



La-Net

AGE 309

TECHNIQUES OF NON-RUMINANT ANIMAL PRODUCTION



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Course code: AGE 309

Course title: Techniques of Non-Ruminant Animal Production

Course credit load: 2 Units

Series 1: Housing and Equipment for Non-Ruminants

- **Part 1.1: Principles of Housing Non-Ruminant Animals**

- Sub Part 1.1.1: Functions and importance of housing
- Sub Part 1.1.2: Site selection and orientation
- Sub Part 1.1.3: Building materials and construction principles

- **Part 1.2: Poultry Housing Systems**

- Sub Part 1.2.1: Extensive and semi-intensive poultry systems
- Sub Part 1.2.2: Intensive poultry housing systems
- Sub Part 1.2.3: Brooder house design

- **Part 1.3: Swine and Rabbit Housing**

- Sub Part 1.3.1: Pig pen design and types
- Sub Part 1.3.2: Farrowing and weaner accommodation
- Sub Part 1.3.3: Rabbit hutch design

- **Part 1.4: Equipment for Non-Ruminant Production**

- Sub Part 1.4.1: Feeding and watering equipment
- Sub Part 1.4.2: Environmental control equipment
- Sub Part 1.4.3: Biosecurity and sanitation equipment



Introduction

Non-ruminant livestock species, poultry, swine, and rabbits, depend on well-designed housing and equipment to protect them from weather extremes, predators, and disease, while supporting efficient feeding, watering, and overall management. AGE 309 examines these species together because they share important production characteristics: relatively short production cycles, high reproductive rates, and intensive management systems compared to ruminant livestock.

This opening Series introduces the general principles of housing non-ruminant animals; specific housing systems for poultry, swine, and rabbits; and the equipment needed for feeding, environmental control, and biosecurity across these species. This foundation supports the management, disease, marketing, and processing topics covered in the remaining four Series of AGE 309.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 1.1** explain the functions of housing and principles of site selection and construction for non-ruminant animals (Linked to Part 1.1),
- **SLO 1.2** describe poultry housing systems, including extensive, semi-intensive, intensive, and brooder house designs (Linked to Part 1.2),
- **SLO 1.3** describe swine and rabbit housing designs (Linked to Part 1.3), and
- **SLO 1.4** identify feeding, environmental control, and biosecurity equipment used in non-ruminant production (Linked to Part 1.4).



1.1 Principles of Housing Non-Ruminant Animals

1.1.1 Functions and importance of housing

Housing for non-ruminant animals serves several essential functions: protection from adverse weather (rain, excessive heat, cold, and wind) that would otherwise stress animals and depress growth, egg production, or reproduction; protection from predators and theft; facilitation of feeding, watering, and routine management tasks through organised, accessible space; and disease control through controlled stocking density, sanitation, and isolation of sick animals.

Good housing also supports record keeping and selective breeding by allowing animals to be grouped, identified, and observed systematically, a management advantage difficult to achieve under fully free-range conditions. The appropriate level of housing investment depends on the production system intensity, scale, and species, ranging from minimal shelter in extensive systems to fully climate-controlled structures in intensive commercial poultry and swine operations.

Fill in the blank: Housing for non-ruminant animals serves several essential functions, including protection from adverse weather, predators, and disease, and facilitation of feeding, watering, and routine _____ tasks.

1.1.2 Site selection and orientation

A good livestock housing site should have well-drained, slightly elevated land to avoid flooding and waterlogging; adequate distance from human residential areas and other livestock farms to reduce disease transmission risk and odour/noise nuisance; reliable access to water and electricity; and good road access for input delivery and product/animal transport.

Building orientation typically runs east-west (long axis) in tropical climates such as Nigeria, minimising direct sun exposure on the long side walls during the hottest parts of the day and



supporting better natural ventilation through prevailing wind patterns, an important low-cost climate control strategy before considering mechanical ventilation equipment (Part 1.4.2).

Fill in the blank: In tropical climates such as Nigeria, livestock housing typically runs _____-west (long axis), minimising direct sun exposure on the long side walls and supporting natural ventilation.

1.1.3 Building materials and construction principles

Roofing materials (corrugated iron/aluminium sheets, asbestos, or thatch) affect internal temperature and cost: metal roofing is durable but transmits heat strongly without adequate roof height or insulation, while thatch provides better natural insulation at lower cost but shorter lifespan and higher fire risk. Wall materials range from solid block/brick (durable, good security, higher cost) to wire mesh or wooden slats (cheaper, better ventilation, common for poultry housing in warmer climates).

Floor type (concrete, raised slatted, or earth) affects sanitation, disease control, and construction cost: concrete floors are easiest to clean and disinfect but most expensive; raised slatted floors (common in some poultry and rabbit housing) separate animals from droppings, improving hygiene; earth floors are lowest cost but hardest to sanitise effectively. Adequate roof height and overhang, eave openings, and ridge vents support passive ventilation, reducing heat stress without electricity-dependent equipment.

Fill in the blank: Raised _____ floors, common in some poultry and rabbit housing, separate animals from droppings, improving hygiene compared to solid earth floors.



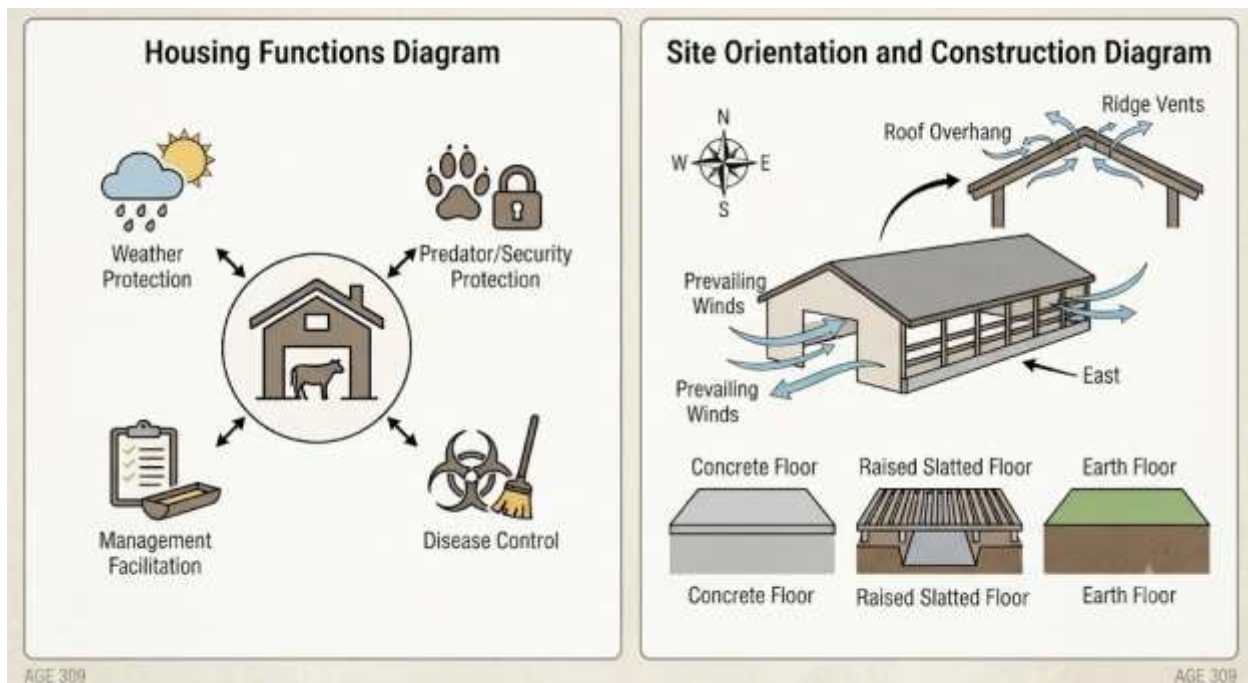


Figure 1.1: Principles of non-ruminant housing

Pilot questions 1.1

1. State four functions of housing for non-ruminant animals.
2. Name three factors to consider when selecting a livestock housing site.
3. Explain why livestock housing is typically oriented east-west in tropical climates.
4. Compare metal roofing and thatch roofing in terms of heat transmission and cost.
5. State one advantage of raised slatted floors over earth floors.

1.2 Poultry Housing Systems

1.2.1 Extensive and semi-intensive poultry systems

Extensive (free-range/backyard) systems allow birds to roam freely during the day, scavenging for part of their feed, with minimal housing provided mainly for night shelter and protection from predators; this low-cost system suits small-scale rural household poultry keeping but offers limited control over feed intake, breeding, and disease exposure.



Semi-intensive systems combine a simple house with an attached outdoor run/paddock, giving birds some freedom to range while allowing better feed and health management than fully extensive systems; this intermediate system suits small commercial layer or dual-purpose flocks where full intensive housing investment is not yet justified.

Fill in the blank: _____ systems combine a simple house with an attached outdoor run, allowing birds some freedom to range while permitting better feed and health management than fully extensive systems.

1.2.2 Intensive poultry housing systems

Deep litter systems house birds on a floor covered with absorbent litter material (wood shavings, rice husks), allowing birds to move freely within the house; this system is widely used for both broiler and layer production in Nigeria, requiring good litter management (depth, moisture control, periodic turning) to prevent disease and ammonia buildup.

Battery cage systems house layers in individual or small-group wire cages arranged in tiers, separating birds from droppings (improving hygiene and egg cleanliness) and allowing higher stocking density and easier individual bird management, though raising animal welfare considerations increasingly debated internationally. Battery cages are primarily used for commercial egg (layer) production rather than broilers, which grow too large and active for cage confinement.

Fill in the blank: _____ cage systems house layers in individual or small-group wire cages, separating birds from droppings and allowing higher stocking density, but raising animal welfare considerations.

1.2.3 Brooder house design

Brooder houses provide the specialised early-life environment day-old chicks require: supplementary heat (since chicks cannot regulate body temperature effectively in the first 2-3 weeks), draft-free but well-ventilated space, and protection from predators and disease, typically



maintained at 32-35 degrees Celsius in the first week, gradually reduced as chicks feather and mature.

Brooder guards (a circular barrier confining chicks near the heat source initially) prevent chicks from straying too far from warmth and huddling in corners (which can cause smothering); adequate floor space allowance per chick (expanded as birds grow) and easy access to feed and water within the brooding area are essential design features for good early chick survival and growth.

Fill in the blank: Brooder houses are typically maintained at _____ to 35 degrees Celsius in the first week of a chick life, gradually reduced as chicks feather and mature.

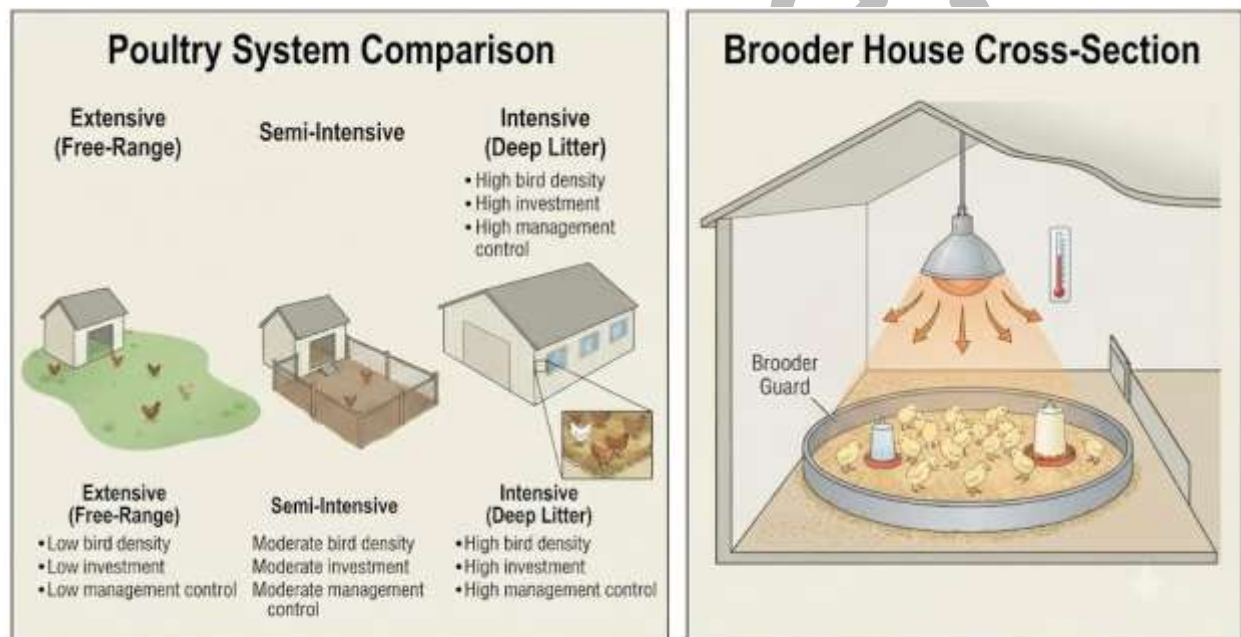


Figure 1.2: Poultry housing systems

Pilot questions 1.2

1. Distinguish between extensive and semi-intensive poultry systems.
2. Describe the deep litter poultry housing system.
3. Explain one advantage and one welfare concern of battery cage systems.
4. State the temperature typically maintained in a brooder house in the first week.
5. Explain the purpose of a brooder guard.



1.3 Swine and Rabbit Housing

1.3.1 Pig pen design and types

Pig housing must accommodate different production stages with different space and environmental needs: grower/finisher pens (for pigs being raised for market) require adequate floor space per animal, a solid or partly slatted floor for hygiene, and a wallow or sprinkler system in hot climates since pigs cannot sweat effectively and rely on external cooling to manage heat stress.

Boar pens (housing breeding males, kept separately to avoid fighting and uncontrolled mating) and gilt/sow housing (for breeding females outside the farrowing period) complete the general pig housing system, with the farrowing-specific housing discussed separately in Part 1.3.2 given its distinct design requirements.

Fill in the blank: Pigs cannot sweat effectively and rely on external cooling such as a wallow or sprinkler system to manage _____ stress, especially important in hot climates.

1.3.2 Farrowing and weaner accommodation

Farrowing pens (for sows giving birth and nursing piglets) require special design features: a farrowing rail or crate restricting sow movement to prevent piglet crushing, supplementary heating/a heated creep area for piglets (which, like chicks, cannot regulate body temperature well at birth), and easy cleaning given the high hygiene demands of the farrowing period.

Weaner pens (housing piglets after weaning from the sow, typically 3-8 weeks of age) require smaller-scale feeding/watering equipment suited to young pigs, careful temperature management (weaned piglets are vulnerable to cold stress and digestive upset during this transition), and adequate space allowance that increases as piglets grow toward the grower stage.

Fill in the blank: A farrowing _____ or crate restricts sow movement during farrowing to prevent piglet crushing, a key design feature of farrowing pen housing.



1.3.3 Rabbit hutch design

Rabbit hutches are typically raised off the ground (on legs or stands) to improve hygiene (separating rabbits from droppings and reducing parasite/disease exposure), provide predator protection, and ease management access; hutch floors are commonly wire mesh (allowing droppings to fall through) or a combination of solid resting boards and mesh sections to protect rabbit feet from injury (sore hocks) associated with prolonged wire floor contact.

Breeding does require a separate nest box within or attached to the hutch for kindling (giving birth) and early kit (baby rabbit) care, while bucks (breeding males) are housed individually to prevent fighting; adequate ventilation and shade are particularly important for rabbit housing given the species sensitivity to heat stress.

Fill in the blank: Rabbit hutch floors are commonly wire mesh, sometimes combined with solid resting boards to protect rabbit feet from injury known as sore _____ associated with prolonged wire floor contact.

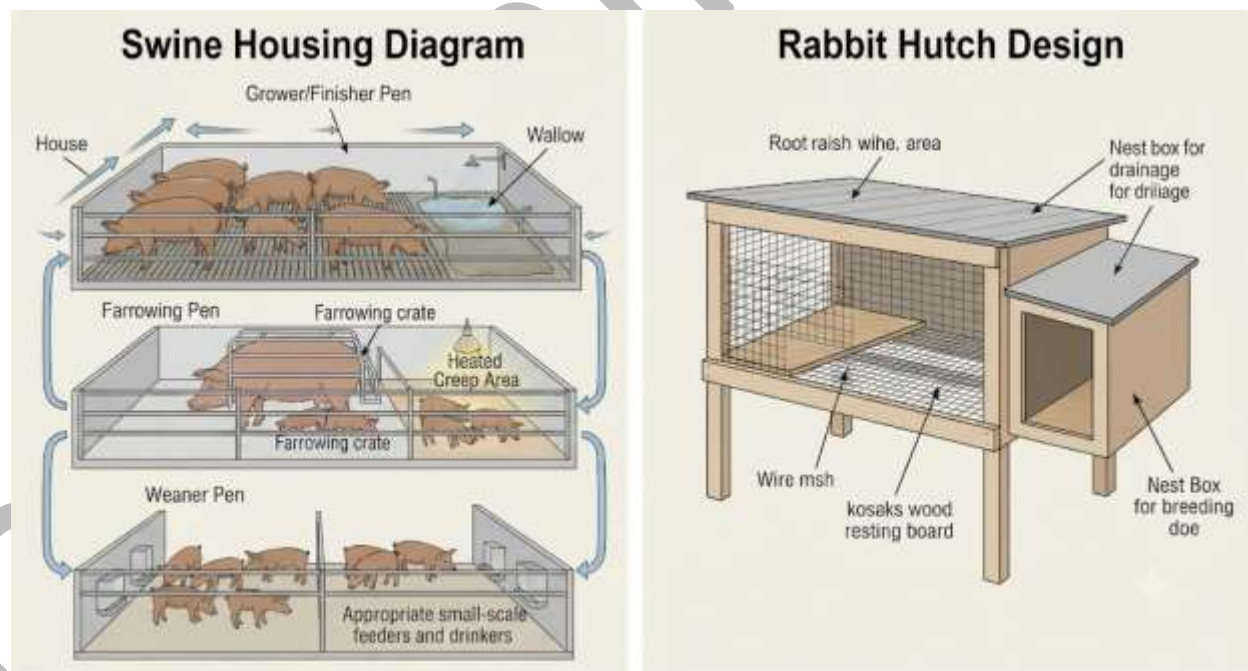


Figure 1.3: Swine and rabbit housing



Pilot questions 1.3

1. Explain why pigs need a wallow or sprinkler system in hot climates.
2. Describe the purpose of a farrowing rail or crate.
3. Explain why weaner pigs require careful temperature management.
4. Explain why rabbit hutches are raised off the ground.
5. Explain the purpose of a nest box in rabbit housing.

