even after recovery, may still be able to infect other birds. It is also harder to keep track of which birds were medicated and which birds were not, therefore raising the concern about drug residues and food safety (refer to 'Medications and Drugs Resistance' on page 24).
 - Always record and remove mortalities and ensure that post-mortems are done by your veterinarian when mortalities increase to more than 1% a day (refer to Annex 2). Rendering, incineration or composting is recommended for mortality disposal.
 - A veterinarian should always be consulted as soon as problems are noticed and not when they are advanced.
 - It is very important to monitor and record feed intake (refer to Annex 4.1 and 4.2).
 - Monitor ventilation and temperature (refer to Annex 5).

- Fly control using fly traps placed a few metres from the house are recommended as flies are a source of disease transmission and the traps generate unpleasant odours, especially during summer.

Ventilation

- Good ventilation management requires minimal temperature fluctuations.
- Ventilation at all ages is needed to remove excess heat, water vapor and/or carbon dioxide (CO₂), ammonia, dust and disease agents such as *Aspergillus fumigatus* spores.
- Maintaining low carbon dioxide levels is particularly important in the first week during the brooding phase when the house has minimum ventilation.
- Management practices such as limited area brooding and low ventilation designed to reduce energy requirements for heating the house together with the increased use of charcoal burners (braziers) generally increase carbon dioxide levels. Exposure to high levels of carbon dioxide during brooding can depress weight gain and affect feed conversion ratio hence the need to control this parameter.
- High levels of carbon dioxide in the poultry house either due to overcrowding, poor ventilation or blocking fresh and cold air during winter with curtains results in an oxygen deficiency in the blood of bird.

House Temperature

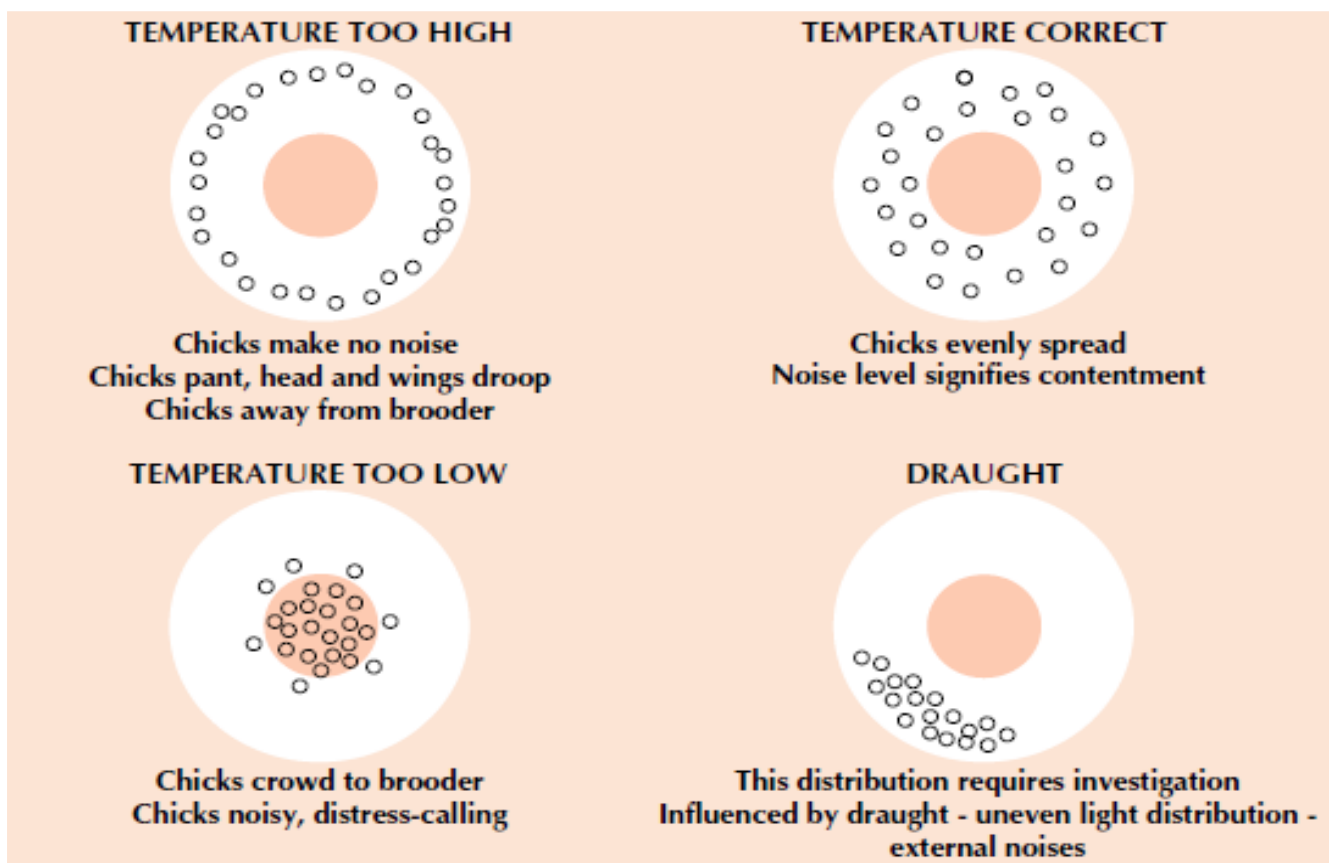
- Chickens perform best when there is minimal variation in house temperature over a 24-hour period. Large temperature variations influence feed conversion efficiency of the bird.
- The ideal environmental temperatures (standard temperatures) are provided by the breed standards guides that can be downloaded off the internet eg. Ross and Cobb for broilers, Hyline and H and N for commercial layers (refer to Annex 5 for standard temperatures).
- Record temperatures twice a day using readings from a maximum/minimum thermometer (refer to Annex 5).
- Birds should initially be placed at a density of 25 birds per square metre for both broilers and layers.
- This should be increased rapidly such that by end of brooding (14 days in summer and 18 to 21 days in winter) birds have occupied the whole house and are at 10 to 12 birds per square meter for broilers. Generally, the lower the stocking density, the higher the bird weight, as overstocking lowers the bird's growth potential.

The diagram below shows a big pink circle in the middle that represents the heat source, the little circles represent the chicks and the white area represents the brooding area. This illustration shows how birds will move away or towards the heat source if they are

hot or cold. Observing the behaviour of the birds will help signal if they are comfortable or not. Chicks should be evenly spread across the brooding area eating, drinking, walking and evenly spread out.

- Comfortable birds will form a circle under the lamp and make soft "cheeping" noises.
- Cold birds will huddle and pile near the heat source and make sharp noises.
- If birds are too hot, they will move as far from the heat source as possible. Some birds will pant if the temperature is too high.
- Birds will do a better job than a thermometer of telling you if they are comfortable.

Figure 3: The Source of Heat and Chick Behaviour



Bird Weights

- Monitoring key production indicators such as body weight, growth rate and feed conversion rate is fundamental in poultry farming to improve the efficiency and profitability of the project.
- Regular weighing of broilers and layers will allow for the identification of possible performance issues in order to implement corrective measure before it is too late.

Weigh birds at approximately the same time and in the same spot on bird weighing days.

- After all, the end goal of raising broilers or layer pullets is to get as many birds or eggs as possible to market using the least amount of feed.
- Weigh and record the weights of a sample of the chicks as soon they arrive (refer to Annex 3.1 and 3.2).
- In addition to the average weight, the distribution of the weight of the birds sampled provides some information about the uniformity of the flock. The more uniform, the easier it is to manage a flock as all the birds have basically the same needs.
- Record weekly weights for a sample of broilers and layers in rearing. Use breed standards as a reference guide on performance (refer to Annex 3.1 and 3.2).
- To achieve these targets a few management tips should be in place:
 - Easy access to feed and where possible, increase the number of feeders above the recommended number to increase feeding space.
 - Follow up feed intake by checking the bird's crop: 95% of the crop should be full within 24 hours.
 - Pay extra attention to feed intake after four days when feeding paper is removed.
 - Try to reduce the proportion of small chicks by seven days by ensuring necessary early feed intake.
 - Correct any brooding conditions such as temperatures and ventilation to stimulate feed intake.
 - Ensure birds are healthy with no obvious signs of illness and if clinical symptoms are observed, consult your veterinarian.

Feeds and Feeding

❖ **Animal Welfare Freedom 3**

✓ *All poultry should have Freedom from thirst, hunger and malnutrition by observing the following:*

- a) *Ensure that the bird's water and nutritional needs are always met.*
 - b) *Provide adequate daily amounts of nutritionally balanced diets.*
 - c) *At all times, offer adequate amounts of good quality potable water - refer to the section on Water below.*
- Always buy the feed from a reputable feed company. If mixing your own feeds on-farm, always make sure you only utilise Grade A or B materials fit for human consumption. Do not use poor quality grains and oilseeds or any raw materials which are stack-burnt, old, rancid or mouldy to avoid harmful contaminants and mycotoxins from affecting the health, welfare and performance of your birds.