1.4 Equipment for Non-Ruminant Production

1.4.1 Feeding and watering equipment

Feeders range from simple trough feeders (low cost, suited to small-scale operations) to tube/hanging feeders (reducing feed wastage and contamination, common in intensive poultry systems) and automatic chain or auger feeding systems (large commercial operations, reducing labour but requiring higher capital investment); feeder design and placement should minimise feed spillage and allow adequate simultaneous access for all animals in a pen/house.

Watering systems range from manual bell/trough drinkers (requiring regular manual refilling and cleaning) to automatic nipple drinkers (poultry and rabbits) and automatic bowl/cup drinkers (pigs), which provide continuous clean water access with less labour but require reliable water pressure and periodic equipment maintenance to function correctly.

Fill in the blank: Automatic _____ drinkers, commonly used for poultry and rabbits, provide continuous clean water access with reduced labour compared to manual bell or trough drinkers.

1.4.2 Environmental control equipment

Heating equipment (infrared heat lamps, gas brooders, charcoal pots) maintains the elevated temperatures young chicks and piglets require (Parts 1.2.3 and 1.3.2); ventilation equipment (exhaust fans, inlet fans, and evaporative cooling pads in more advanced systems) manages air quality, temperature, and humidity in intensive housing where passive ventilation alone is



insufficient, particularly important in hot Nigerian climates and for high-density commercial operations.

Lighting equipment (timed artificial lighting) is used in commercial layer operations to regulate day length and stimulate consistent egg production regardless of natural season length variation; temperature and humidity monitoring devices (thermometers, hygrometers, and in advanced systems automated sensors linked to control systems) support timely management decisions and early detection of environmental problems.

Fill in the blank: Timed artificial _____ is used in commercial layer poultry operations to regulate day length and stimulate consistent egg production regardless of natural season length.

1.4.3 Biosecurity and sanitation equipment

Footbaths/foot dips (containers of disinfectant solution placed at house entrances) reduce pathogen introduction on footwear; disinfection equipment (sprayers for cleaning and disinfecting housing between batches, particularly important in all-in-all-out poultry/pig production systems) supports the disease prevention principles explored further in Series 3.

Personal protective equipment (boots, overalls, and where appropriate gloves and masks, dedicated to specific houses or used with strict cleaning protocols between houses) reduces cross-contamination risk between different animal groups or farms; record-keeping materials and equipment (even simple notebooks or basic digital tools) support the management and disease tracking discussed throughout this course, an often underappreciated but essential category of farm equipment.

Fill in the blank: _____ /foot dips, containers of disinfectant solution placed at house entrances, reduce pathogen introduction on footwear, an important biosecurity equipment item.



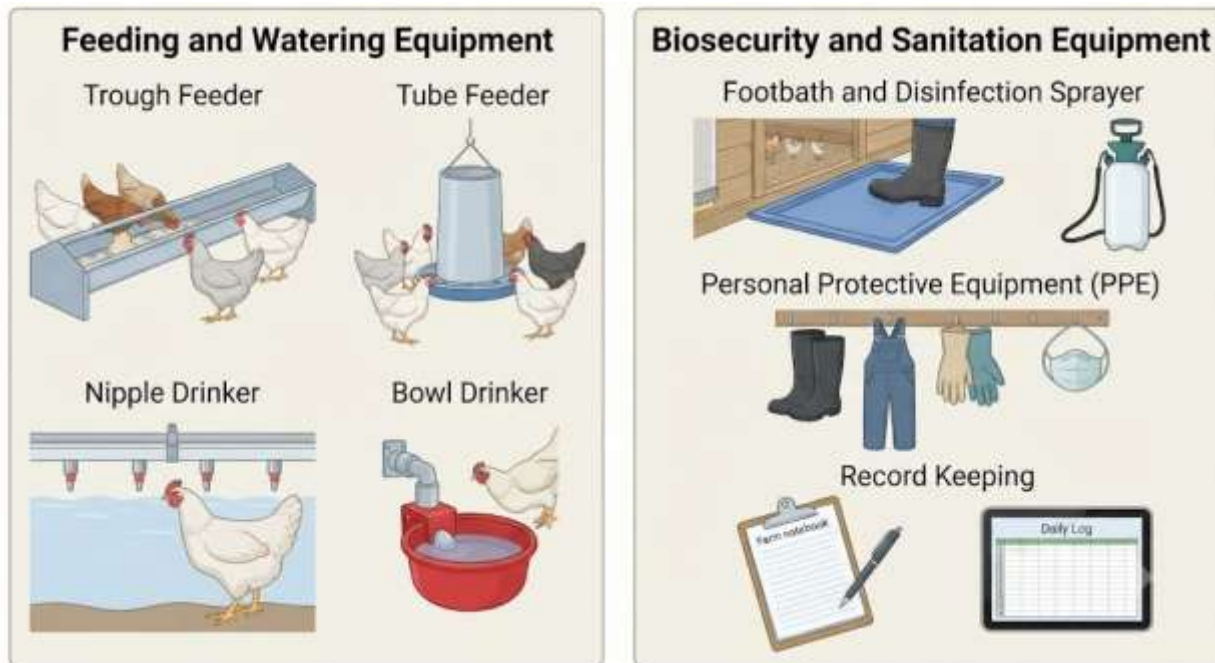


Figure 1.4: Equipment for non-ruminant production

Pilot questions 1.4

1. Name three types of poultry/livestock feeders.
2. Compare manual and automatic watering systems.
3. Explain the purpose of artificial lighting in commercial layer operations.
4. Explain the purpose of a footbath at a livestock house entrance.
5. Explain why record-keeping equipment is considered essential farm equipment.



Series Summary

This Series examined **livestock housing as the provision of structures that protect animals, improve management, enhance security, and reduce disease risks**. A suitable site should have good drainage, access to water, electricity and roads, and adequate distance from homes and other farms. In tropical areas, houses are commonly oriented east–west to reduce heat exposure. Construction materials and design may include metal or thatched roofs, solid or mesh walls, concrete, slatted or earth floors, and adequate natural ventilation. Poultry may be kept under extensive, semi-intensive, or intensive systems, including deep-litter and battery-cage housing. Brooder houses require careful temperature control, beginning at about 32–35°C during the first week.

The Series also covered **housing and equipment requirements for pigs, rabbits, and poultry**. Swine facilities include grower and finisher pens, farrowing pens with rails and heated creep areas, and warm weaner pens. Rabbit housing commonly uses raised hutches with wire-mesh and solid-floor sections, while breeding does require nest boxes. Essential equipment includes trough, tube, or automatic feeders; manual, nipple, or bowl drinkers; and systems for heating, lighting, and ventilation. Biosecurity measures such as footbaths, disinfection, protective clothing, restricted access, and proper record keeping help prevent disease outbreaks. By completing this Series, students should achieve SLOs 1.1–1.4.

Glossary of Terms

- **Battery cage:** a wire cage housing system for layer poultry, separating birds from droppings and allowing high stocking density.
- **Brooder guard:** a circular barrier confining day-old chicks near a heat source to prevent straying and corner huddling.
- **Deep litter system:** a poultry housing system using absorbent floor litter, allowing birds to move freely within the house.



- **Farrowing rail/crate:** a structure restricting sow movement during farrowing to prevent piglet crushing.
- **Footbath:** a container of disinfectant solution at a house entrance, reducing pathogen introduction on footwear.
- **Nest box:** a box within or attached to a rabbit hutch used by breeding does for kindling and early kit care.
- **Semi-intensive system:** a poultry housing system combining a house with an attached outdoor run.
- **Sore hocks:** foot injury in rabbits associated with prolonged contact with wire mesh flooring.
- **Weaner pen:** housing for piglets after weaning, requiring careful temperature and feeding management.



Concept Check Questions [Series 1]

Objective Questions

1. Livestock housing in tropical climates is typically oriented _____ -west to minimise sun exposure and support ventilation. (Linked to SLO 1.1)
2. _____ systems combine a poultry house with an attached outdoor run. (Linked to SLO 1.2)
3. A farrowing _____ restricts sow movement to prevent piglet crushing. (Linked to SLO 1.3)
4. Rabbit foot injury from prolonged wire mesh contact is called sore _____. (Linked to SLO 1.3)
5. _____ drinkers provide continuous clean water access with reduced labour in poultry and rabbit housing. (Linked to SLO 1.4)

Short-Answer Questions

6. Name three functions of livestock housing. (Linked to SLO 1.1)
7. Name three poultry housing systems. (Linked to SLO 1.2)
8. Name two types of pig pens by production stage. (Linked to SLO 1.3)
9. Name three types of feeding/watering equipment. (Linked to SLO 1.4)
10. State the purpose of a brooder guard. (Linked to SLO 1.2)

Long-Answer Questions

11. Explain the functions of housing and principles of site selection and construction. (Linked to SLO 1.1)
12. Describe poultry, swine, and rabbit housing systems. (Linked to SLOs 1.2, 1.3)
13. Identify feeding, environmental control, and biosecurity equipment for non-ruminant production. (Linked to SLO 1.4)

Answers to Concept Check Questions [Series 1]

Objective Questions

1. East.
2. Semi-intensive.
3. Rail.



4. Hocks.
5. Nipple.

Short-Answer Questions

6. Weather protection, predator/security protection, and disease control.
7. Extensive, semi-intensive, and intensive (deep litter or battery cage).
8. Grower/finisher pens and farrowing pens (or weaner pens, boar pens).
9. Trough feeders, tube feeders, and nipple drinkers.
10. To confine chicks near the heat source and prevent straying or corner huddling.

Long-Answer Questions

11. Housing protects against weather, predators, and disease while facilitating management. Site selection considers drainage, distance from other farms, and utility/road access; orientation is typically east-west; construction balances roofing, wall, and floor material choices for cost, durability, and hygiene.
12. Poultry housing ranges from extensive to intensive (deep litter, battery cage) with specialised brooder houses for chicks. Swine housing includes grower/finisher, farrowing, and weaner pens, each with distinct design needs. Rabbit hutches are raised, with wire mesh/solid floor combinations and nest boxes for breeding does.
13. Feeding/watering equipment ranges from manual troughs to automatic systems. Environmental control equipment includes heating, ventilation, and lighting. Biosecurity equipment includes footbaths, disinfection sprayers, PPE, and record-keeping tools.

Answers to Pilot Questions [Series 1]

Part 1.1

1. Weather protection, predator/security protection, management facilitation, and disease control.
2. Drainage, distance from residences/other farms, and water/electricity/road access.
3. East-west orientation minimises direct sun on side walls and supports natural ventilation through prevailing winds.
4. Metal roofing transmits heat strongly but is durable; thatch insulates better and costs less but has shorter lifespan and fire risk.
5. Raised slatted floors separate animals from droppings, improving hygiene.



Part 1.2

1. Extensive systems let birds roam freely with minimal housing; semi-intensive adds a house with an attached run for better management.
2. Deep litter houses birds on absorbent litter material, allowing free movement within the house.
3. Advantage: separates birds from droppings and allows higher density. Concern: animal welfare due to confinement.
4. 32-35 degrees Celsius.
5. It confines chicks near the heat source, preventing straying and corner huddling.

Part 1.3

1. Pigs cannot sweat effectively, so external cooling is needed to manage heat stress.
2. It restricts sow movement during farrowing to prevent piglet crushing.
3. Weaned piglets are vulnerable to cold stress and digestive upset during the weaning transition.
4. Raising hutches improves hygiene, predator protection, and management access.
5. The nest box provides a space for kindling and early kit care.

Part 1.4

1. Trough, tube/hanging, and automatic chain/auger feeders.
2. Manual systems need regular refilling/cleaning; automatic systems provide continuous access with less labour but need maintenance.
3. Artificial lighting regulates day length to stimulate consistent egg production year-round.
4. It reduces pathogen introduction into the house on workers footwear.
5. It supports management decisions and disease tracking over time.



References and Attributions

Textual References (Books and External Sources)

- FAO (Food and Agriculture Organization of the United Nations). (2025). Guidelines for sustainable agriculture. FAO.
- North, M. O., & Bell, D. D. (1990). Commercial chicken production manual (4th ed.). Van Nostrand Reinhold.
- Aduku, A. O., & Olukosi, J. O. (1990). Animal products processing and handling in the tropics. Living Books Series, Abuja.
- Sastry, N. S. R., & Thomas, C. K. (2006). Livestock production management. Kalyani Publishers.

Figures, Plates, Tables, and Boxes

- Figure 1.1: Principles of non-ruminant housing Attribution: AI generated. Suggested OER search string: "livestock housing functions site selection orientation construction Nigeria non-ruminant OER".
- Figure 1.2: Poultry housing systems Attribution: AI generated. Suggested OER search string: "poultry housing extensive semi-intensive deep litter battery cage brooder Nigeria OER".
- Figure 1.3: Swine and rabbit housing Attribution: AI generated. Suggested OER search string: "pig housing farrowing pen rabbit hutch design Nigeria non-ruminant OER".
- Figure 1.4: Equipment for non-ruminant production Attribution: AI generated. Suggested OER search string: "poultry pig rabbit feeding equipment watering biosecurity footbath Nigeria OER".



Series 2: Management of Poultry, Swine, and Rabbits

- **Part 2.1: Poultry Management**

- Sub Part 2.1.1: Brooding and chick management
- Sub Part 2.1.2: Broiler production management
- Sub Part 2.1.3: Layer and breeder management

- **Part 2.2: Nutrition and Feeding Management**

- Sub Part 2.2.1: Poultry feeding programmes
- Sub Part 2.2.2: Swine feeding programmes
- Sub Part 2.2.3: Rabbit feeding programmes

- **Part 2.3: Swine Management**

- Sub Part 2.3.1: Breeding and reproduction management
- Sub Part 2.3.2: Farrowing and piglet management
- Sub Part 2.3.3: Growing and finishing pig management

- **Part 2.4: Rabbit Management**

- Sub Part 2.4.1: Breeding and kindling management
- Sub Part 2.4.2: Kit and grower management
- Sub Part 2.4.3: Record keeping and culling decisions



Introduction

Having established the housing and equipment foundations in Series 1, this Series turns to the day-to-day and stage-specific management practices that determine the productivity of poultry, swine, and rabbit enterprises. Each species and production purpose (broiler versus layer poultry, breeding versus finishing pigs) requires tailored management attention at each life stage.

This Series covers poultry management (brooding, broiler, and layer/breeder stages); nutrition and feeding programmes across all three species; swine breeding, farrowing, and growing/finishing management; and rabbit breeding, kit, and record-keeping practices. This builds toward the disease, marketing, and processing topics of the remaining Series.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 2.1** describe brooding, broiler, and layer/breeder poultry management practices (Linked to Part 2.1),
- **SLO 2.2** explain feeding programmes for poultry, swine, and rabbits (Linked to Part 2.2),
- **SLO 2.3** describe breeding, farrowing, and growing/finishing management practices for swine (Linked to Part 2.3), and
- **SLO 2.4** describe breeding, kit management, and record-keeping practices for rabbits (Linked to Part 2.4).

2.1 Poultry Management

2.1.1 Brooding and chick management

Brooding management (covered alongside brooder house design in Series 1) requires pre-heating the brooder house before chick arrival, ensuring clean litter and adequate feeder/drinker placement, and close monitoring of chick behaviour (huddling indicates cold; panting and



spreading away from heat source indicates excessive heat) to adjust temperature appropriately during the critical first 2-3 weeks.

Vaccination against key diseases (covered in detail in Series 3) typically begins within the first days of life, alongside beak trimming or other minor procedures depending on the production system; close attention to early growth rate and uniformity within a batch helps identify and address management or health problems before they affect overall flock performance.

Fill in the blank: During brooding, chick _____ (huddling indicates cold; panting and spreading away from heat indicates excessive heat) helps managers adjust brooder temperature appropriately.

2.1.2 Broiler production management

Broiler management focuses on maximising growth rate and feed efficiency over a short production cycle (typically 6-8 weeks to market weight), requiring careful feeding programme management (Part 2.2.1), stocking density control (overcrowding reduces growth uniformity and increases disease/heat stress risk), and litter management to maintain good foot and leg health.

Regular weighing of sample birds tracks growth against target performance curves, allowing early identification of underperformance; lighting programmes (extended light hours encouraging more feeding time) and careful pre-slaughter management (covered further in Series 4 and 5) round out the key broiler management considerations distinct from layer management.

Fill in the blank: Broiler chickens are typically raised to market weight over a short production cycle of _____ weeks, requiring careful feeding and stocking density management.

2.1.3 Layer and breeder management

Layer management aims to sustain consistent egg production over an extended laying cycle (typically starting around 18-20 weeks of age and continuing for 12 months or more), requiring stable nutrition, lighting programmes (Series 1), and stress minimisation (sudden changes in



feed, light, or environment can disrupt laying), alongside nest box management and frequent egg collection to maintain egg cleanliness and reduce breakage/loss.

Breeder management (for birds producing hatching eggs rather than table eggs) requires additional attention to fertility and hatchability factors, including correct male-to-female ratios, careful nutrition (avoiding both under- and over-conditioning which both reduce fertility), and stricter biosecurity to protect valuable genetic stock, distinguishing breeder flocks from commercial table-egg layer flocks.

Fill in the blank: Breeder flock management requires correct male-to-female _____ and careful nutrition to support fertility and hatchability of eggs, distinguishing it from commercial table-egg layer management.