- Ensure that the feed purchased meets the needs for the age and type of birds kept on the farm. Laying birds must receive feeds with at least 4% calcium to meet their needs to produce the shell of eggs produced.
- Store your feeds and raw materials safely and free from moisture. Wet storage conditions cause feed and raw materials to become stale and mouldy. These wet moulds may produce mycotoxins especially during warm weather months of the year. Feeding mouldy feeds to poultry may cause illnesses which reduce feed conversion rate, increase mortalities and time taken to reach market weight.
- Feed is approximately 70% of the cost of production. It is therefore critically important to provide good quality feed and to avoid wastage.
- Poor feed storage facilities reduce the shelf-life and quality of feed over time through the loss of critical nutrients such as vitamins, essential fatty acids and antioxidants. The result will be poor bird health, reduced growth and higher mortalities. Feeds and raw materials need to be protected and a feed storage facility should meet the following standards:
 - Provide shelter from direct sunlight and rain.
 - Be properly ventilated, cool and dry.
 - Keep feed dry (and therefore ensure low humidity).
 - Protect feed from vermin (rats/mice) and insect pests.
 - Keep feed off the ground to prevent ground condensation and mould spoilage.
 - Keep feed away from chemicals and drugs.
- Feed should be stacked on pallets above the floor to avoid moisture build-up between the bags of feeds and the floor. Feed should also be stacked away from the wall to improve air circulation and also to control rodents.
- Feed must be always available to make sure that birds never go hungry during their lifetime.
- Ensure that old feed is used first (first-in, first-out). Feed should only be stored for a short period of time, ideally for less than two months from the date of manufacture. Reducing storage time ensures that the feed is turned over faster, thereby reducing the inventory costs and providing the birds with fresh, high quality feed.
- Record all feed purchases and usage to track the above point and also to calculate feed conversion ratio – see below.
- Mice and rats (rodents) are good at finding feed stores and can lead to significant feed losses; furthermore, they can transmit diseases.
- Rodent control should be in place and regularly maintained. Choose a good rodent trap and rodenticide bait to control rodents in addition to sealing all holes (using removable material such as a brick to cover water outlets) that allows rodents to access your feed stores. Make sure doors are closed behind you so that they do not gain access while you are in the room.
- Feed formulation and costs: The cost of feeds is in part driven by the amount of proteins and calories per kg of feed. Cheap feeds likely mean a lower level of these

nutrients or the absence of important vitamin and mineral premixes. Therefore, the birds will need to consume more feeds to meet their nutritional requirements.

Feeding

- At least half of the birds should be able to feed at the same time.
- Distance between feeders must not be greater than 3m.
- Never provide mouldy or contaminated feed. Moulds can reduce the nutritional value of feeds and release several mycotoxins when consumed by the birds. Mycotoxin-contaminated feeds have adverse effects on the health and productivity of poultry.
- Regularly clean feeders and drinkers at least twice a day to encourage feeding tendencies.
- Placing too much feed in chick feeders results in feed wastage and contributes to poor feed conversion and loss of profit.

Feed Conversion Ratio (FCR)

- This is the ability of the bird to convert feed consumed to meat. Feed efficiency is calculated by dividing feed intake by weight gain, resulting in typical values around 1.8 for 42-day old broilers. This means that for each 1800g of feed eaten by the bird, it should gain a weight of 1 kg:

$$\text{FCR} = \frac{\text{Total kg feed consumed}}{\text{Total live weight}}$$

- The lower the ratio, the more efficient the flock was in using the feed supplied.
- As is typical of all animals, broilers and layers experience a period of rapid growth early in their development. This is then followed by a slow rate of growth as more feed is used in maintaining the already existing body structure. As a result, feed efficiency is much better in the first weeks of broiler production and then declines with increased weight.

Water

- Water is the most important of all nutrients. Water of good quality should therefore be always available.
- Check water quality periodically by submitting water samples to a reputable laboratory at least twice a year to evaluate bacterial contamination (especially *E.coli*) and mineral composition. Chemical treatment helps lower bacterial contamination (of particular importance is Salmonellae and *E. coli*) and consequently lowers mortality.

- Water temperature plays a major role on water intake in birds. As long as water temperature is below body temperature, the bird receives some benefit from drinking because it helps with heat dissipation and body temperature regulation.
- Water consumption is generally 1.7 to 1.8 times the feed consumed.