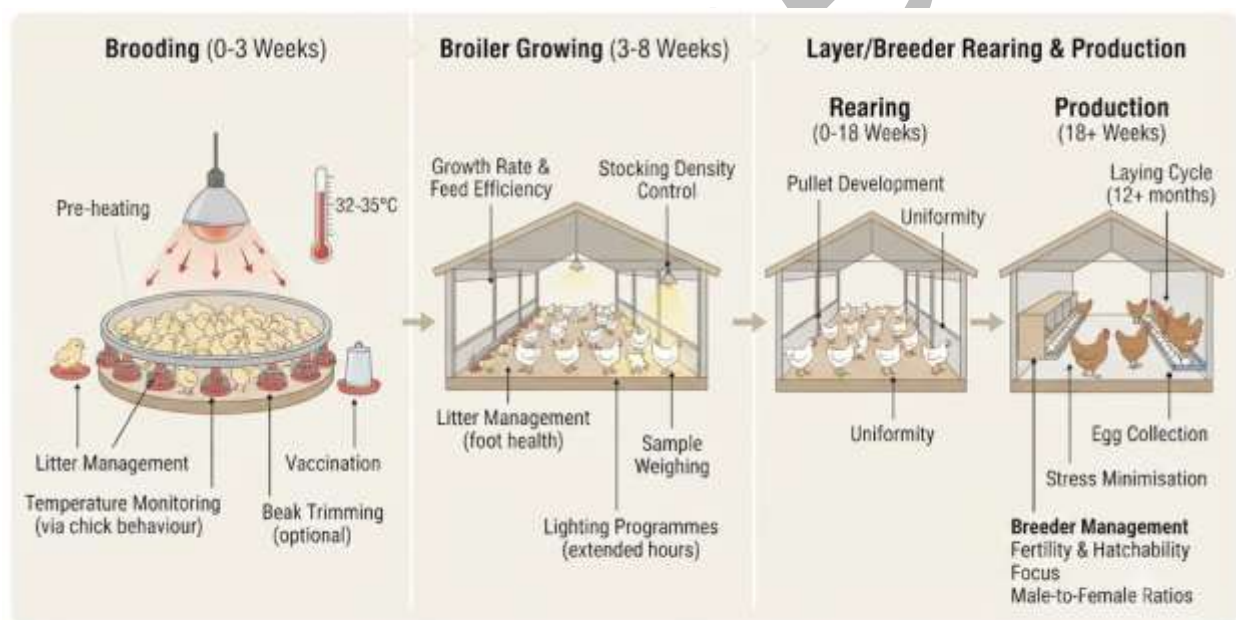


Figure 2.1: Poultry management across production stages

Figure 2.1: Poultry management across production stages

Pilot questions 2.1

1. Explain how chick behaviour indicates brooder temperature problems.
2. State the typical broiler production cycle length to market weight.
3. Explain why overcrowding is a concern in broiler management.



4. State the typical age at which layer egg production begins.
5. Explain why breeder flock management requires correct male-to-female ratios.

2.2 Nutrition and Feeding Management

2.2.1 Poultry feeding programmes

Poultry feed is formulated in distinct phases matching growth/production stage: starter feed (high protein, for chicks 0-3/4 weeks), grower feed (for growing pullets or finishing broilers), and layer feed (higher calcium for eggshell formation, for laying hens); broiler feeding programmes typically use only two or three phases over the short production cycle, while layer programmes maintain consistent feed for the extended laying period.

Feed should be available *ad libitum* (free access) for broilers to maximise growth rate, while layer feed intake is often more closely monitored to avoid excessive weight gain that can reduce laying performance and increase health problems; clean water must always be available alongside feed, since water restriction quickly reduces feed intake and growth/production.

Fill in the blank: _____ feed, formulated with higher protein for chicks in the first 3-4 weeks, is the first phase-specific poultry feed in a typical feeding programme.

2.2.2 Swine feeding programmes

Pig feeding programmes follow growth stages similarly to poultry: creep feed (a palatable starter feed introduced to piglets before weaning to ease the transition to solid feed), weaner feed (higher protein/energy density for the nutritionally vulnerable post-weaning period), grower feed, and finisher feed (formulated to optimise growth rate and carcass quality as pigs approach market weight).

Gestating and lactating sow nutrition differs substantially from growing pig nutrition: lactating sows require much higher energy and protein intake to support milk production for piglets, while



gestating sows need more moderate intake to avoid excessive weight gain, requiring distinct feeding programmes across the breeding female production cycle.

Fill in the blank: _____ feed is a palatable starter feed introduced to piglets before weaning to ease the transition to solid feed.

2.2.3 Rabbit feeding programmes

Rabbits are hindgut fermenters with a digestive system well suited to processing high-fibre forage alongside concentrate feed; a balanced rabbit diet combines good quality forage/hay (essential for digestive health and preventing diarrhoea) with a commercial or home-formulated pelleted concentrate providing protein, energy, and key vitamins/minerals.

Feeding requirements vary by production stage: growing rabbits and lactating does require higher protein and energy intake than maintenance-stage adult rabbits; sudden feed changes should be avoided since they can disrupt the sensitive rabbit digestive system, making gradual transitions important when changing feed types or sources.

Fill in the blank: Rabbits are hindgut _____, with a digestive system well suited to processing high-fibre forage alongside concentrate feed.



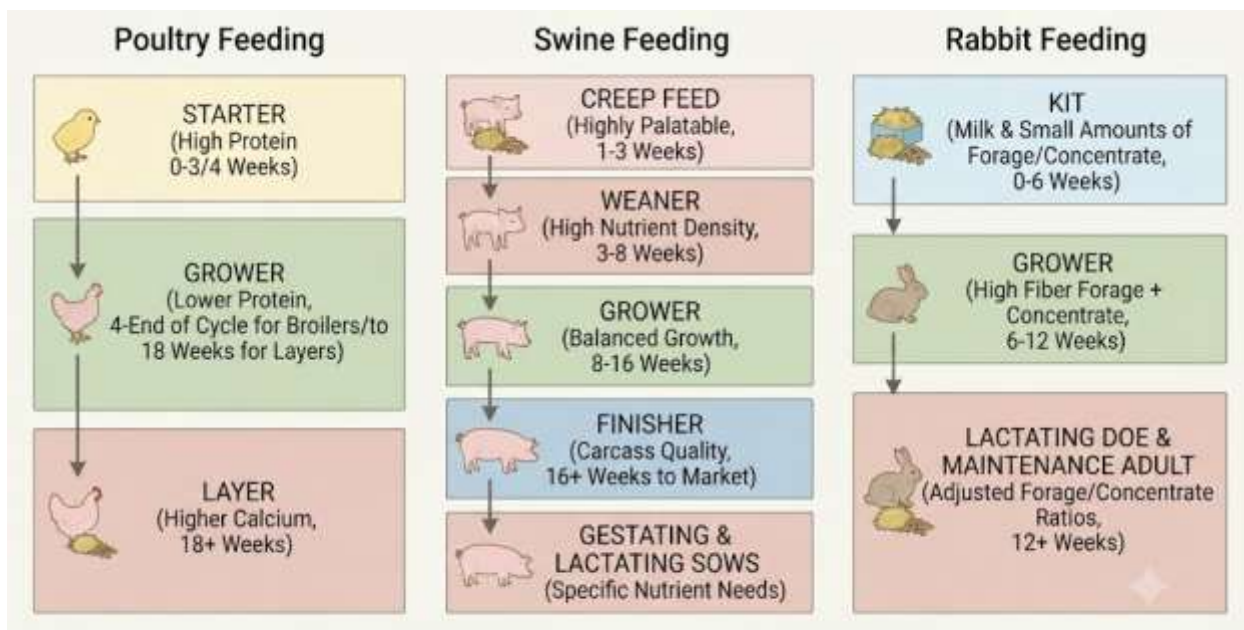


Figure 2.2: Feeding programmes across non-ruminant species.

Figure 2.2: Feeding programmes across non-ruminant species

Pilot questions 2.2

1. Name three phases of poultry feed and their target group.
2. Explain the purpose of creep feed in pig production.
3. Distinguish between gestating and lactating sow nutritional needs.
4. Explain why rabbits need both forage and concentrate feed.
5. Explain why sudden feed changes should be avoided in rabbit feeding.

2.3 Swine Management

2.3.1 Breeding and reproduction management

Gilts (young females) typically reach breeding readiness around 6-8 months of age and 100-120 kg body weight, with breeding timed to oestrus detection (heat signs) for natural mating or artificial insemination; boars require adequate space, nutrition, and exercise to maintain fertility and breeding soundness.



Pregnancy (gestation) in pigs lasts approximately 114 days (about 3 months, 3 weeks, 3 days, a commonly used memory aid); accurate breeding date recording supports planning for farrowing pen preparation and feed transition timing discussed in Part 2.2.2.

Fill in the blank: Pig gestation lasts approximately _____ days, commonly remembered as 3 months, 3 weeks, 3 days.

2.3.2 Farrowing and piglet management

As farrowing approaches, sows are moved to prepared farrowing pens (Series 1) and closely monitored; newly born piglets require prompt drying, navel cord disinfection, and assistance reaching the udder for early colostrum intake, critical for passive immunity since piglets are born with very limited maternal antibody transfer through the placenta.

Iron supplementation (piglets are born with limited iron reserves and sow milk is low in iron, risking anaemia) and teeth clipping or tail docking (where practised, to reduce injury risk) are common early piglet management procedures; creep feed introduction (Part 2.2.2) begins around 1-2 weeks of age to prepare piglets for weaning, typically occurring at 3-8 weeks depending on the production system.

Fill in the blank: _____ supplementation is given to newborn piglets because they are born with limited reserves and sow milk is low in this nutrient, risking anaemia.

2.3.3 Growing and finishing pig management

Growing and finishing pig management focuses on maximising growth rate and feed conversion efficiency while maintaining health and carcass quality, requiring appropriate stocking density, feeding programme management (Part 2.2.2), and regular health monitoring; pigs are typically marketed at 90-120 kg live weight depending on market preference and breed.

Castration of male pigs not intended for breeding (where practised, typically performed at a young age to reduce boar taint in meat and aggressive behaviour) and parasite control (covered



further in Series 3) are additional considerations during the growing phase that affect both welfare and final product quality.

Fill in the blank: Pigs are typically marketed at _____ to 120 kg live weight depending on market preference and breed, the target of growing and finishing management.

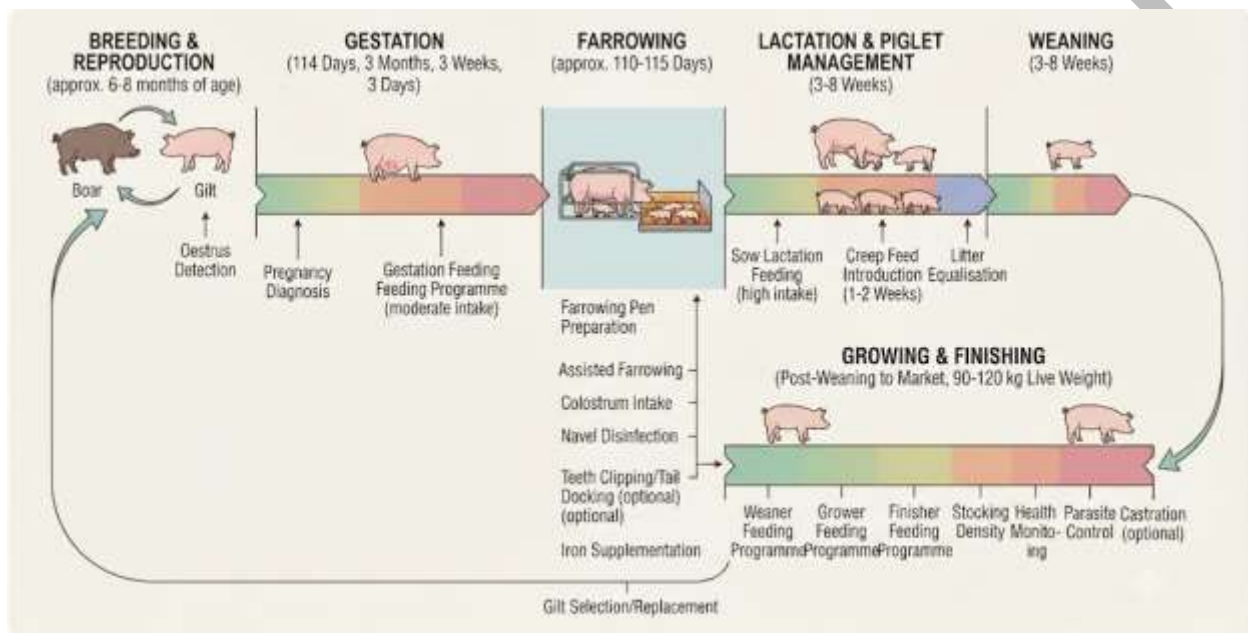


Figure 2.3: Swine management across the production cycle.

Figure 2.3: Swine management across the production cycle

Pilot questions 2.3

1. State the typical age and weight at which gilts reach breeding readiness.
2. State the approximate gestation length in pigs.
3. Explain why early colostrum intake is critical for newborn piglets.
4. Explain why iron supplementation is given to newborn piglets.
5. State the typical market weight range for finishing pigs.



2.4 Rabbit Management

2.4.1 Breeding and kindling management

Does (female rabbits) typically reach breeding readiness around 5-8 months depending on breed size, with mating arranged by introducing the doe to the buck cage (rather than the reverse, to reduce aggression risk); rabbits are induced ovulators, meaning ovulation is triggered by mating itself rather than occurring on a fixed cycle, distinguishing rabbit reproduction from most other livestock species.

Gestation lasts approximately 28-32 days, after which the doe prepares a nest (using a provided nest box and her own fur for insulation) before kindling (giving birth); minimal disturbance around kindling time reduces stress that could cause the doe to neglect or harm the litter.

Fill in the blank: Rabbits are induced _____, meaning ovulation is triggered by mating itself rather than occurring on a fixed cycle, unlike most other livestock species.

2.4.2 Kit and grower management

Newborn kits (baby rabbits) are born hairless and blind, fully dependent on the doe nest and milk for the first 2-3 weeks; kits begin to leave the nest box and sample solid feed around 3 weeks of age, with full weaning typically occurring around 4-6 weeks depending on the production system and breed.

Growing rabbits (post-weaning to market or breeding age) require adequate space allowance (overcrowding increases aggression and disease risk), consistent feeding (Part 2.2.3), and regular health monitoring; rabbits intended for meat production are typically marketed around 8-12 weeks of age, depending on target market weight and breed growth rate.

Fill in the blank: Newborn rabbit kits are born hairless and blind, fully dependent on the doe nest and milk for the first _____ to 3 weeks of life.



2.4.3 Record keeping and culling decisions

Good rabbit record keeping tracks breeding dates, litter size and survival, growth rates, and health events for individual does and bucks, supporting informed decisions about which animals to retain for continued breeding and which to cull (remove from the breeding herd) due to poor productivity (small litters, high kit mortality) or health/age-related decline.

Systematic culling and replacement of underperforming breeding stock, guided by accurate records rather than guesswork, is a key driver of herd productivity improvement over time in rabbit enterprises, paralleling the record-keeping and selection principles relevant across all non-ruminant species covered in this course.

Fill in the blank: _____, removing underperforming breeding does or bucks from the herd based on accurate records, is a key driver of rabbit herd productivity improvement over time.

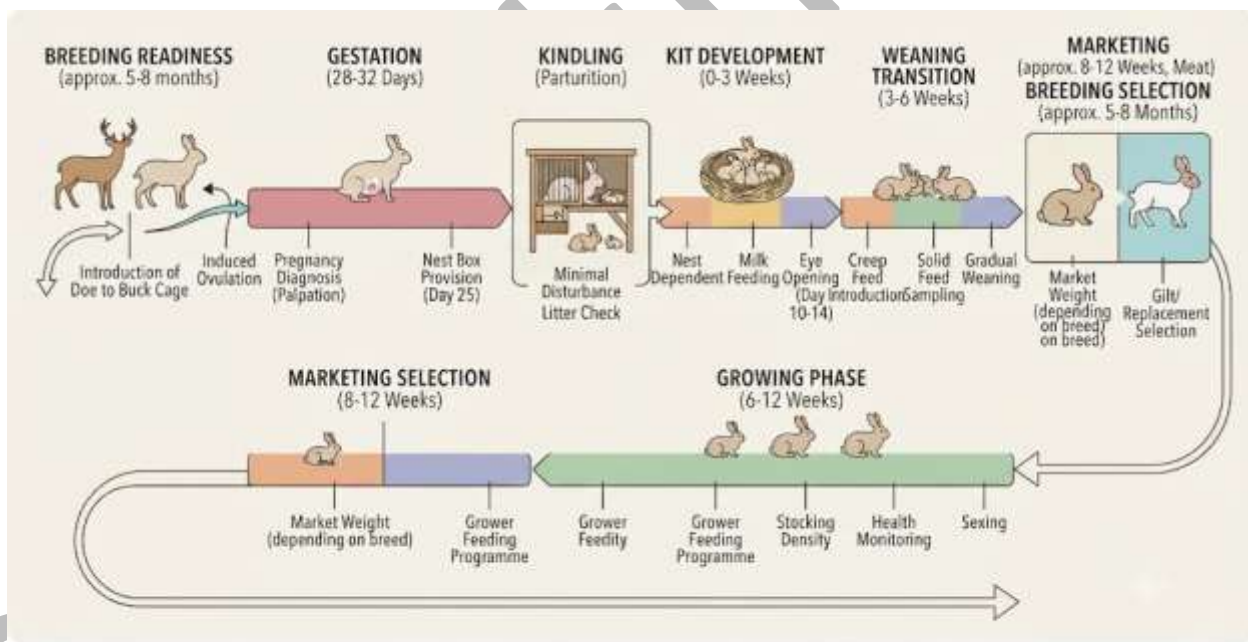


Figure 2.4: Rabbit breeding and management cycle.

Figure 2.4: Rabbit breeding and management cycle

Pilot questions 2.4

1. Explain induced ovulation in rabbits.



2. State the approximate gestation length in rabbits.
3. Describe the condition of newborn rabbit kits.
4. State the typical age range for weaning and for marketing meat rabbits.
5. Explain the role of record keeping in rabbit culling decisions.



Series Summary

This Series examined **the management of poultry, pigs, and rabbits through proper breeding, feeding, growth monitoring, and health care**. Poultry management includes brooding, where chick behaviour helps indicate whether the temperature is suitable; broiler production, which commonly follows a 6–8 week cycle; and layer or breeder management, which requires consistent nutrition, lighting, and fertility control. Feeding programmes should match each production stage, including starter, grower, and layer diets for poultry; creep, weaner, grower, finisher, gestation, and lactation diets for pigs; and suitable forage and concentrates for rabbits.