Pre-Slaughter

❖ **Animal Welfare Freedom 4**

✓ *Freedom from fear.*

a) *Ensure that staff responsible for handling the birds is adequately trained and competent so that birds are handled with care and patience, having regard for the bird's natural instincts.*

b) *Avoid unnecessary sudden noises on the farm.*

c) *Maintain birds in appropriate social groupings where possible to reduce undue stress and injuries.*

- Reducing stress at catching is crucial to reduce mortalities before slaughter and ensure meat quality. Pre-slaughter stress results in a depletion of glycogen reserves and poor bleeding which adversely affects meat quality, taste and meat keeping qualities.
- When birds reach market weight, they should be slaughtered within the shortest time possible to limit excess feed consumption or sold in the shortest period possible if it is live bird sales.
- Prepare and plan for catching at least 24 hours before slaughter.
- Water must be available until the start of catching.
- Withdraw feed 8 to 12 hours before slaughter.
- Lighting should be dimmed at the time of catching. Catching birds at night is recommended, as birds are less active.
- It is recommended that the whole flock be slaughtered at once to manage costs and to allow for housing cleaning and the resting period recommended in the 'all-in all-out' system.
- When selling from the production pen, there is need to respect biosecurity so that customers do not have to get into the pen to choose their birds. Rather, have a selling cage away from the poultry house.

Slaughter

- It is important to plan ahead to ensure that you always abide by the law. Legislation is in place to protect the welfare of the birds and covers food hygiene and public health concerns as well.
- Slaughter of chickens should be humane, quick, and sufficient bleeding time allowed.
- For poultry to be slaughtered humanely, it is important that the task is done by someone competent and confident in the necessary procedure.

- In backyards or on-farm, the most commonly used restraint device is the cone. Birds are inverted into the device with the head lowered through a hole. Slaughter can then be carried out immediately.
- The time for which birds are restrained in a cone should be as short as possible. It is a good idea to maintain hand contact with the bird for the first few seconds it is in the cone as this will help calm the bird.
- Remember that you must not cause any avoidable pain or suffering to any bird.
- A sharp, clean knife should be used to cut across the front of the neck just below the head. When slaughtering birds for consumption, for food safety reasons, birds should be kept suspended for a while after neck-cutting to allow time for the blood to drain from the carcass before plucking and evisceration can begin.

Figure. 4 Cone used to slaughter a broiler in backyard/on-farm operations



- Slaughtering facilities and equipment should meet food safety standards and should be done in accordance with Statutory Instrument (SI) 50 of 1995 which states that no person shall sell, or keep, transport or expose for sale any meat or offal unless:
 - It has been obtained from animals or birds that have been slaughtered in a registered slaughterhouse; and
 - The meat or offal has been inspected by a meat inspector and passed as unconditionally fit for human consumption.
- Birds should be bled, scalded, de-feathered, heads and feet removed and bodies washed in a separate area or room designated as a “dirty” area.
- Carcasses should be eviscerated and washed, chilled, packed and refrigerated in a separate room designated as a “clean” area. These two areas should be separated by adequate space.
- Containers should be provided in all areas to collect waste material such as feathers, and offal.

- Bacterial contamination of chicken carcasses usually takes place during slaughter and processing. These organisms can survive and multiply in the sold product and pose serious health risks to consumers, especially Salmonella. Therefore, high hygiene standards must be practiced during the slaughter processing.
- Always have running water available when slaughtering birds and wash and sanitise hands.

Common Diseases and Culling

❖ **Animal Welfare Freedom 5**

- ✓ *Ensure poultry have the Freedom from pain, injury and disease by ensuring:*
 - Flock inspection at least twice a day.*
 - Isolating and treating sick birds promptly in consultation with an authorised veterinarian.*
 - Avoid inappropriate handling of birds that cause them unnecessary pain, suffering or excitement.*
 - Approach birds calmly at all times.*

- Watch closely for early signs of disease and consult a veterinarian for quick treatment. Sick birds do not perform well and can infect other birds.
- Identify and remove birds that are too weak to perform or non-starters as early in the grow-out period as possible. Poor performers with no chance of making it to market in the normal period should be managed separately under medication and culled if there is no improvement within 7 days.
- Some diseases like sub-clinical coccidiosis can be more subtle, causing changes in feed utilisation because of various parasites and microbes that can reduce the efficiency of digestion and absorption of nutrients. It is important to always monitor feed utilisation.
- Proper disposal of dead birds should be in place. Disposal of dead poultry is by burial in a pit that is far from the poultry houses or by incineration where available. The pit should be at least 1.5m deep and covered to prevent scavengers spreading diseases.
- It is also important to explore other disposal methods such as incineration, rendering where possible and supplying crocodile and fish farming units.