The Series also covered **reproductive and young-stock management in pigs and rabbits**. Gilts are commonly bred at about 6–8 months, and pig gestation lasts approximately 114 days. Newborn piglets require early colostrum intake, warmth, and iron supplementation, while growers are managed toward a market weight of about 90–120 kg. Rabbits are induced ovulators with a gestation period of about 28–32 days. Kits depend on the nest during the first 2–3 weeks, are usually weaned at 4–6 weeks, and may be marketed at 8–12 weeks. Accurate records support monitoring, selection, culling, and overall herd improvement. By completing this Series, students should achieve SLOs 2.1–2.4.

Glossary of Terms

- **Colostrum:** the first milk produced after birth, rich in antibodies critical for newborn passive immunity, especially important in piglets.
- **Creep feed:** a palatable starter feed introduced to young animals (piglets, kits) before full weaning.
- **Culling:** removing underperforming breeding animals from a herd based on productivity or health records.
- **Gestation:** the pregnancy period; approximately 114 days in pigs and 28–32 days in rabbits.



- **Induced ovulator:** an animal, such as the rabbit, in which ovulation is triggered by mating rather than occurring on a fixed cycle.
- **Kindling:** the act of giving birth in rabbits.
- **Kit:** a baby rabbit, born hairless and blind, fully dependent on the doe for the first weeks of life.



Concept Check Questions [Series 2]

Objective Questions

1. Broiler chickens are typically raised to market weight over _____ weeks. (Linked to SLO 2.1)
2. _____ feed is introduced to piglets before weaning to ease the transition to solid feed. (Linked to SLO 2.2)
3. Pig gestation lasts approximately _____ days. (Linked to SLO 2.3)
4. Rabbits are induced _____, triggered by mating rather than a fixed cycle. (Linked to SLO 2.4)
5. Newborn piglets receive _____ supplementation due to limited reserves and low iron in sow milk. (Linked to SLO 2.3)

Short-Answer Questions

1. Name three poultry feed phases. (Linked to SLO 2.2)
2. State the typical market weight range for finishing pigs. (Linked to SLO 2.3)
3. State the approximate gestation length in rabbits. (Linked to SLO 2.4)
4. Name two early piglet management procedures. (Linked to SLO 2.3)
5. Explain why colostrum intake is important for piglets. (Linked to SLO 2.3)

Long-Answer Questions

1. Describe brooding, broiler, and layer/breeder poultry management practices. (Linked to SLO 2.1)
2. Explain feeding programmes for poultry, swine, and rabbits. (Linked to SLO 2.2)
3. Describe breeding, farrowing/kindling, and growing management for swine and rabbits. (Linked to SLOs 2.3, 2.4)

Answers to Concept Check Questions [Series 2]

Objective Questions



1. 6-8.
2. Creep.
3. 114.
4. Ovulators.
5. Iron.

Short-Answer Questions

1. Starter, grower, and layer feed.
2. 90-120 kg.
3. 28-32 days.
4. Navel cord disinfection and iron supplementation (or teeth clipping/tail docking).
5. Colostrum provides antibodies critical for passive immunity since piglets receive limited maternal antibody transfer before birth.

Long-Answer Questions

1. Brooding requires temperature monitoring via chick behaviour. Broilers are managed over a 6-8 week cycle with growth tracking. Layers/breeders need consistent nutrition and lighting, with breeders requiring careful fertility management.
2. Poultry feed has starter, grower, and layer phases. Swine feed has creep, weaner, grower, finisher, and gestation/lactation phases. Rabbits need forage plus concentrate, varying by production stage.
3. Swine: breeding at 6-8 months, 114-day gestation, farrowing with colostrum/iron management, finishing at 90-120 kg. Rabbits: induced ovulators, 28-32 day gestation, kindling, kit nest-dependence, weaning at 4-6 weeks, marketing at 8-12 weeks.



Answers to Pilot Questions [Series 2]

Part 2.1

1. Huddling indicates the brooder is too cold; panting and spreading away from the heat source indicates it is too hot.
2. 6-8 weeks.
3. Overcrowding reduces growth uniformity and increases disease/heat stress risk.
4. Around 18-20 weeks of age.
5. Correct ratios support adequate fertilisation and good hatchability of eggs.

Part 2.2

1. Starter (chicks 0-3/4 weeks), grower (growing pullets/broilers), and layer feed (laying hens).
2. Creep feed eases the piglet transition from milk to solid feed before weaning.
3. Lactating sows need much higher energy/protein for milk production; gestating sows need more moderate intake to avoid excess weight gain.
4. Forage supports digestive health while concentrate supplies protein, energy, and key nutrients.
5. Sudden changes can disrupt the sensitive rabbit digestive system and cause diarrhoea.

Part 2.3

1. Around 6-8 months of age and 100-120 kg body weight.
2. Approximately 114 days.
3. Colostrum provides antibodies for passive immunity since piglets have limited maternal antibody transfer before birth.
4. Piglets are born with limited iron reserves and sow milk is low in iron, risking anaemia.
5. 90-120 kg live weight.

Part 2.4

1. Ovulation in rabbits is triggered by mating itself, rather than occurring on a fixed cycle.
2. Approximately 28-32 days.
3. Kits are born hairless and blind, fully dependent on the doe nest and milk.
4. Weaning around 4-6 weeks; marketing around 8-12 weeks.



5. Records identify underperforming does/bucks (small litters, high mortality) to guide culling and herd improvement.



References and Attributions

Textual References (Books and External Sources)

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Figures, Plates, Tables, and Boxes

- Figure 2.1: Poultry management across production stages Attribution: AI generated. Suggested OER search string: "poultry brooding broiler layer breeder management Nigeria non-ruminant OER".
- Figure 2.2: Feeding programmes across non-ruminant species Attribution: AI generated. Suggested OER search string: "poultry swine rabbit feeding programme starter grower finisher Nigeria OER".
- Figure 2.3: Swine management across the production cycle Attribution: AI generated. Suggested OER search string: "swine pig breeding farrowing piglet management growing finishing Nigeria OER".
- Figure 2.4: Rabbit breeding and management cycle Attribution: AI generated. Suggested OER search string: "rabbit breeding kindling kit management record keeping Nigeria OER".



Series 3: Diseases and Parasites in Non-Ruminants

- **Part 3.1: Principles of Disease and Health Management**

- Sub Part 3.1.1: Disease transmission and the disease triangle
- Sub Part 3.1.2: Biosecurity principles
- Sub Part 3.1.3: Vaccination programmes

- **Part 3.2: Major Poultry Diseases and Parasites**

- Sub Part 3.2.1: Viral diseases of poultry
- Sub Part 3.2.2: Bacterial diseases of poultry
- Sub Part 3.2.3: External and internal parasites of poultry

- **Part 3.3: Major Swine Diseases and Parasites**

- Sub Part 3.3.1: Viral and bacterial diseases of swine
- Sub Part 3.3.2: Internal and external parasites of swine
- Sub Part 3.3.3: Zoonotic concerns in swine production

- **Part 3.4: Major Rabbit Diseases and General Health Management**

- Sub Part 3.4.1: Common rabbit diseases
- Sub Part 3.4.2: Rabbit parasites
- Sub Part 3.4.3: General health monitoring and culling for disease control



Introduction

Disease and parasite control is among the most significant determinants of profitability in non-ruminant production, where high stocking densities and intensive management create conditions favouring rapid disease spread if not properly managed. Building on the housing, equipment, and management practices of Series 1 and 2, this Series examines the principles of disease prevention and the major diseases and parasites affecting poultry, swine, and rabbits in Nigeria.

This Series covers general disease transmission and biosecurity principles; major poultry viral and bacterial diseases and parasites; major swine diseases, parasites, and zoonotic concerns; and common rabbit diseases and general health monitoring. This prepares students for the transportation, marketing, and processing topics of Series 4 and 5, where animal health status directly affects product quality and market access.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 3.1** explain disease transmission, biosecurity principles, and vaccination programmes for non-ruminant animals (Linked to Part 3.1),
- **SLO 3.2** describe major viral and bacterial diseases and parasites of poultry (Linked to Part 3.2),
- **SLO 3.3** describe major diseases, parasites, and zoonotic concerns in swine production (Linked to Part 3.3), and
- **SLO 3.4** describe common rabbit diseases, parasites, and general health monitoring practices (Linked to Part 3.4).



3.1 Principles of Disease and Health Management

3.1.1 Disease transmission and the disease triangle

Disease occurs through the interaction of three factors, the disease triangle: a susceptible host animal, a virulent pathogen (virus, bacterium, parasite, or fungus), and a favourable environment (temperature, humidity, stocking density, stress) supporting pathogen survival and spread; managing any one factor (resistant breeds, pathogen elimination, or environmental improvement) reduces disease risk.

Transmission routes include direct contact between animals, indirect contact (contaminated equipment, feed, water, footwear, or vehicles, the basis of fomite transmission), airborne spread (especially relevant in enclosed intensive housing), and vector-borne transmission (insects, rodents, or wild birds carrying pathogens between farms), with intensive systems (Series 1) facing particular airborne and contact transmission risk due to high stocking density.

Fill in the blank: The disease triangle describes the interaction of a susceptible host, a virulent pathogen, and a favourable _____; managing any one factor reduces disease risk.

3.1.2 Biosecurity principles

Biosecurity is the set of practices preventing pathogen introduction to and spread within a farm, comprising three levels: conceptual biosecurity (site location decisions, such as distance from other farms, made before construction); structural biosecurity (perimeter fencing, footbaths, dedicated equipment, covered in Series 1); and operational/management biosecurity (visitor restrictions, all-in-all-out flock/herd management, cleaning and disinfection protocols between batches, and isolation of sick or newly introduced animals).

All-in-all-out management (introducing and removing an entire batch of animals together, rather than continuously mixing ages) breaks disease transmission cycles between batches by allowing complete cleaning and a rest period before the next batch arrives, a key biosecurity principle



particularly important in intensive poultry and swine production where disease can otherwise persist and spread between successive groups.

Fill in the blank: _____ -in-all-out management, introducing and removing an entire animal batch together, breaks disease transmission cycles between successive groups by allowing complete cleaning between batches.

3.1.3 Vaccination programmes

Vaccination stimulates an animal immune system to develop protective antibodies against specific diseases without causing the disease itself, an essential tool particularly for viral diseases (Part 3.2.1) where treatment options are limited once infection occurs; vaccination programmes are designed around the specific disease risks prevalent in a region and production system, administered at ages timed to overcome maternal antibody interference while providing protection before likely field exposure.

Correct vaccine storage (most poultry/livestock vaccines require refrigeration, the cold chain, and lose effectiveness if mishandled), administration method (drinking water, spray, injection, or eye-drop depending on the vaccine and species), and timing relative to other stressors (avoiding vaccination during periods of heat stress, transport, or other illness) all affect vaccination programme success, making correct execution as important as the vaccination schedule itself.

Fill in the blank: Correct vaccine storage requires maintaining the cold _____ , since most poultry and livestock vaccines lose effectiveness if not kept properly refrigerated.



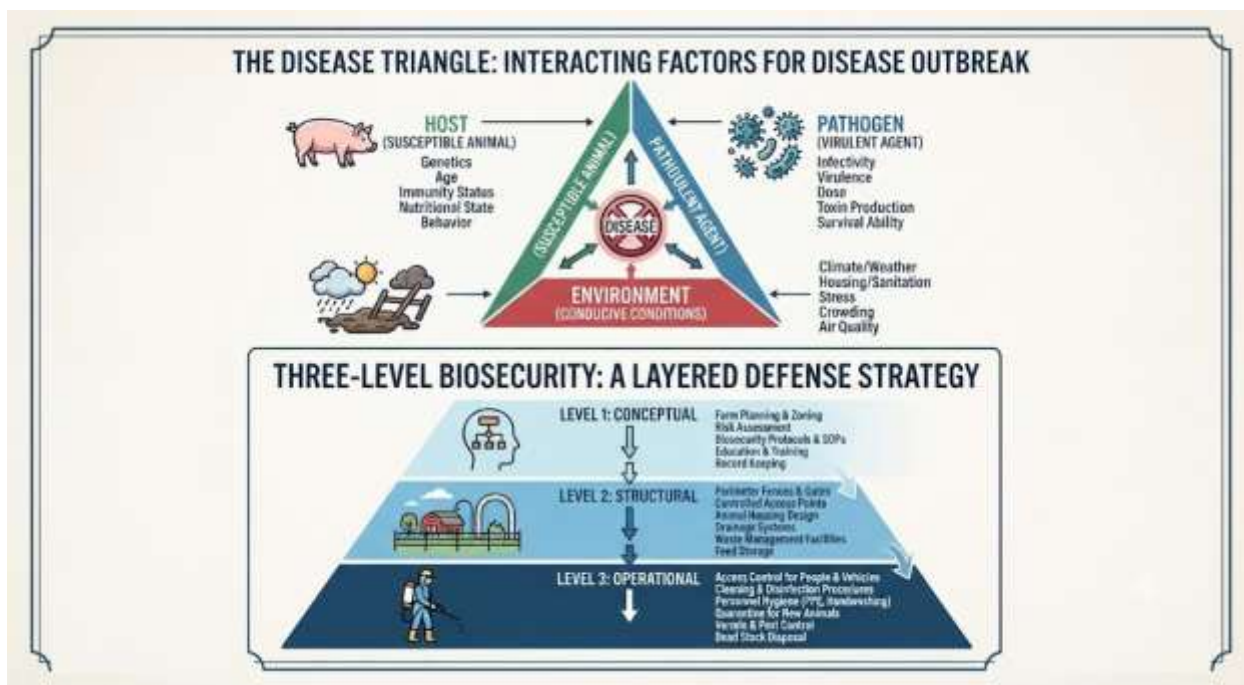


Figure 3.1: Disease principles and biosecurity

Pilot questions 3.1

1. Explain the disease triangle and how each factor can be managed.
2. Name four disease transmission routes.
3. Name the three levels of biosecurity.
4. Explain the purpose of all-in-all-out management.
5. Explain why correct vaccine storage (cold chain) is important.

3.2 Major Poultry Diseases and Parasites

3.2.1 Viral diseases of poultry

Newcastle disease, a highly contagious viral disease causing respiratory, nervous, and digestive signs and significant mortality, is one of the most economically important Nigerian poultry diseases, controlled primarily through regular vaccination since no effective treatment exists once birds are infected. Infectious bursal disease (Gumboro), affecting young chicks immune system development, and avian influenza (highly pathogenic strains causing severe mortality and



a serious zoonotic and trade concern) are other significant viral threats requiring vaccination and strict biosecurity respectively.

Fowl pox (causing skin lesions and, in severe cases, respiratory signs) and Marek disease (a viral disease causing tumours and paralysis, particularly in young birds) round out the major poultry viral diseases, each managed primarily through vaccination given the general lack of effective antiviral treatment in poultry production.

Fill in the blank: _____ disease, a highly contagious viral disease causing respiratory, nervous, and digestive signs, is one of the most economically important Nigerian poultry diseases, controlled primarily through vaccination.

3.2.2 Bacterial diseases of poultry

Fowl typhoid and fowl cholera (*Pasteurella*/*Salmonella*-related bacterial diseases causing septicaemia, diarrhoea, and mortality) and chronic respiratory disease/mycoplasmosis (causing respiratory signs and reduced production, often complicated by secondary bacterial infection) are significant bacterial disease concerns, generally more responsive to antibiotic treatment than viral diseases but still better managed through prevention (biosecurity, sanitation) than reliance on treatment.

Coliform infections (*E. coli*-related, often secondary to stress, poor ventilation, or other primary disease) and necrotic enteritis (a bacterial gut disease often associated with coccidiosis damage, Part 3.2.3, creating entry conditions for the causative *Clostridium* bacteria) illustrate how bacterial disease frequently interacts with management and other health problems rather than occurring in isolation.

Fill in the blank: Necrotic enteritis, a bacterial gut disease, is often associated with prior damage from _____, which creates entry conditions for the causative *Clostridium* bacteria.



3.2.3 External and internal parasites of poultry

External parasites (mites, lice, and fleas) cause irritation, feather damage, reduced production, and, in heavy infestations, anaemia; managed through regular housing cleaning, appropriate acaricide/insecticide treatment, and dust-bathing provision (where birds can access loose soil/sand to help control parasites naturally in extensive systems).

Internal parasites, particularly coccidiosis (a protozoan parasite damaging the intestinal lining, especially significant in young birds raised on litter where the parasite oocysts accumulate) and various intestinal worms, are managed through anticoccidial medication (often included in starter feed), litter management (Series 1), and appropriate deworming programmes where indicated.

Fill in the blank: _____, a protozoan parasite damaging the intestinal lining, is especially significant in young birds raised on litter where the parasite oocysts accumulate.

POULTRY DISEASE & PARASITE IDENTIFICATION CHART: SYMPTOMS & CONTROL METHODS			
DISEASE / PARASITE AGENT	IDENTIFICATION & SYMPTOMS	KEY SYMPTOMS VISUALIZED	CONTROL & PREVENTION METHODS
 Marek's Disease (Virus)	Neurological signs, weight loss, tumors	 Leg paralysis, gray eyes	 Vaccination (day-old chicks), biosecurity, culling
 Newcastle Disease (Virus)	Respiratory distress, nervous signs, decreased egg production	 Twisted neck (torticollis), coughing	 Vaccination, strict isolation, sanitation
 Coccidiosis (Protozoa)	Diarrhea, bloody droppings, ruffled feathers	 Bloody or mucus-filled feces, huddling	 Coccidiostats in feed, clean litter, dry conditions
 Avian Influenza (Virus)	High mortality, respiratory distress, cyanosis	 Swollen head, comb, wattle; sudden death	 Strict quarantine, biosecurity, depopulation
PARASITES			
 Red Mites (External)	Blood-feeding, anemia, restlessness, reduced laying	 Mites hiding in cracks, blood spots on eggs	 Acaricide treatment of housing, dusting birds, deep cleaning
 Lice (External)	Feathers damaged, feather loss, irritation	 Lice eggs (nits) at feather base	 Insecticide dusts/sprays, regular checks
 Roundworms (Internal)	Weight loss, stunted growth, unthriftiness	 Worms in droppings, poor appetite	 Anthelmintic medication, rotation of range
 Gapeworms (Internal)	Coughing, gasping for air, stretching neck	 "Gasping" behavior, head shaking	 Anthelmintic treatment, avoiding contaminated soil

Figure 3.2: Major poultry diseases and parasites

Pilot questions 3.2

1. Explain why Newcastle disease is controlled primarily through vaccination.



2. Name two bacterial diseases of poultry.
3. Explain the relationship between coccidiosis damage and necrotic enteritis.
4. Name two external parasites of poultry and their effects.
5. State how coccidiosis is typically managed in young birds.