Yolk sac infection

A bacterial infection normally experienced during early growth stages when the yolk is still being utilised by the chick and is characterised by a discoloured (darkening) and distended belly. Factors aggravating yolk sac infection include poor hygiene in the hatchery, during transportation and in the brooding environment. It may be associated with omphalitis (navel infection).

Newcastle Disease (NCD, ND)

This is a viral disease that can cause up to 100% mortality within 24 to 72 hours in unvaccinated flocks. It is characterised by respiratory problems, digestive problems and nervous disorders eg. neck-twisting, walking in circles and star gazing. Affected chickens do not always exhibit respiratory or nervous signs. This disease needs to be differentiated from Avian Influenza (bird flu) - a similar disease of equally high economic importance. In Zimbabwe, chicks are normally vaccinated for NCD at one day old and should be booster vaccinated by the age of three weeks for effective immunity.

Infectious Bursal Disease (IBD) or Gumboro Disease

IBD is a highly infectious viral disease of young chickens, causing destruction of the immune system. It usually affects chickens between three and seven weeks, but older birds up to twelve weeks may also be affected. Clinical IBD occurs usually between 4 and 8 weeks of age. Symptoms include poor uniformity and growth, diarrhoea, inactivity and ruffled feathers. Mortality varies from 5 to 30% or more. Birds should be vaccinated against this disease within the first two weeks of life. There is a subclinical form of the disease that results from the damage to the immune system leading to opportunistic infections and poor weight gain.

Chronic Respiratory Disease (CRD, Mycoplasmosis)

CRD is caused by bacteria-like organisms and is a significant cause of respiratory disease in poultry such as coughing, sneezing and a nasal discharge. Young chickens (broiler chicks or layer pullets) will show respiratory distress. The birds frequently show a lack of appetite, decreased weight gain and increased feed conversion ratios. In adult birds, the most common symptoms are sneezing, coughing and general signs of respiratory congestion. CRD does not normally cause an alarming number of deaths. The effect is more of a chronic nature causing reduced weight gain and feed conversion ratios in broilers. However, the overall economic loss can be significant in broilers. Antibiotics may reduce clinical signs and vertical transmission (transfer of disease from the hen to its chick) but does not eliminate infection. Control requires good biosecurity, and prevention is typically through sourcing birds from Mycoplasma-free breeder flocks.

Coccidiosis

This is a protozoal infection characterised by blood stained droppings in severe cases. Other symptoms include poor growth, weight and uniformity, inactivity, ruffled feathers, loss of appetite and mortality. Formal broiler stockfeed manufacturers normally include anti-coccidials in the feeds. The flock should be kept on friable litter at appropriate stocking densities. The major predisposing factor is poor litter management.

Figure 4: Caeca severely affected by Coccidiosis



Colisepticaemia (Colibacillosis)

A generalised infection caused by bacteria. An affected flock will appear dejected with a mild background 'snick' and/or a mild scour may be seen. A poultry house containing an infected flock usually has its own characteristic smell. Carcasses of birds that have died from colisepticaemia tend to 'green' quicker than those that have died from other causes. Effective hygiene practices and minimising stress in flocks reduces chances of disease outbreak.

Ascites (Water-belly disease)

This is a syndrome arising from reduced oxygen pressure in the blood. It may originate from poor heating and ventilation during brooding and/or other factors affecting oxygen demand as the birds develop. Flock mortality due to this syndrome can reach 10% with peak mortality seen at 4 to 5 weeks. Good ventilation and management of heat stress help to alleviate this condition.

Notifiable Diseases

It is compulsory to report notifiable diseases to the nearest Government Provincial Veterinary Officer within 24 hours of their discovery. According to SI 49 of 2017, such diseases are as follows:

- Avian Influenza
- Newcastle disease
- Infectious bursal disease
- Fowl typhoid
- Pullorum disease
- Turkey Rhinotracheitis
- Avian Mycoplasma gallisepticum
- Avian Mycoplasma synoviae
- Infectious Laryngotracheitis
- Avian infectious bronchitis
- Avian chlamydiosis

- Duck virus hepatitis
- Salmonellosis

Vaccinations

- Vaccination programmes vary according to the prevalence of disease in each area. In Zimbabwe, it is generally recommended to vaccinate against Infectious Bursal Disease (Gumboro), Newcastle Disease and Infectious Bronchitis for broilers. Commercial layers require more vaccinations depending on farm history.
- Only vaccinate healthy birds. If the health status of birds is questionable then delay vaccination and consult a veterinarian.
- On the farm, birds may be vaccinated through several methods: in water, spray or injection. The choice of vaccines will guide the mode of administration required. Some methods are easier to implement than others
- Medication should never be a substitute to good management practices.
- No medication must be administered at least 2 days before and 2 days after vaccination. However, vitamins may be given in drinking water even a day before or just after vaccination.
- Record the vaccination date, name of vaccine, disease being vaccinated against, times for water withdrawal, mixing of water and chlorine binder and dye, mixing of vaccine and calculations of water for vaccination (refer to sample recording chart in Annex 6).
- Handle, transport, store and administer the vaccines as recommended by the manufacturer. Poultry vaccines are always transported and stored under refrigerated conditions on ice in a flask.
- Store the vaccine with proper identification to avoid confusion.
- Record the serial number, type, name of the manufacturers and expiry date of each batch and who performed the vaccination. Do not use old, opened vaccines.
- If flocks of different age groups are to be vaccinated on a particular day, or different vaccines are to be used on different flocks, then use different insulated containers for each flock.
- Discard all empty vaccine containers by incineration. Avoid contamination of the environment. Do not leave containers in the poultry house.
- Do not keep mixed or opened vaccine vials on the premises.
- Do not mix the vaccines until use.

Medications and Drug Resistance

- Any incidences of high mortality, disease outbreak and performance related concerns should be reported to the veterinarian as soon as possible.
- An antibiotic residue is a small amount of leftover drug, or parts of the drug that are not completely broken down in the chicken's body or removed from the eggs

destined for human consumption. These residues can be identified in animal products or tissues. Antibiotic resistance is a process where the bacteria that the antibiotics are intended to kill or inhibit have adapted to them, making the drugs less effective.

- Do not give medications such as antibiotics as a routine/standard practice unless advised by the veterinarian as the levels of multi-drug resistant bacteria have increased.
- Using antibiotics in targeted ways to prevent disease is key to minimising their use overall.
- Always observe the withdrawal period of the antibiotic as chicken meat or eggs for human consumption contaminated with drug residues may pose serious public health hazards in the form of antibiotic resistant bacterial formation, allergic manifestations, or alteration of useful bacteria of the digestive tract.
- Use veterinary medicines and biologicals strictly in accordance with the manufacturer’s instructions or veterinary prescription.
- Keep all treated birds on the farm until the relevant withdrawal times have expired and ensure that meat or eggs from these animals is not used for human consumption until the withdrawal period has elapsed.
- Keep detailed records of the origin and use of all veterinary products, including batch numbers, dates of an administration, individuals or groups treated and withdrawal times (refer to Annex 7).
- Keep veterinary products in a secure area that is cool and dry.

Layer Management

Table 2: Layer stages

Stage	Age
Brooding	1 – 6 weeks
Growing	6 – 12 weeks
Pullet	12 – 18 weeks
Transfer (Point of Lay)	16 – 17 weeks
Laying	18 – 80 weeks
Replacement	80 weeks

- The brooding of layers and broilers is the same – refer to the section on Receiving Chicks and Brooding.
- Hatchery beak treatment or 7 to 10-day beak trimming reduces feed wastage and makes the beak less damaging to other birds. Hatchery beak treatment uses infrared energy that treats the beak tissue and inhibits (stops) beak re-growth, and this is done at the hatchery before chick delivery. The treated portion of the beak will appear white at first, then begin to darken after several days. Over the next 2–3

weeks, the treated beak tip will soften and slough off gradually. Beaks of infrared beak-treated chicks may appear slightly longer than those trimmed with a hot blade.