3.3 Major Swine Diseases and Parasites

3.3.1 Viral and bacterial diseases of swine

African swine fever, a highly contagious and often fatal viral disease with no available vaccine, is among the most economically devastating swine diseases globally and in Nigeria, controlled exclusively through strict biosecurity and rapid outbreak response (culling/quarantine) since no treatment or vaccination exists. Classical swine fever and porcine reproductive and respiratory syndrome (PRRS) are other significant viral concerns affecting growth and reproduction respectively.

Bacterial diseases including erysipelas (causing skin lesions, arthritis, and sometimes sudden death), colibacillosis (E. coli-related diarrhoea, particularly affecting young piglets), and various respiratory bacterial infections (often complicating viral respiratory disease) are generally more treatable with antibiotics than the major viral diseases but still benefit substantially from preventive biosecurity and sanitation.

Fill in the blank: African swine _____, a highly contagious and often fatal viral disease with no available vaccine, is controlled exclusively through strict biosecurity and rapid outbreak response.

3.3.2 Internal and external parasites of swine

Internal parasites (roundworms, particularly *Ascaris suum*, and various other intestinal worms) reduce growth rate and feed efficiency, managed through regular deworming programmes and manure/litter management reducing parasite egg/larva survival in the environment. Mange (caused by mites burrowing into skin, causing intense itching and skin damage) is the most



significant external parasite concern in pigs, managed through acaricide treatment and good sanitation.

Lice infestation, while generally less severe than mange, also causes irritation and reduced performance if left unmanaged; regular observation for scratching, skin lesions, and condition changes supports early parasite detection before significant production losses occur.

Fill in the blank: _____, caused by mites burrowing into pig skin and causing intense itching and skin damage, is the most significant external parasite concern in swine production.

3.3.3 Zoonotic concerns in swine production

Several swine diseases and parasites have zoonotic potential (capable of infecting humans), making swine health management a public health as well as production concern: trichinellosis and taeniasis/cysticercosis (pork tapeworm, transmitted through inadequately cooked infected pork) are significant zoonotic parasite concerns, prevented through proper meat inspection, cooking, and pig management (avoiding pig exposure to human waste).

Leptospirosis (a bacterial disease transmissible between pigs and humans through contact with infected urine or contaminated water) and, more rarely in well-managed Nigerian systems, certain influenza strains with pandemic potential, underscore the importance of good hygiene practices (handwashing, protective equipment, Series 1) for farm workers handling pigs, alongside the animal-level disease management discussed throughout this Part.

Fill in the blank: Taeniasis/cysticercosis, the pork tapeworm, is a significant zoonotic parasite concern transmitted to humans through inadequately _____ infected pork.



SWINE DISEASE, PARASITE, & ZOOONOTIC CONCERN IDENTIFICATION CHART					
AGENT TYPE	AGENT NAME		IDENTIFICATION & SYMPTOMS (SWINE)	ZOOONOTIC CONCERN (HUMAN RISK)	CONTROL & PREVENTION METHODS
DISEASES					
	Virus	 African Swine Fever (ASF)	High fever, hemorrhages, sudden death, cyanosis	None known	Strict quarantine, biosecurity, depopulation, movement control
	Virus	 Porcine Reproductive and Respiratory Syndrome (PRRS)	Reproductive failure (abortions, weak piglets), respiratory distress	None known	Vaccination, herd closure, biosecurity
	Bacteria	 Swine Dysentery (<i>Brachyspira hyodysenteriae</i>)	Bloody diarrhea, weight loss, dehydration	Low risk (gastrointestinal infection)	Antibiotic treatment, improved sanitation, all-in/all-out system
	Bacteria	 Erysipelas (<i>Erysipelothrix rhusiopathiae</i>)	Diamond-shaped skin lesions, fever, arthritis	Skin infection (Erysipeloid)	Vaccination, antibiotic treatment
PARASITES					
	External	 Mange Mite (<i>Sarcoptes scabiei</i> var. <i>suis</i>)	Intense itching, crusty skin lesions, reduced growth	Causes temporary skin irritation in humans (Scabies)	Acaricide treatment, biosecurity
	External	 Hog Louse (<i>Haemataphys suis</i>)	Anemia, irritation, scratching	Not directly zoonotic, but transmits other diseases	Insecticide treatment
	Internal	 Roundworms (<i>Ascaris suum</i>)	Coughing (larval migration), reduced growth, liver damage, intestinal blockage	Larval migration can cause visceral larva migrans in humans	Anthelmintic medication, sanitation
	Internal	 Pork Tapeworm (<i>Taenia solium</i>)	Asymptomatic (swine), cysts in muscle (measly pork)	Ingestion of cysts causes Neurocysticercosis in humans	Meat inspection, proper cooking, sanitation
ZOOONOTIC CONCERNS					
	Virus	 Influenza A (Swine Flu)	Fever, coughing, lethargy, nasal discharge	High risk (respiratory infection, pandemic potential)	Vaccination (swine), PPE for workers, biosecurity
	Bacteria	 <i>Streptococcus suis</i>	Meningitis, arthritis, septicemia	High risk (meningitis, sepsis in exposed humans)	Antibiotics, hygiene, PPE
	Bacteria	 <i>Salmonella</i> (e.g., <i>S. Typhimurium</i>)	Diarrhea, fever, dehydration	High risk (foodborne illness)	Sanitation, feed hygiene, antibiotics
	Parasite	 <i>Toxoplasma gondii</i>	Usually asymptomatic (swine)	High risk (Toxoplasmosis, birth defects, immunocompromised risk)	Rodent control, proper cooking, avoiding raw meat

Figure 3.3: Major swine diseases, parasites, and zoonotic concerns

Pilot questions 3.3

1. Explain why African swine fever is controlled exclusively through biosecurity.
2. Name two bacterial diseases of swine.
3. Describe mange and its primary control method.
4. Explain what makes a disease or parasite zoonotic, with one swine example.
5. Explain how taeniasis/cysticercosis is typically prevented.

3.4 Major Rabbit Diseases and General Health Management

3.4.1 Common rabbit diseases

Rabbit haemorrhagic disease (a highly contagious and often fatal viral disease, an emerging concern in some regions) and pasteurellosis (a bacterial disease causing respiratory signs, abscesses, and reproductive problems, one of the most common rabbit health issues) are significant rabbit disease concerns, with pasteurellosis particularly favoured by poor ventilation and overcrowding (Series 1).



Enteritis/digestive disturbance (often triggered by sudden feed changes, Part 2.2.3, or contaminated feed/water) is a common and sometimes fatal rabbit health problem given the species sensitive digestive system, underscoring the close link between feeding management and disease prevention discussed throughout this Series.

Fill in the blank: _____, a bacterial disease causing respiratory signs, abscesses, and reproductive problems, is one of the most common rabbit health issues, favoured by poor ventilation and overcrowding.

3.4.2 Rabbit parasites

Ear mange (caused by mites in the ear canal, causing crusty scabs and intense irritation) and other mite-related skin conditions are significant external parasite concerns in rabbits, managed through acaricide treatment and good hutch sanitation (Series 1). Coccidiosis (similar in principle to the poultry disease, Part 3.2.3, but caused by different Eimeria species specific to rabbits) affects the intestinal tract or, in some forms, the liver, particularly in young rabbits raised in unsanitary conditions.

Internal worms (various intestinal parasites) are generally less severe a concern in well-managed rabbit operations than in some other livestock species, but regular observation and, where indicated, deworming support overall herd health alongside the other parasite control measures discussed in this Part.

Fill in the blank: Ear _____, caused by mites in the ear canal causing crusty scabs and intense irritation, is a significant external parasite concern in rabbit production.

3.4.3 General health monitoring and culling for disease control

Regular observation of rabbit appetite, droppings consistency, coat condition, and behaviour allows early detection of health problems before they progress to severe illness or spread to other animals; isolating sick animals promptly (a practical application of the biosecurity principles discussed in Part 3.1.2) limits disease spread within a rabbitry.



As discussed in Series 2, culling decisions based on health and productivity records support overall herd health by removing chronically ill or poor-performing animals, reducing the disease reservoir within the herd and improving the genetic and health quality of the remaining breeding stock over successive generations, an integrated approach combining the management, nutrition, and disease principles covered across this Series.

Fill in the blank: _____ sick animals promptly, a practical application of biosecurity principles, limits disease spread within a rabbitry and is an important general health management practice.

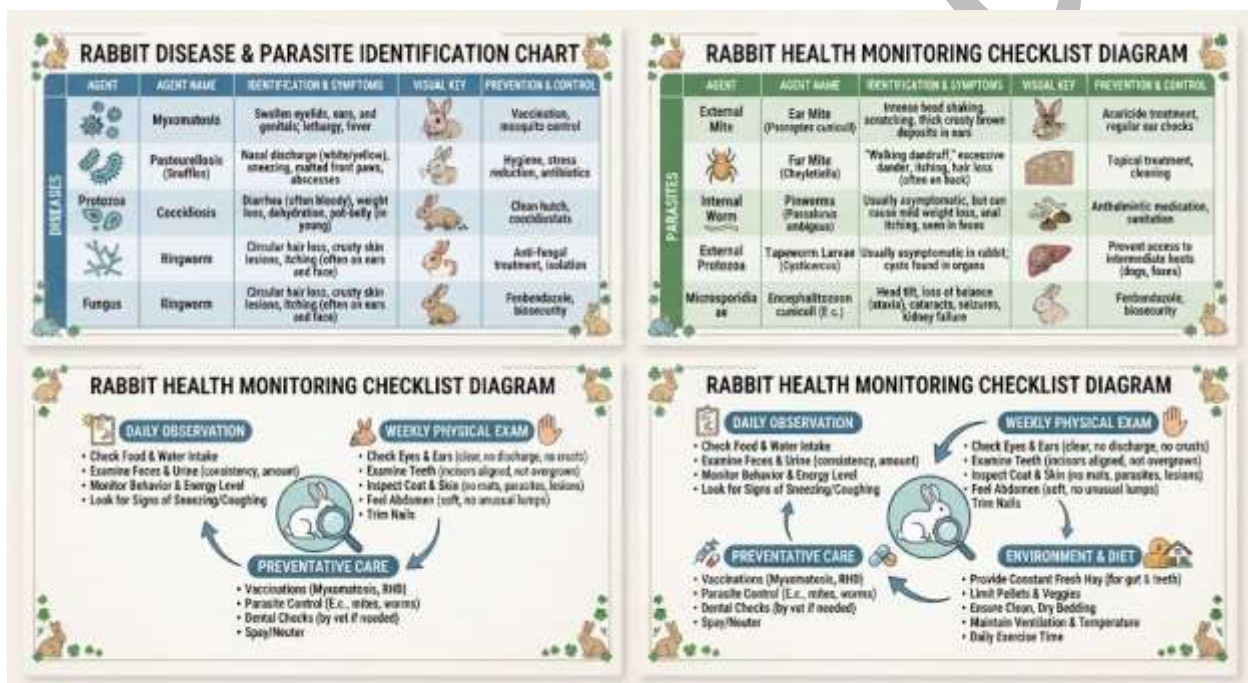


Figure 3.4: Rabbit diseases, parasites, and health monitoring

Pilot questions 3.4

- Describe pasteurellosis and the conditions that favour it.
- Explain why enteritis is a common rabbit health concern.
- Describe ear mange in rabbits.
- Name four signs to observe for early disease detection in rabbits.
- Explain how culling supports overall herd health.



Series Summary

This Series examined **livestock disease as any condition that disrupts the normal health and productivity of animals**. Disease occurrence is influenced by the interaction of the host, pathogen, and environment, known as the disease triangle. Infections may spread through direct contact, contaminated objects, air, or vectors. Prevention depends on strong biosecurity, including conceptual, structural, and operational measures, all-in-all-out management, sanitation, controlled movement, and proper vaccination. Vaccines must be stored under the correct cold-chain conditions and administered at the appropriate time and by the recommended method.

The Series also covered major diseases of poultry, pigs, and rabbits. Poultry diseases include Newcastle disease, infectious bursal disease, avian influenza, fowl typhoid, fowl cholera, coccidiosis, mites, and lice. Important swine diseases include African swine fever, which has no effective treatment or widely available vaccine and therefore requires strict biosecurity, as well as erysipelas, colibacillosis, roundworms, mange, taeniasis, and leptospirosis. Rabbit diseases include rabbit haemorrhagic disease, pasteurellosis, enteritis, ear mange, and coccidiosis. Regular monitoring of appetite, droppings, coat condition, and behaviour, together with timely treatment and culling, helps maintain herd health. By completing this Series, students should achieve SLOs 3.1–3.4.

Glossary of Terms

- **African swine fever:** a highly contagious, often fatal viral swine disease with no available vaccine or treatment, controlled only through biosecurity.
- **All-in-all-out management:** introducing and removing an entire animal batch together to break disease cycles between groups.
- **Biosecurity:** practices preventing pathogen introduction to and spread within a farm.
- **Coccidiosis:** a protozoan parasite disease damaging the intestinal lining, significant in young poultry and rabbits.



- **Disease triangle:** the interaction of host, pathogen, and environment required for disease to occur.
- **Newcastle disease:** a highly contagious viral poultry disease causing respiratory, nervous, and digestive signs, controlled through vaccination.
- **Pasteurellosis:** a common bacterial rabbit disease causing respiratory signs, abscesses, and reproductive problems.
- **Zoonotic disease:** a disease or parasite capable of transmitting from animals to humans.

Concept Check Questions [Series 3]

Objective Questions

1. The disease triangle describes host, pathogen, and _____ interaction. (Linked to SLO 3.1)
2. _____ disease is a highly contagious viral poultry disease controlled primarily through vaccination. (Linked to SLO 3.2)
3. African swine _____ has no available vaccine and is controlled only through biosecurity. (Linked to SLO 3.3)
4. _____ is a common bacterial rabbit disease favoured by poor ventilation and overcrowding. (Linked to SLO 3.4)
5. A _____ disease is capable of transmitting from animals to humans. (Linked to SLO 3.3)

Short-Answer Questions

1. Name four disease transmission routes. (Linked to SLO 3.1)
2. Name two viral diseases of poultry. (Linked to SLO 3.2)
3. Name two diseases or parasites of swine with zoonotic potential. (Linked to SLO 3.3)
4. Name two diseases or parasites of rabbits. (Linked to SLO 3.4)
5. Name three signs used for early disease detection in livestock. (Linked to SLO 3.4)

Long-Answer Questions

1. Explain disease transmission, biosecurity, and vaccination principles. (Linked to SLO 3.1)



2. Describe major viral and bacterial diseases and parasites of poultry. (Linked to SLO 3.2)
3. Describe major diseases, parasites, and zoonotic concerns in swine and rabbit production. (Linked to SLOs 3.3, 3.4)

Answers to Concept Check Questions [Series 3]

Objective Questions

1. Environment.
2. Newcastle.
3. Fever.
4. Pasteurellosis.
5. Zoonotic.

Short-Answer Questions

1. Direct contact, indirect/fomite contact, airborne spread, and vector-borne transmission.
2. Newcastle disease and infectious bursal disease (or avian influenza, fowl pox, Marek disease).
3. Taeniasis/cysticercosis and leptospirosis.
4. Pasteurellosis and ear mange (or rabbit haemorrhagic disease, coccidiosis).
5. Appetite, droppings consistency, and coat condition (or behaviour).

Long-Answer Questions

1. Disease results from host, pathogen, and environment interaction, spread through direct, indirect, airborne, or vector routes. Biosecurity (conceptual, structural, operational, including all-in-all-out management) and correctly executed vaccination programmes (cold chain, timing) are the primary prevention tools.
2. Major viral diseases include Newcastle disease and infectious bursal disease, controlled by vaccination. Bacterial diseases include fowl typhoid and fowl cholera. External parasites (mites, lice) and internal parasites (coccidiosis, worms) are managed through sanitation and medication.
3. Swine diseases include African swine fever (biosecurity only), erysipelas, and mange, with taeniasis and leptospirosis posing zoonotic risk. Rabbit diseases include pasteurellosis and



enteritis, with ear mange and coccidiosis as key parasites; general health monitoring and culling support herd health.

Answers to Pilot Questions [Series 3]

Part 3.1

1. Disease requires a susceptible host, a virulent pathogen, and a favourable environment; managing any one factor (resistant breeds, pathogen elimination, environment improvement) reduces risk.
2. Direct contact, indirect/fomite contact, airborne spread, and vector-borne transmission.
3. Conceptual, structural, and operational biosecurity.
4. It breaks disease transmission cycles between batches by allowing full cleaning and rest before the next group arrives.
5. Vaccines lose effectiveness if not properly refrigerated, reducing protection.

Part 3.2

1. No effective treatment exists once birds are infected, so prevention through vaccination is essential.
2. Fowl typhoid and fowl cholera (or chronic respiratory disease/mycoplasmosis).
3. Coccidiosis damages the intestinal lining, creating entry conditions for the *Clostridium* bacteria causing necrotic enteritis.
4. Mites and lice, causing irritation, feather damage, and reduced production.
5. Through anticoccidial medication, often included in starter feed, alongside litter management.

Part 3.3

1. No vaccine or treatment exists, so prevention through biosecurity and rapid outbreak response is the only control option.
2. Erysipelas and colibacillosis.
3. Mange is caused by skin-burrowing mites causing itching and skin damage, controlled through acaricide treatment and sanitation.



4. A zoonotic disease can transmit from animals to humans; pork tapeworm (taeniasis/cysticercosis) is a swine example.
5. Through proper meat inspection, thorough cooking, and avoiding pig exposure to human waste.