- Traditional beak trimming is performed using a hot blade in pullets less than 10 days of age. The hot blade process, usually performed by hand, simultaneously trims and cauterises (stops bleeding) beak tissue, which requires skill and should be performed by adequately trained personnel:
 - Hy-Line Brown commercial layers should be beak treated at hatching by infrared beak treatment or beak trimmed between 7 – 10 days of age by precision beak trimming. If necessary, re-trim at 6 weeks or 12 – 14 weeks of age.
 - A second beak trim is recommended in open-sided housing.
- Monitor body weights weekly from 0 to 17 weeks (refer to Annex 3.2). Flock uniformity is an essential quality of a flock as the more uniform, the easier it is to meet the needs of all the birds.
- Transfer the flock to the production facility by 16 weeks of age or after administration of the last live vaccines.
- An adequate nesting area for layers to lay their eggs (at least one area per five birds) should be made available if layers are located in a litter bed.
- Most laying pullets are housed in cages and should be moved to these facilities at 16 weeks which is 2 weeks before egg production begins.
- Layers should be kept in the same house or cage during their laying year. Moving them when they are laying may cause them to stop laying for several weeks.
- Layers in cages should be housed in cages with a minimum height of 45cm and area of 550cm² per bird and not above that for animal welfare reasons so that they are not overcrowded and depress production.

Artificial Lights

- Rearing and production in the tropics like Zimbabwe is usually done using natural light hence the recommendations do not apply to climate-controlled houses.
- Day length should be increased gradually as the pullets come into egg production and should reach a 14 to 16-hr light period per day to stimulate egg production.
- During egg production, the length of the light period should never be reduced as this will reduce egg production.
- The natural lighting of the open type housing traditionally used in the tropics is augmented with four hours of artificial light, administered in two 2-hour periods, one in the early hours of the morning (03.30 to 05.30 hours) and the other in the early evening (19.30 to 21.30 hours).

Egg Collection

- Collect eggs at least twice a day, once in the morning and again in the afternoon. Eggs should be stored in a cool place if not sold (or used) the next day after collection.
- Record the number of eggs collected each day (refer to Annex 8).
- Eggs that are only slightly dirty can be cleaned or rubbed with an egg brush, paper towel, sanding sponge or plastic scourer with a gentle rubbing action. Dirty eggs with mud or faeces that cannot be removed easily using this method should be separated from clean eggs.
- If a dry cloth is used it must be changed if there is any sign of soiling and there should be enough cloths to ensure that only a clean cloth is passed over the egg each time. Dirty cloths must be sanitised, washed and dried thoroughly before reuse.
- Any cloth or material used to dry clean eggs must be food safe.
- Precautions must be taken if using a damp cloth to clean eggs:
 - Wash water must be sanitised and changed often.
 - Sanitisers and detergents must be food safe and only used as per the manufacturer's instructions.
 - Damp cloths should not be dripping wet. They should be rinsed in sanitised water and thoroughly wrung out.
 - No water should be left on the surface of the egg. A fine film of moisture that is readily evaporated should only be seen.

Layer Management

- Unproductive hens should be culled (removed) from the flock as they will continually consume feed while not producing eggs. Signs of an unproductive hen include pale and shrunken combs/wattles, thin and emaciated bodies, inactive and dull appearance. Daily monitoring for the culling of birds should be done.
- A high rate of culled birds is a sign of management problems that need to be addressed immediately.
- Daily monitoring of water intake, feed consumption and egg produced are valuable information to gauge of the overall health status of the flock.
- Call a veterinarian if there is a sudden decrease in egg production, increase in mortality and/or increase in white eggs. Brown layers lay brown eggs and if there is some form of stress on the birds or disease (usually respiratory like Newcastle or Infectious Bronchitis) the eggs will turn white, hence the need to engage a veterinarian as soon as possible.
- Enough fresh feed and water should always be available during the brooding, growing, pullet and laying periods.
- Feed should be available to the birds on a 24-hour basis. However, it is not good practice to simply fill feeders to the brim once a day because of the bird's "pecking"

behaviour while eating and feed is wasted. Providing adequate amounts of feed more often, once in the morning and again in the afternoon, is highly recommended.

- It is recommended to have the feeders empty at least once per day to force the birds to eat everything, even the small particles. Most often these small particles contain essential minerals and vitamins.
- Dead birds should be collected every day and properly disposed of by burning, burying, composting, or by other appropriate means. They should be disposed of immediately to prevent disease transmission to other birds. They should never be eaten or sold.
- Dead birds can be routinely checked for worm load by doing an autopsy.
- The bird's feathers, skin and body parts should be routinely checked for mites, lice, and fleas.
- A vaccination program will be made available by the day-old chick supplier and should be followed strictly without trying to cut costs as they help prevent diseases that can cause more severe losses. Vaccinations for Newcastle and Infectious Bronchitis is recommended every 6 – 8 weeks once birds start laying from 18 weeks to 80 weeks.

Records and Record Keeping

- Even if you are keeping a small flock, recordkeeping helps keep track of your expenses and aids in monitoring the progress of your flock. It is good practice to maintain accurate retrievable records of each flock.
- Why Record Keeping is Vital:
 - For you to make critical financial decisions as well as create a budget, you will need to analyse your records.
 - For you to make decisions on feed consumption, effectiveness of the feed and efficiency of feed conversion into meat/liveweight for broiler and eggs for layers.
 - Keeping records will help you identify mistakes that can be avoided in the future.
 - Records will help you study the production performance and check whether it meets the prescribed standards.
 - Records will help your veterinarian get a good history of the flock when attending to a problem or a poultry consultant when looking to improve your efficiencies and therefore profitability.

Annex 1 General Information

Farm Name: _____	House Number: _____
Source of Chicks: _____	Parent Flock Age: _____
Hatch Date: _____	Date Placed: _____
Time Placed: _____	Placing Floor Temperature: _____
Number Placed: _____	Parent Age: _____
Dead on Arrival: _____	Stocking Density: _____

Annex 2 Mortality for Broiler and Layers

Week	Mortality																			
	1		2		3		4		5		6		7		Week Total	Total	Cum %	Target % - Broilers	Target % - Layers	Balance Alive
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night						
1																		2	1	
2																		1	0.5	
3																		0.5	0.5	
4																		0.5	0.5	
5																		0.5	0.5	
6																		0.5	0.5	
7																			0.5	
8																			0.5	
9																			0.5	
10																			0.5	

Annex 3.1 Broiler Weights

Bird Weights				
Age	Actual (g)	Target (g) – Ross 308	Target (g) – COBB 500	Feed Conversion Ratio
1 day		42	42	
7 days		182	164	
14 days		455	430	
21 days		874	843	
28 days		1412	1397	
35 days		2021	2017	
42 days		2652	2625	

Annex 3.2 Layer Weights

Age (Weeks)	Actual Weight (g)	Target Weight (g) – Hyline
1		68 – 72
2		121 – 129
3		184 – 196
4		257 – 273
5		349 – 371
6		446 – 474
7		543 – 577
8		650 – 690
9		757 – 803
10		863 – 917
11		960 – 1020
12		1048 – 1112
13		
14		
15		
16		
17		

Annex 4.1 Feed Consumed – Broilers

Week	Feed Used Day of the Week							Type of Feed Given
	1	2	3	4	5	6	7	
1								
2								
3								
4								
5								
6								

Annex 4.2 Feed Consumed – Layers

Week	Feed Used Day of the Week							Type of Feed Given
	1	2	3	4	5	6	7	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Annex 5 Daily Temperatures

Daily Temperatures – Broilers						
Day	Minimum	Maximum	Standard	Night	Minimum	Maximum
1			30°C	1		
2			29°C	2		
3			28°C	3		
4			28°C	4		
5			28°C	5		
6			27°C	6		
7			27°C	7		
8			27°C	8		
9			26°C	9		
10			26°C	10		
11			26°C	11		
12			26°C	12		
13			25°C	13		
14			25°C	14		
15			24°C	15		
16			24°C	16		
17			24°C	17		
18			23°C	18		
19			23°C	19		
20			23°C	20		
21			22°C	21		

Daily Temperatures – Layers						
Day	Minimum	Maximum	Standard	Night	Minimum	Maximum
1			35°C	1		
2			34°C	2		
3			33°C	3		
4			32°C	4		
5			31°C	5		
6			30°C	6		
7			30°C	7		
8			30°C	8		
9			30°C	9		
10			29°C	10		
11			29°C	11		
12			29°C	12		
13			29°C	13		
14			28°C	14		
15			28°C	15		
16			28°C	16		
17			28°C	17		
18			27°C	18		
19			27°C	19		
20			26°C	20		
21			26°C	21		

Annex 6 Technical Details

Vaccination	Disease	Due Date	Date Done	Manufacturer	Batch Number	Expiry Date	Method of Administration

Annex 7: Drug/Medicine Register

Medication	Flock I.D.	Administration Date	Batch Number	Withdrawal Period	Reason for Administration

Annex 8: Egg Collection Record

Date	Total Eggs Collected	Clean Eggs	Dirty Eggs	White/Misshaped Eggs

Annex 9 Suggested Links

Laying hens technical resources: Hy-line <https://www.hyline.com/technical-resources>

Calculation of day light requirements: <https://sales.hyline.com/WebLighting/WebLighting.aspx>

This publication was produced with the financial support of the European Union. Its contents are the sole responsibility of the Inclusive Poultry Value Chain project partners and do not necessarily reflect the views of the European Union.