Part 3.4

1. Pasteurellosis causes respiratory signs, abscesses, and reproductive problems, favoured by poor ventilation and overcrowding.
2. Rabbits have a sensitive digestive system easily disrupted by sudden feed changes or contaminated feed/water.
3. Ear mange is caused by mites in the ear canal, causing crusty scabs and intense irritation.
4. Appetite, droppings consistency, coat condition, and behaviour.
5. Culling removes chronically ill or poor-performing animals, reducing the disease reservoir and improving herd quality.



References and Attributions

Textual References (Books and External Sources)

- North, M. O., & Bell, D. D. (1990). Commercial chicken production manual (4th ed.). Van Nostrand Reinhold.
- Aduku, A. O., & Olukosi, J. O. (1990). Animal products processing and handling in the tropics. Living Books Series, Abuja.
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- FAO (Food and Agriculture Organization of the United Nations). (2025). Guidelines for sustainable agriculture. FAO.

Figures, Plates, Tables, and Boxes

- Figure 3.1: Disease principles and biosecurity Attribution: AI generated. Suggested OER search string: "disease triangle biosecurity all-in-all-out vaccination non-ruminant Nigeria OER".
- Figure 3.2: Major poultry diseases and parasites Attribution: AI generated. Suggested OER search string: "Newcastle disease fowl typhoid coccidiosis poultry parasite Nigeria OER".
- Figure 3.3: Major swine diseases, parasites, and zoonotic concerns Attribution: AI generated. Suggested OER search string: "African swine fever mange pork tapeworm zoonotic swine disease Nigeria OER".
- Figure 3.4: Rabbit diseases, parasites, and health monitoring Attribution: AI generated. Suggested OER search string: "rabbit pasteurellosis ear mange coccidiosis health monitoring Nigeria OER".



Series 4: Transportation and Marketing Techniques

- **Part 4.1: Principles of Livestock Transportation**

- Sub Part 4.1.1: Pre-transport preparation
- Sub Part 4.1.2: Transport conditions and animal welfare
- Sub Part 4.1.3: Transport-related stress and mortality

- **Part 4.2: Species-Specific Transportation Practices**

- Sub Part 4.2.1: Transporting live poultry
- Sub Part 4.2.2: Transporting swine
- Sub Part 4.2.3: Transporting rabbits and eggs

- **Part 4.3: Marketing Channels and Pricing**

- Sub Part 4.3.1: Marketing channels for non-ruminant products
- Sub Part 4.3.2: Price determination and grading
- Sub Part 4.3.3: Contract and cooperative marketing arrangements

- **Part 4.4: Marketing Strategy and Market Information**

- Sub Part 4.4.1: Market timing and seasonal demand
- Sub Part 4.4.2: Branding and product differentiation
- Sub Part 4.4.3: Market information and decision making



Introduction

Getting non-ruminant livestock and their products from the farm to the market in good condition and at a favourable price is as important to overall enterprise profitability as the production and health management covered in Series 1 through 3. Poor transport practices can cause significant weight loss, injury, or mortality, while poor marketing decisions can erode the value created through good production management.

This Series covers the general principles of livestock transportation and animal welfare; species-specific transport practices for poultry, swine, rabbits, and eggs; marketing channels, pricing, and grading; and marketing strategy including timing, branding, and market information use. This prepares students for the final processing and establishment topics of Series 5.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 4.1** explain the principles of livestock transportation, including pre-transport preparation and welfare considerations (Linked to Part 4.1),
- **SLO 4.2** describe species-specific transportation practices for poultry, swine, rabbits, and eggs (Linked to Part 4.2),
- **SLO 4.3** describe marketing channels, pricing, grading, and contract/cooperative arrangements for non-ruminant products (Linked to Part 4.3), and
- **SLO 4.4** explain marketing strategy, including timing, branding, and market information use (Linked to Part 4.4).



4.1 Principles of Livestock Transportation

4.1.1 Pre-transport preparation

Pre-transport preparation reduces stress, injury, and mortality risk during the journey: animals should be fasted appropriately before transport (reducing waste production and digestive upset during transit, though water access should generally continue up to loading), handled calmly to avoid bruising or injury, and checked for health status, since sick or visibly stressed animals are poor transport candidates and may not be marketable on arrival regardless of transport quality.

Vehicle and crate/cage preparation (cleaning and disinfecting transport equipment between uses, a biosecurity practice linked to Series 3, and ensuring adequate but not excessive stocking density within crates/vehicles) should be completed before animals are loaded, minimising the time animals spend waiting in loaded but stationary vehicles, a period of particular heat stress risk in Nigerian conditions.

Fill in the blank: Animals should be _____ appropriately before transport, reducing waste production and digestive upset during transit, though water access should generally continue up to loading.

4.1.2 Transport conditions and animal welfare

Adequate ventilation during transport (avoiding fully enclosed, poorly ventilated vehicles, particularly important in Nigerian heat) prevents heat stress and suffocation risk, especially in densely loaded poultry crates; stocking density within crates/vehicles must balance space efficiency against the welfare and survival risk of overcrowding, with established guidelines (varying by species, crate size, and ambient temperature) informing appropriate loading rates.

Journey duration should be minimised where possible, and rest stops with water access provided for longer journeys; careful loading and unloading technique (avoiding rough handling, drops, or



excessive force) reduces bruising and injury that both harms animal welfare and reduces product quality/value at the point of sale or processing (Series 5).

Fill in the blank: _____ density within transport crates/vehicles must balance space efficiency against the welfare and survival risk of overcrowding, informed by established guidelines varying by species and conditions.

4.1.3 Transport-related stress and mortality

Transport stress (a combination of physical exertion, novel environment, temperature extremes, and, for some species, social disruption from mixing unfamiliar animals) can cause measurable weight loss (shrinkage), reduced product quality (e.g. pale, soft, exudative meat in stressed pigs, a recognised quality defect), and, in severe cases, mortality during or shortly after transport.

Minimising these losses requires attention to all the factors discussed in Parts 4.1.1 and 4.1.2: proper pre-transport preparation, appropriate stocking density and ventilation, careful handling, and minimised journey duration and waiting time; transport losses represent a direct, avoidable reduction in farm income, making good transport practice an economically as well as ethically important management area.

Fill in the blank: Pale, soft, exudative meat is a recognised quality defect in pigs associated with transport _____ shortly before slaughter.



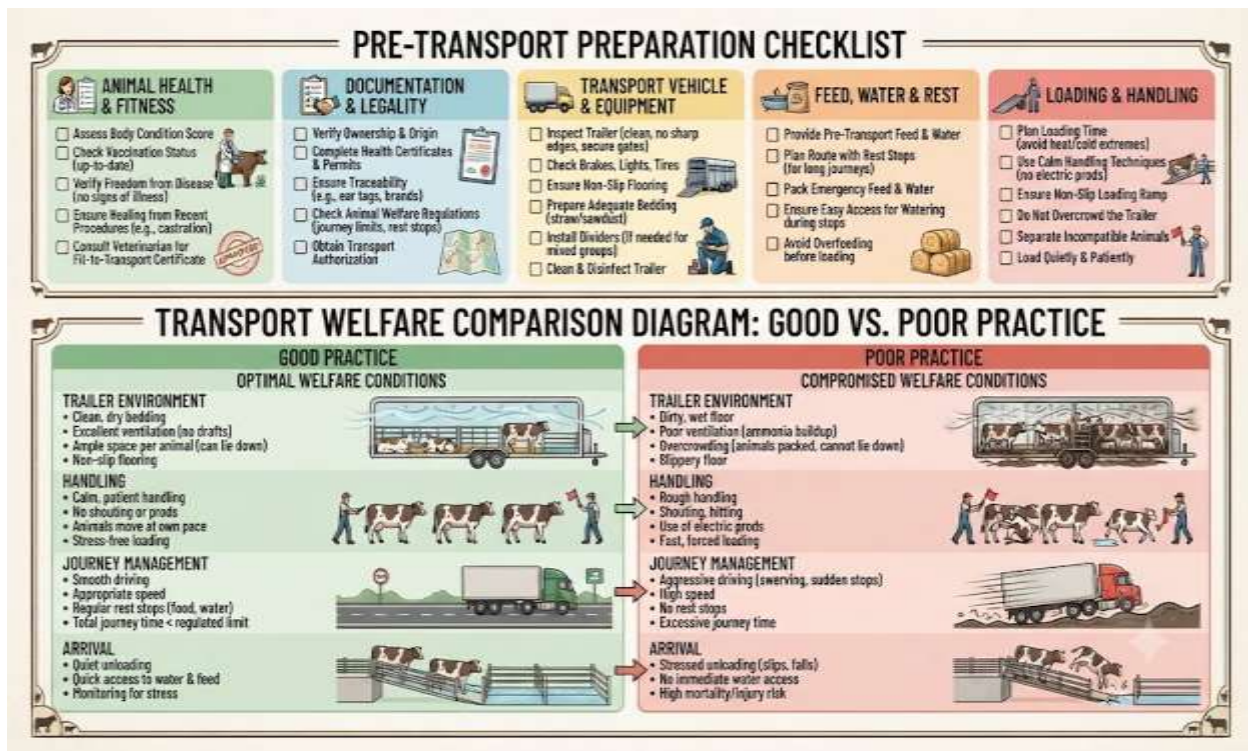


Figure 4.1: Principles of livestock transportation

Pilot questions 4.1

1. Name three pre-transport preparation steps.
2. Explain why ventilation is particularly important during livestock transport in Nigeria.
3. Explain why stocking density during transport must be carefully managed.
4. Explain pale, soft, exudative meat and its cause.
5. Explain why minimising transport losses is economically important.

4.2 Species-Specific Transportation Practices

4.2.1 Transporting live poultry

Live poultry are typically transported in ventilated crates (plastic or wooden, with adequate openings for airflow), loaded to avoid overcrowding (which causes smothering and heat stress) while still using vehicle space efficiently; catching and crating should be done calmly, preferably



during cooler parts of the day, to reduce stress and injury (bruising, broken bones from rough handling).

Crates should be stacked to allow continued airflow between tiers rather than fully blocking ventilation, and journey timing should avoid the hottest part of the day where possible; broilers destined for processing (Series 5) require particular care since bruising and stress at this stage directly affects final carcass quality and value.

Fill in the blank: Poultry crates should be stacked to allow continued _____ between tiers during transport, rather than fully blocking it.

4.2.2 Transporting swine

Pigs are transported in appropriately sized, well-ventilated vehicles or trailers, with non-slip flooring (reducing injury from slipping, particularly important given pig anatomy and weight) and, in hot conditions, some form of cooling provision (since pigs cannot sweat effectively, as discussed in Series 1) such as water spraying en route for longer journeys.

Mixing unfamiliar pigs during transport should be minimised where practical, since pigs establish social hierarchies and unfamiliar groupings can lead to fighting and injury; loading ramps should have a gentle incline and non-slip surface to reduce loading stress and injury risk, an often underappreciated detail in pig transport logistics.

Fill in the blank: Pig transport vehicles should have non-slip flooring to reduce injury from slipping, an important consideration given pig anatomy and _____ .

4.2.3 Transporting rabbits and eggs

Rabbits are transported in well-ventilated carrying crates/cages, with attention to temperature control (rabbits are particularly heat-sensitive, Series 1) and minimised handling stress, given the species generally more nervous disposition compared to poultry or pigs; separating unfamiliar rabbits (particularly bucks) during transport reduces fighting risk similar to the pig mixing concern discussed above.



Hatching eggs require careful handling distinct from live animal transport: maintaining appropriate temperature (avoiding both overheating and chilling, which can reduce hatchability) and minimising rough handling/vibration (which can damage the developing embryo or crack the shell) during transport from the layer/breeder farm to the hatchery; table eggs similarly require careful handling to avoid cracking and contamination, affecting marketable quality.

Fill in the blank: Hatching eggs require careful temperature control during transport, since both overheating and chilling can reduce _____ at the hatchery.

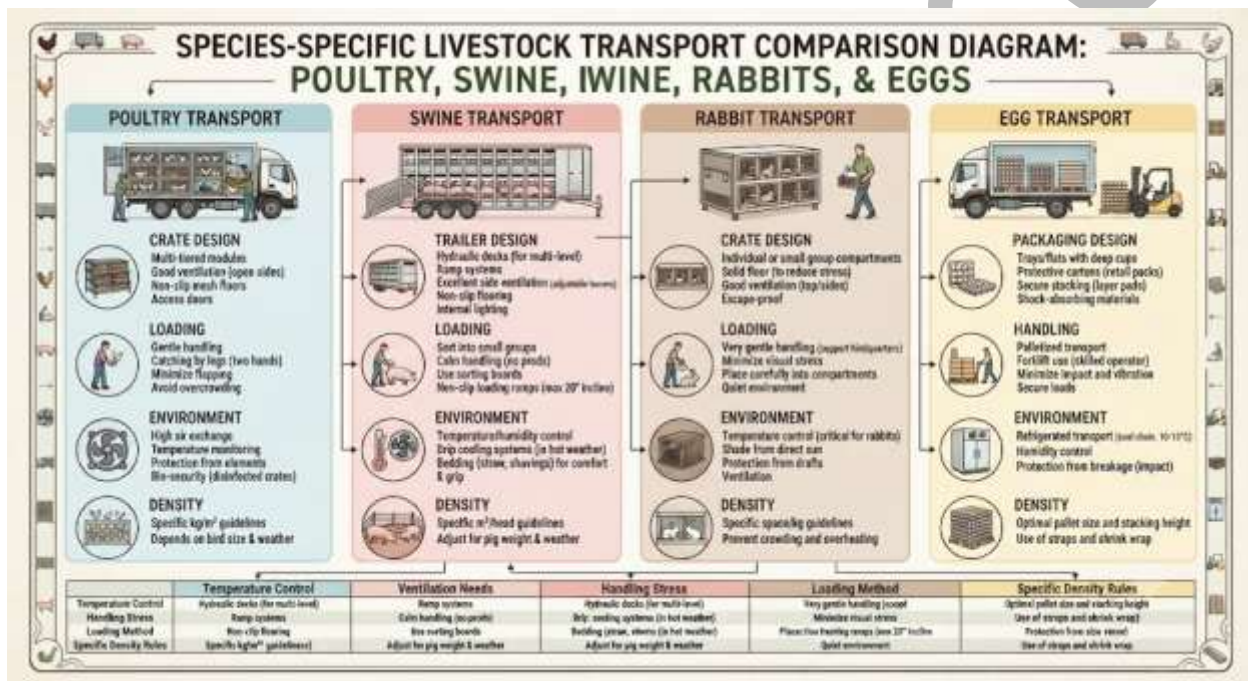


Figure 4.2: Species-specific transportation practices

Pilot questions 4.2

1. Explain how poultry crates should be stacked during transport.
2. Explain why non-slip flooring is important in pig transport vehicles.
3. Explain why unfamiliar pigs or rabbits should not be mixed during transport.
4. Explain why hatching eggs require careful temperature control during transport.
5. State two risks to hatching eggs from rough handling during transport.



4.3 Marketing Channels and Pricing

4.3.1 Marketing channels for non-ruminant products

Direct marketing (farm gate sales, farmers selling directly to consumers or local restaurants/hotels) offers the farmer the full retail price but requires the farmer to perform all marketing functions themselves; this suits smaller-scale producers with local market access. Live bird/animal markets (urban markets where live poultry, pigs, or rabbits are sold to retail buyers or for direct slaughter) remain a dominant marketing channel for much of Nigerian non-ruminant production.

Contract supply to processors or large retailers (Part 4.3.3) and cooperative marketing (pooling produce from multiple small producers, similar to the agricultural marketing principles covered in related courses) represent alternative channels offering potentially better price stability and bargaining power compared to fragmented individual sales into live markets, though requiring more organisation and, for contract supply, meeting specific buyer quality and consistency requirements.

Fill in the blank: _____ marketing, farm gate sales directly to consumers or local buyers, offers the farmer the full retail price but requires performing all marketing functions themselves.

4.3.2 Price determination and grading

Prices for live animals and products are influenced by weight/size, breed, health/condition, and seasonal demand patterns (Part 4.4.1); grading (sorting by size, weight, or quality characteristics, similar in principle to the agricultural produce grading covered in related marketing courses) facilitates price differentiation and buyer confidence, though formal grading standards are less developed and consistently applied for Nigerian live animal/poultry markets than for some other agricultural commodities.

Egg grading (by size and, for some markets, shell quality/cleanliness) is somewhat more standardised than live animal grading in Nigerian practice, supporting price differentiation between grades; price negotiation in live markets typically occurs through direct buyer-seller



bargaining, similar to the negotiation-based price discovery discussed for agricultural commodities generally.

Fill in the blank: _____ grading, by size and shell quality/cleanliness, is somewhat more standardised than live animal grading in Nigerian marketing practice.

4.3.3 Contract and cooperative marketing arrangements

Contract farming arrangements (a processor or large buyer contracting directly with producers, specifying quality, quantity, and delivery terms, and often guaranteed purchase price) provide price stability and planning certainty for producers willing to meet the specified production standards, increasingly used in Nigerian commercial broiler and egg production linked to larger processing or marketing companies.

Cooperative marketing arrangements (producers pooling output for collective sale, similar to the agricultural marketing cooperative principles covered elsewhere) can improve bargaining power and access to larger buyers than individual small producers could reach alone, though success depends on cooperative governance quality and member commitment, paralleling the cooperative marketing considerations discussed for crop production.

Fill in the blank: _____ farming arrangements specify quality, quantity, and delivery terms between a processor/buyer and producers, often including a guaranteed purchase price providing planning certainty.



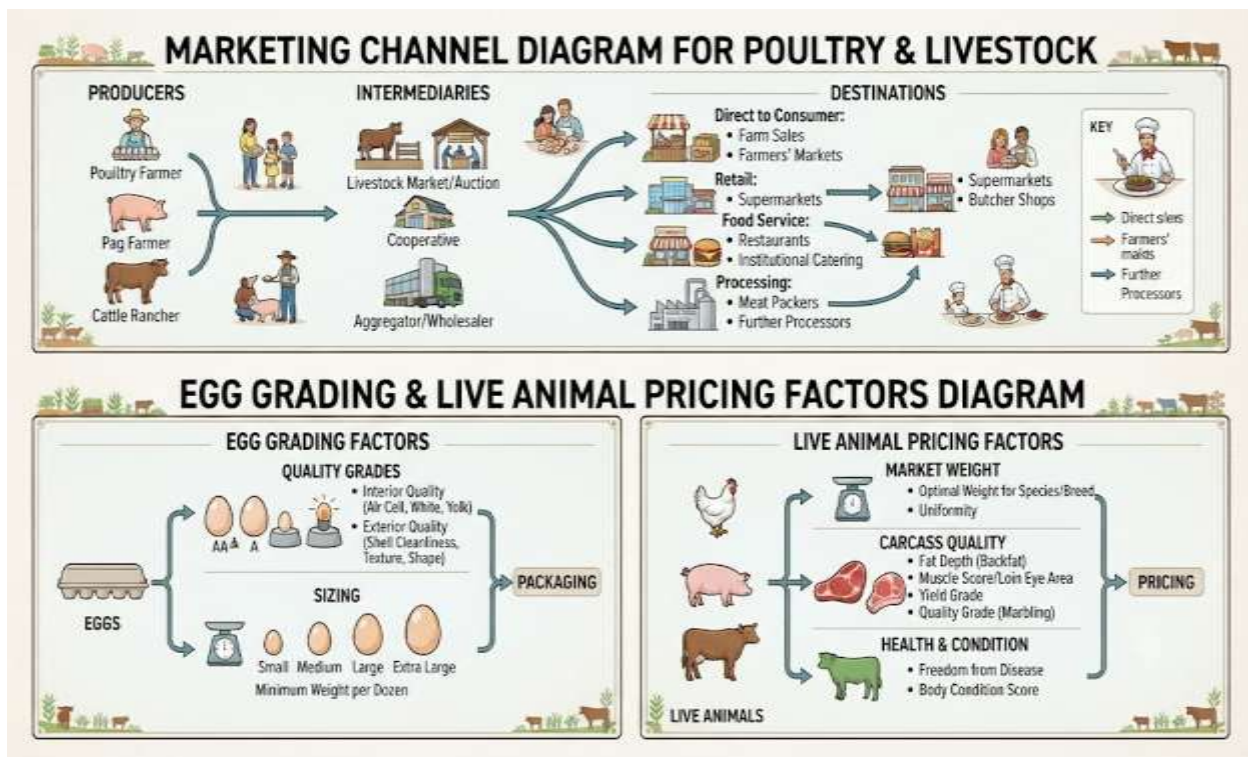


Figure 4.3: Marketing channels, pricing, and grading

Pilot questions 4.3

1. Name three marketing channels for non-ruminant products.
2. Explain the trade-off of direct/farm gate marketing.
3. Explain egg grading and what it is typically based on.
4. Describe contract farming arrangements and one benefit they provide.
5. Explain the potential benefit of cooperative marketing for small producers.

4.4 Marketing Strategy and Market Information

4.4.1 Market timing and seasonal demand

Demand for poultry and other non-ruminant products in Nigeria rises sharply during festive periods (Christmas, Easter, Eid celebrations) and other ceremonial occasions, creating



predictable seasonal price peaks that informed producers can plan production cycles to target, similar to the seasonal demand patterns discussed for agricultural products generally.

Conversely, periods of high supply relative to demand (e.g. immediately after a major festive period, when many producers have sold their stock) can see temporary price weakness; planning marketing timing, where flexible, to avoid concentrated low-demand periods and target seasonal demand peaks is a practical strategy for improving average realised price across a production cycle.

Fill in the blank: Demand for poultry and other non-ruminant products rises sharply during _____ periods such as Christmas, Easter, and Eid celebrations, creating predictable seasonal price peaks.

4.4.2 Branding and product differentiation

Branding (establishing a recognised farm or company identity associated with consistent quality) and product differentiation (e.g. marketing eggs as free-range or organic, or branding processed chicken products distinctly from generic live-market poultry) can support premium pricing for producers able to consistently deliver the differentiated quality attribute, similar to the branding and market segmentation strategies discussed in agricultural marketing courses.

Building a reliable reputation among repeat buyers (whether individual consumers, restaurants, or institutional buyers) reduces the price-taking position of relying solely on anonymous live-market sales, supporting more stable and potentially higher average prices over time for producers investing in consistent quality and customer relationships.

Fill in the blank: _____, establishing a recognised farm identity associated with consistent quality, can support premium pricing for producers able to consistently deliver a differentiated product attribute.



4.4.3 Market information and decision making

Access to current market price information (through market visits, mobile phone-based services, or buyer/cooperative networks, similar to the market information principles discussed for crop marketing) supports better-informed decisions about when and where to sell, and at what price to negotiate, reducing the risk of accepting an unfavourable price due to lack of awareness of prevailing market conditions elsewhere.

Combining market information with the production planning, transport, and channel selection considerations covered throughout this Series allows non-ruminant producers to make integrated marketing decisions that maximise realised value from their production investment, completing the link between good production/health management (Series 1-3) and good marketing execution covered in this Series.

Fill in the blank: Access to current market price _____ supports better-informed decisions about when and where to sell, reducing the risk of accepting an unfavourable price due to lack of awareness.

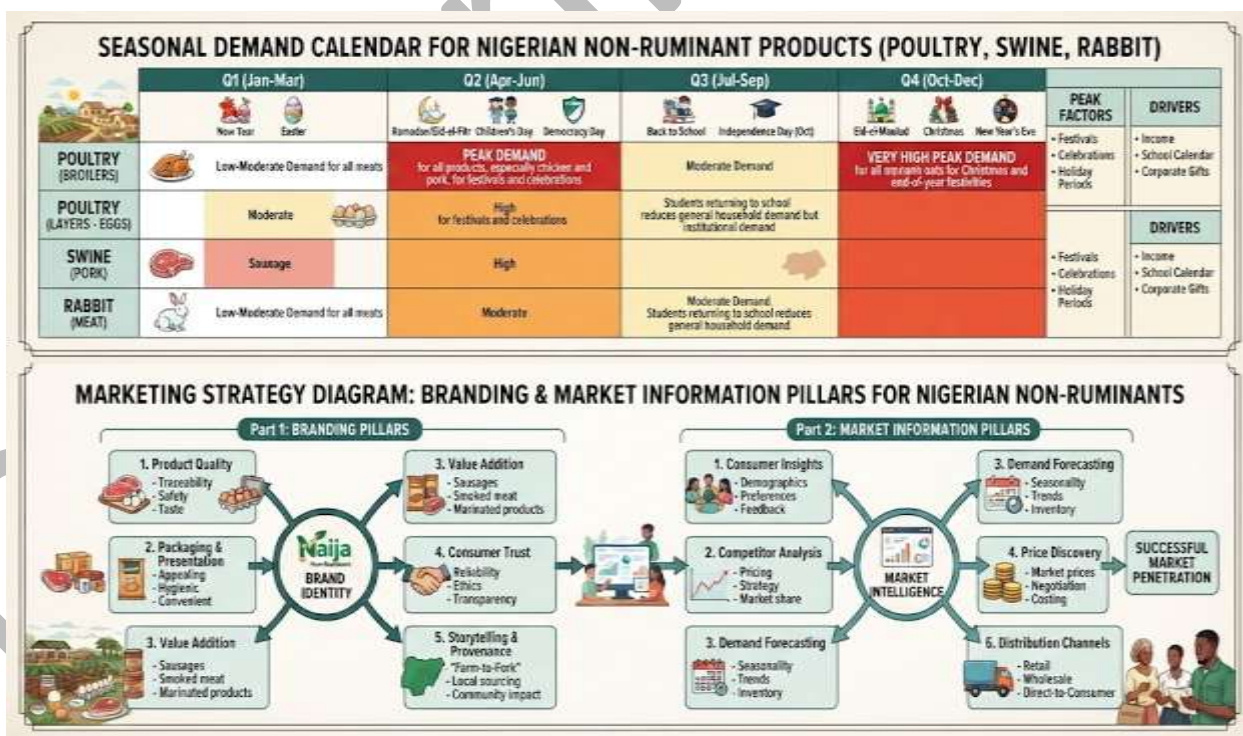


Figure 4.4: Marketing strategy and market information



Pilot questions 4.4

1. Name three festive periods associated with peak Nigerian poultry demand.
2. Explain why prices may weaken after a major festive period.
3. Explain branding and product differentiation with one example.
4. Explain how building a reputation with repeat buyers benefits a producer.
5. Explain how market information access supports better marketing decisions.



Series Summary

This Series examined **livestock transportation as the safe movement of animals and animal products from one location to another while protecting welfare, quality, and market value.**

Preparation includes fasting where appropriate, health inspection, and cleaning of vehicles, crates, and equipment. During transport, proper ventilation, suitable stocking density, gentle handling, and temperature control reduce stress, injury, mortality, weight loss, and poor meat quality. Poultry require ventilated crates with airflow between tiers, pigs need non-slip floors, cooling, and minimal mixing of unfamiliar animals, while rabbits require protection from heat and overcrowding. Eggs should be transported with minimal vibration and proper temperature control to preserve quality and hatchability.

The Series also covered **livestock marketing as the process of moving animals and animal products from producers to buyers through suitable channels.** Common channels include farm-gate sales, live-animal markets, contract supply, and cooperative marketing. Prices are influenced by weight, breed, body condition, quality, season, and demand, while egg grading is generally more standardised than live-animal grading. Effective marketing involves selling during periods of high demand, using branding and product differentiation to obtain premium prices, and accessing reliable market information for better production and sales decisions. By completing this Series, students should achieve SLOs 4.1–4.4.

Glossary of Terms

- **Branding:** establishing a recognised farm or company identity associated with consistent product quality.
- **Contract farming:** an arrangement in which a processor or buyer contracts directly with producers, specifying quality, quantity, and delivery terms.
- **Direct marketing:** farm gate sales directly to consumers or local buyers, offering full retail price but requiring the farmer to perform all marketing functions.



- **Grading:** sorting animals or products by size, weight, or quality characteristics to facilitate price differentiation.
- **Pale, soft, exudative (PSE) meat:** a pork quality defect associated with pre-slaughter transport stress.
- **Stocking density (transport):** the number of animals per unit space within a transport crate or vehicle, balancing space efficiency against welfare/survival risk.
- **Transport stress:** physiological and behavioural stress arising from handling, novel environment, temperature, and journey conditions during transport.



Concept Check Questions [Series 4]

Objective Questions

1. Animals should be _____ appropriately before transport, reducing waste production during transit. (Linked to SLO 4.1)
2. Poultry crates should be stacked to allow continued _____ between tiers during transport. (Linked to SLO 4.2)
3. _____ marketing offers the farmer the full retail price but requires performing all marketing functions themselves. (Linked to SLO 4.3)
4. Demand for poultry rises sharply during _____ periods such as Christmas and Eid. (Linked to SLO 4.4)
5. _____, a pork quality defect, is associated with pre-slaughter transport stress. (Linked to SLO 4.1)

Short-Answer Questions

1. Name three pre-transport preparation steps. (Linked to SLO 4.1)
2. Name two species-specific transport considerations. (Linked to SLO 4.2)
3. Name three marketing channels for non-ruminant products. (Linked to SLO 4.3)
4. Explain contract farming and one benefit it provides. (Linked to SLO 4.3)
5. Explain branding with one example. (Linked to SLO 4.4)

Long-Answer Questions

1. Explain the principles of livestock transportation and welfare considerations. (Linked to SLO 4.1)
2. Describe species-specific transportation practices for poultry, swine, rabbits, and eggs. (Linked to SLO 4.2)
3. Describe marketing channels, pricing, and marketing strategy for non-ruminant products. (Linked to SLOs 4.3, 4.4)



Answers to Concept Check Questions [Series 4]

Objective Questions

1. Fasted.
2. Airflow.
3. Direct.
4. Festive.
5. PSE meat.

Short-Answer Questions

1. Fasting, health checking, and vehicle/crate cleaning.
2. Non-slip flooring for pigs and heat sensitivity for rabbits.
3. Direct/farm gate, live markets, and contract supply (or cooperative marketing).
4. A processor contracts directly with producers for specified quality/quantity; provides price stability.
5. Branding establishes a recognised identity for consistent quality; example: marketing eggs as free-range.

Long-Answer Questions

1. Transportation requires pre-transport preparation (fasting, health check, equipment cleaning), good welfare conditions (ventilation, stocking density, careful handling), and minimising stress/mortality risk, since transport losses directly reduce farm income.
2. Poultry need ventilated crates with airflow between tiers; swine need non-slip flooring and cooling; rabbits need heat protection and separation; eggs need temperature control and minimal vibration for hatchability.
3. Marketing channels include direct sale, live markets, contract supply, and cooperative marketing. Pricing depends on weight, breed, condition, and season; egg grading is relatively standardised. Strategy includes timing around festive demand peaks, branding for premium pricing, and using market information for better decisions.

Answers to Pilot Questions [Series 4]



Part 4.1

1. Fasting, health checking, and cleaning/disinfecting vehicles or crates.
2. Heat stress and suffocation risk are high in poorly ventilated, densely loaded vehicles under Nigerian heat.
3. Overcrowding risks welfare and survival, while underloading wastes transport capacity.
4. It is pale, soft, watery pork caused by stress shortly before slaughter.
5. Transport losses (weight loss, injury, mortality) directly reduce farm income.

Part 4.2

1. Stacked to allow continued airflow between tiers, not fully blocking ventilation.
2. It reduces injury from slipping given pig weight and anatomy.
3. Unfamiliar animals can fight, causing injury and stress.
4. Both overheating and chilling can reduce hatchability of the eggs.
5. Embryo damage and shell cracking.

Part 4.3

1. Direct/farm gate sale, live bird/animal markets, and contract supply (or cooperative marketing).
2. It offers full retail price but requires the farmer to perform all marketing functions alone.
3. Egg grading is based on size and shell quality/cleanliness, supporting price differentiation.
4. A buyer contracts directly with producers on quality/quantity/price terms, providing price stability.
5. It improves bargaining power and access to larger buyers than individual producers could reach alone.

Part 4.4

1. Christmas, Easter, and Eid celebrations.
2. Many producers sell stock at once after a festive peak, increasing supply relative to demand.
3. Branding builds a recognised identity for consistent quality; example: branding eggs as free-range.
4. It reduces reliance on anonymous live-market sales, supporting more stable, potentially higher prices.



5. It reduces the risk of accepting an unfavourable price due to lack of awareness of market conditions elsewhere.



References and Attributions

Textual References (Books and External Sources)

- North, M. O., & Bell, D. D. (1990). Commercial chicken production manual (4th ed.). Van Nostrand Reinhold.
- Aduku, A. O., & Olukosi, J. O. (1990). Animal products processing and handling in the tropics. Living Books Series, Abuja.
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- FAO (Food and Agriculture Organization of the United Nations). (2025). Guidelines for sustainable agriculture. FAO.

Figures, Plates, Tables, and Boxes

- Figure 4.1: Principles of livestock transportation Attribution: AI generated. Suggested OER search string: "livestock transport preparation welfare stocking density Nigeria non-ruminant OER".
- Figure 4.2: Species-specific transportation practices Attribution: AI generated. Suggested OER search string: "poultry swine rabbit egg transportation Nigeria non-ruminant OER".
- Figure 4.3: Marketing channels, pricing, and grading Attribution: AI generated. Suggested OER search string: "poultry swine rabbit marketing channel egg grading Nigeria non-ruminant OER".
- Figure 4.4: Marketing strategy and market information Attribution: AI generated. Suggested OER search string: "poultry seasonal demand branding market information Nigeria non-ruminant marketing OER".



Series 5: Processing and Establishment Practices

- **Part 5.1: Poultry Slaughter and Processing**

- Sub Part 5.1.1: Pre-slaughter handling and stunning
- Sub Part 5.1.2: Slaughter and dressing procedures
- Sub Part 5.1.3: Egg handling and processing

- **Part 5.2: Swine and Rabbit Processing**

- Sub Part 5.2.1: Pig slaughter and dressing
- Sub Part 5.2.2: Rabbit slaughter and dressing
- Sub Part 5.2.3: Meat preservation methods

- **Part 5.3: Quality Assurance and Food Safety**

- Sub Part 5.3.1: Meat inspection and quality grading
- Sub Part 5.3.2: Hygiene and sanitation in processing
- Sub Part 5.3.3: Regulatory framework for animal product safety

- **Part 5.4: Establishing a Non-Ruminant Enterprise**

- Sub Part 5.4.1: Enterprise planning and feasibility
- Sub Part 5.4.2: Start-up requirements and scaling
- Sub Part 5.4.3: Record keeping and business management



Introduction

This final Series of AGE 309 covers the processing stage that transforms live poultry, swine, and rabbits into marketable meat and egg products, the quality assurance and food safety considerations governing that processing, and the practical steps involved in establishing and managing a non-ruminant production enterprise. It draws together the housing, management, health, and marketing knowledge built across the previous four Series.

This Series covers poultry slaughter, dressing, and egg processing; swine and rabbit slaughter and dressing, and meat preservation; quality assurance, hygiene, and the regulatory framework for animal product safety; and the practical steps of enterprise planning, start-up, and business management for non-ruminant production.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 5.1** describe poultry slaughter, dressing, and egg handling/processing practices (Linked to Part 5.1),
- **SLO 5.2** describe swine and rabbit slaughter, dressing, and meat preservation methods (Linked to Part 5.2),
- **SLO 5.3** explain quality assurance, hygiene, and the regulatory framework for animal product safety (Linked to Part 5.3), and
- **SLO 5.4** describe the practical steps of establishing and managing a non-ruminant production enterprise (Linked to Part 5.4).



5.1 Poultry Slaughter and Processing

5.1.1 Pre-slaughter handling and stunning

Pre-slaughter handling (covered partly under transport in Series 4) should minimise stress through calm handling, appropriate holding time with water access before slaughter, and avoiding rough catching/carrying that causes bruising visible in the final dressed carcass. Stunning (rendering birds unconscious before slaughter, using electrical water-bath stunners in larger commercial operations) reduces pain and improves worker safety and bleed-out quality, though many smaller Nigerian operations slaughter without formal stunning.

Whatever the method, the goal is rapid, humane slaughter with effective bleeding (severing major blood vessels to allow complete blood drainage), since incomplete bleeding affects meat appearance, shelf life, and quality, making this step as important to product quality as it is to animal welfare.

Fill in the blank: Effective _____, severing major blood vessels to allow complete blood drainage, is important for meat appearance, shelf life, and quality, not just animal welfare.

5.1.2 Slaughter and dressing procedures

After bleeding, scalding (immersing carcasses in hot water, typically 50-60 degrees Celsius) loosens feathers for plucking (manual or mechanical), followed by evisceration (removing internal organs) and final inspection/trimming; correct scalding temperature and time matters since too-hot or too-long scalding can damage skin appearance and quality.

Chilling the dressed carcass promptly after processing (reducing temperature to slow bacterial growth) is essential for food safety and shelf life, whether through ice/water immersion chilling (common in many Nigerian operations) or air chilling (more common in larger, more capital-intensive facilities); the entire slaughter-to-chilling chain should proceed without unnecessary delay to maintain product quality and safety.



Fill in the blank: _____ , immersing carcasses in hot water typically 50-60 degrees Celsius, loosens feathers for plucking during poultry processing.

5.1.3 Egg handling and processing

Table eggs require careful collection (frequent collection reduces breakage and contamination risk), cleaning (where practised, using appropriate methods that do not damage the protective cuticle layer more than necessary), grading by size, and appropriate storage (cool, stable temperature significantly extends shelf life compared to storage at ambient tropical temperature).

Candling (examining eggs against a light source) is used both for hatching egg quality assessment (detecting cracks, blood spots, or developmental problems) and, in some processing operations, for table egg quality checking before packaging; proper packaging (cartons or trays protecting eggs from breakage and contamination during distribution) completes the basic egg handling chain from farm to market.

Fill in the blank: _____ , examining eggs against a light source, is used for hatching egg quality assessment and, in some operations, table egg quality checking.

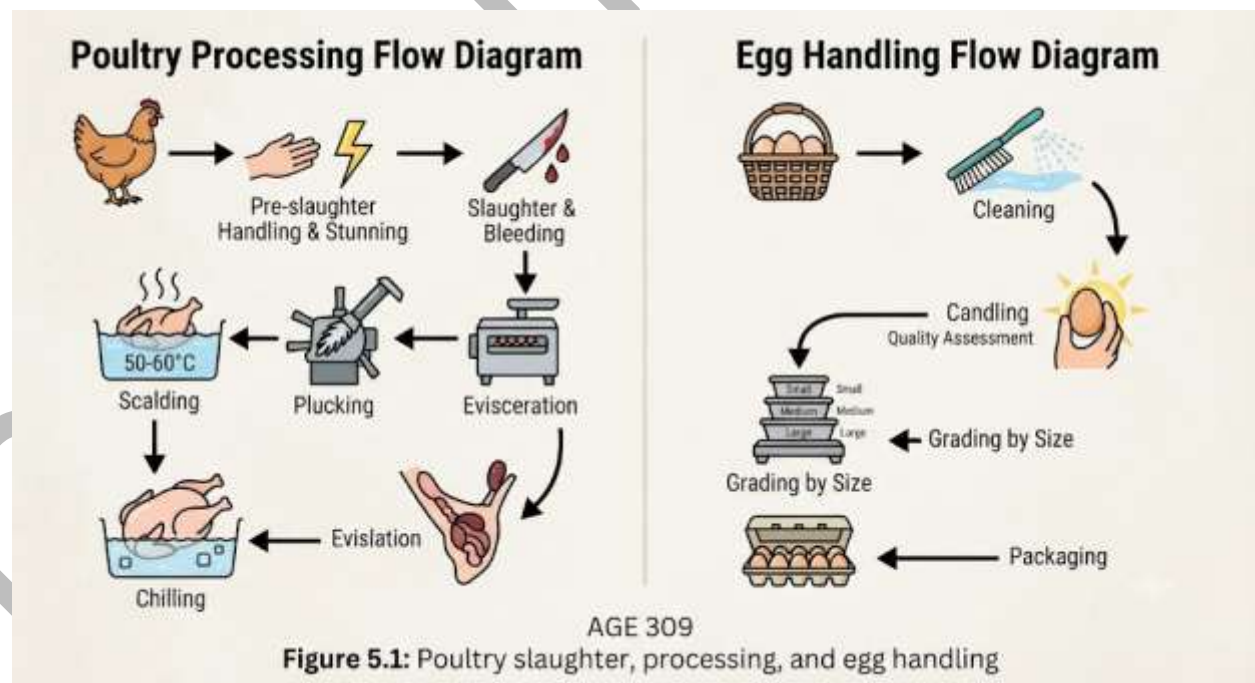


Figure 5.1: Poultry slaughter, processing, and egg handling



Pilot questions 5.1

1. Explain the purpose of stunning before poultry slaughter.
2. Explain why effective bleeding matters for meat quality.
3. Describe the scalding step in poultry processing.
4. Explain why prompt chilling after processing is important.
5. Explain the purpose of candling eggs.

5.2 Swine and Rabbit Processing

5.2.1 Pig slaughter and dressing

Pig slaughter follows similar general principles to poultry (humane stunning where used, effective bleeding, prompt processing) but with species-specific steps: scalding and dehairing (removing bristles, either by scalding/scraping or, in some systems, skinning instead) followed by evisceration, splitting the carcass, and inspection.

Chilling the dressed pig carcass promptly is essential given pork susceptibility to spoilage and the food safety concerns (Series 3) associated with inadequately processed pork; carcass grading (by weight, fat thickness, and muscling) affects price and informs further processing or cutting decisions for different market segments.

Fill in the blank: _____, removing bristles either by scalding/scraping or skinning, is a species-specific step in pig slaughter and dressing distinct from poultry processing.

5.2.2 Rabbit slaughter and dressing

Rabbit slaughter (typically a quick, humane method such as cervical dislocation or stunning followed by bleeding) is followed by skinning (removing the pelt, which itself can be a marketable by-product) and evisceration; rabbit carcasses are generally processed at smaller scale than poultry or pigs, often suiting simpler, lower-capital processing methods given the smaller average Nigerian rabbit enterprise scale.



Prompt chilling after dressing remains important for rabbit meat as for other species, given its relatively lean composition and susceptibility to quality decline if not properly cooled and stored; rabbit meat marketing in Nigeria remains a smaller, more specialised market segment compared to poultry, influencing the appropriate scale and approach to processing investment.

Fill in the blank: Rabbit _____, removing the pelt during dressing, can itself be a marketable by-product alongside the meat.

5.2.3 Meat preservation methods

Chilling/refrigeration (Parts 5.1.2 and 5.2.1) extends shelf life for days; freezing extends shelf life much further (weeks to months) but requires reliable cold-chain infrastructure (electricity, freezer capacity) that remains a constraint for many smaller Nigerian non-ruminant enterprises, particularly outside major urban centres.

Smoking, salting, and drying (traditional preservation methods requiring less infrastructure than refrigeration/freezing) remain relevant for some Nigerian poultry, pork, and other meat products, particularly where reliable electricity and cold storage are unavailable; each method extends shelf life through different mechanisms (moisture reduction, salt concentration, or smoke compound deposition inhibiting microbial growth) but also changes product flavour and texture compared to fresh or simply chilled meat.

Fill in the blank: _____, salting, and drying are traditional meat preservation methods requiring less infrastructure than refrigeration or freezing, remaining relevant where reliable electricity is unavailable.



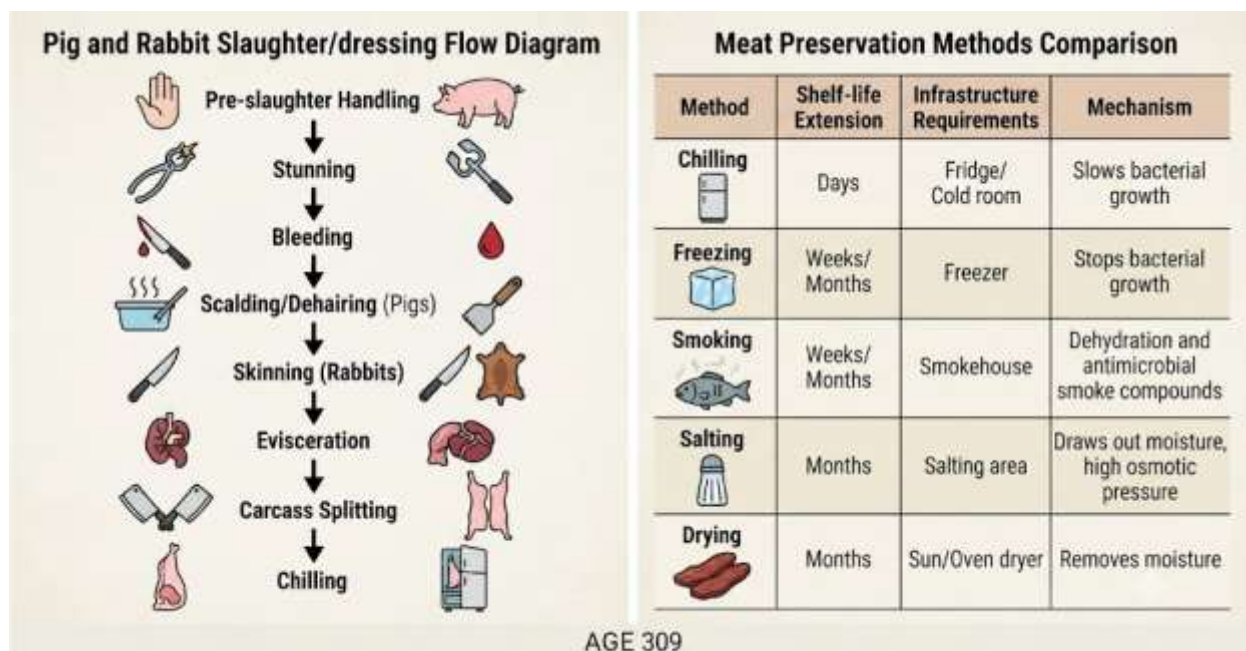


Figure 5.2: Swine/rabbit processing and meat preservation

Figure 5.2: Swine/rabbit processing and meat preservation

Pilot questions 5.2

1. Describe dehairing in pig processing.
2. Describe the slaughter method typically used for rabbits.
3. Explain why rabbit skin can be a marketable by-product.
4. Distinguish between chilling and freezing as preservation methods.
5. Name two traditional meat preservation methods and their mechanism.

5.3 Quality Assurance and Food Safety

5.3.1 Meat inspection and quality grading

Meat inspection (checking for signs of disease, contamination, or abnormality both before slaughter, ante-mortem, and after, post-mortem) protects consumers from unsafe product and identifies animals/carcasses requiring condemnation or further investigation, a food safety function distinct from, but related to, the quality grading discussed for live animals in Series 4.



Quality grading of dressed carcasses (by weight, fat cover, muscling, and visual defects) supports price differentiation and informs appropriate market positioning (whole bird/carcass sale versus cut-up/portioned products for different market segments), paralleling the agricultural produce grading principles covered in related marketing courses.

Fill in the blank: Meat _____ checks for signs of disease, contamination, or abnormality both before slaughter (ante-mortem) and after (post-mortem), protecting consumers from unsafe product.

5.3.2 Hygiene and sanitation in processing

Processing facility hygiene (clean equipment and surfaces, adequate water supply, proper waste/offal disposal, and pest control) and worker hygiene (clean protective clothing, handwashing, and exclusion of sick workers from food handling) together minimise contamination risk throughout the slaughter-to-market chain, extending the biosecurity and sanitation principles introduced in Series 1 and 3 into the processing stage.

Maintaining the cold chain (Part 5.2.3) from processing through distribution to final sale, avoiding temperature abuse (extended time at unsafe temperatures allowing bacterial growth), is a critical hygiene control point, particularly challenging in Nigerian contexts with inconsistent electricity supply and limited cold storage/transport infrastructure at smaller market scales.

Fill in the blank: Maintaining the cold _____ from processing through distribution to final sale, avoiding extended time at unsafe temperatures, is a critical hygiene control point in meat and egg marketing.

5.3.3 Regulatory framework for animal product safety

The National Agency for Food and Drug Administration and Control (NAFDAC) regulates food safety, including registration requirements for processed animal products sold commercially in Nigeria; veterinary services (federal and state) oversee animal health certification and meat inspection at abattoirs and slaughter facilities, a regulatory role distinct from but complementary to NAFDAC food product oversight.



Standards Organisation of Nigeria (SON) involvement in product standards, and local government regulation of slaughterhouse/abattoir operation and market hygiene, complete the multi-layered Nigerian regulatory framework governing animal product safety from farm through processing to final retail sale, similar in structure to the regulatory bodies discussed for crop-based food products in related agricultural marketing courses.

Fill in the blank: _____ services (federal and state) oversee animal health certification and meat inspection at abattoirs and slaughter facilities in Nigeria.

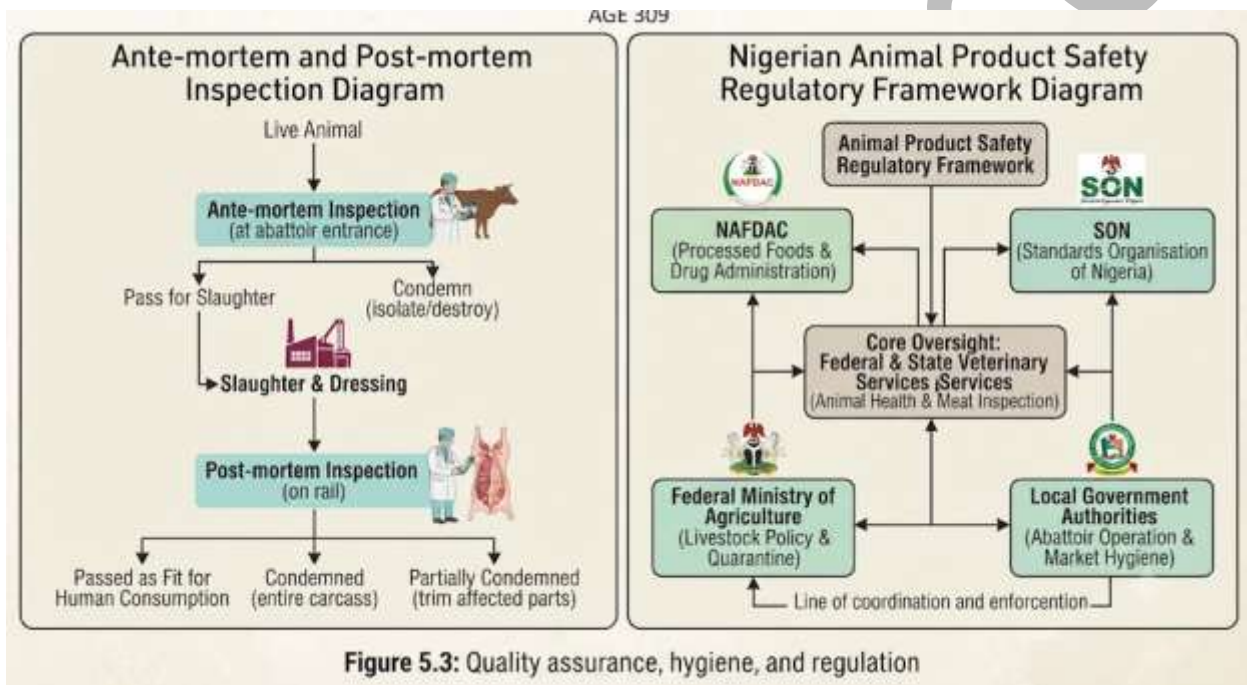


Figure 5.3: Quality assurance, hygiene, and regulation

Pilot questions 5.3

1. Distinguish between ante-mortem and post-mortem inspection.
2. Name three factors used in carcass quality grading.
3. Name two hygiene practices important in processing facilities.
4. Explain why maintaining the cold chain is a critical hygiene control point.
5. Name two Nigerian regulatory bodies involved in animal product safety.



5.4 Establishing a Non-Ruminant Enterprise

5.4.1 Enterprise planning and feasibility

Establishing a non-ruminant enterprise begins with feasibility assessment: evaluating market demand and access (Series 4), available capital and land, the chosen species and production system (Series 1-2) matched to the entrepreneur resources and skills, and a realistic understanding of the disease/health risks (Series 3) and management commitment required for the chosen scale and intensity.

A basic business plan (estimating start-up costs, ongoing operating costs, expected production and revenue, and break-even timing) helps clarify whether a proposed enterprise is likely to be financially viable before significant capital is committed, a planning discipline relevant across all the species and systems covered throughout this course.

Fill in the blank: A basic _____ plan, estimating start-up costs, operating costs, expected revenue, and break-even timing, helps clarify financial viability before significant capital is committed to a new enterprise.

5.4.2 Start-up requirements and scaling

Start-up requirements typically include securing appropriate land/site (Series 1 site selection principles), constructing or acquiring housing and equipment (Series 1), sourcing healthy foundation stock from reliable suppliers, and securing adequate working capital for feed, health products, and operating expenses until the first production cycle generates revenue.

Starting at a manageable scale (rather than over-extending capital and management capacity at the outset) and scaling up gradually as experience, cash flow, and market access develop, is generally a sounder strategy for new entrants than attempting large-scale operation immediately, reducing the risk of being unable to manage health, feeding, or marketing challenges effectively at an unfamiliar scale.



Fill in the blank: Starting at a manageable _____ and scaling up gradually as experience and cash flow develop is generally a sounder strategy for new entrants than attempting large-scale operation immediately.

5.4.3 Record keeping and business management

Production records (feed consumption, growth/weight, mortality, egg production, breeding dates) and financial records (income, expenses, and resulting profit/loss by production cycle) together support informed management decisions and allow tracking of enterprise performance over time, directly building on the record-keeping principles introduced for individual species management in Series 2.

Regular review of these records against production targets and financial projections (Part 5.4.1) allows early identification of underperformance (whether from health, management, feeding, or market factors) and informs decisions about culling, scaling, marketing channel adjustment, or other corrective action, completing the integration of production, health, marketing, and business management knowledge developed across all five Series of AGE 309.

Fill in the blank: Regular review of production and financial records against targets allows early identification of _____ and informs corrective management or business decisions.



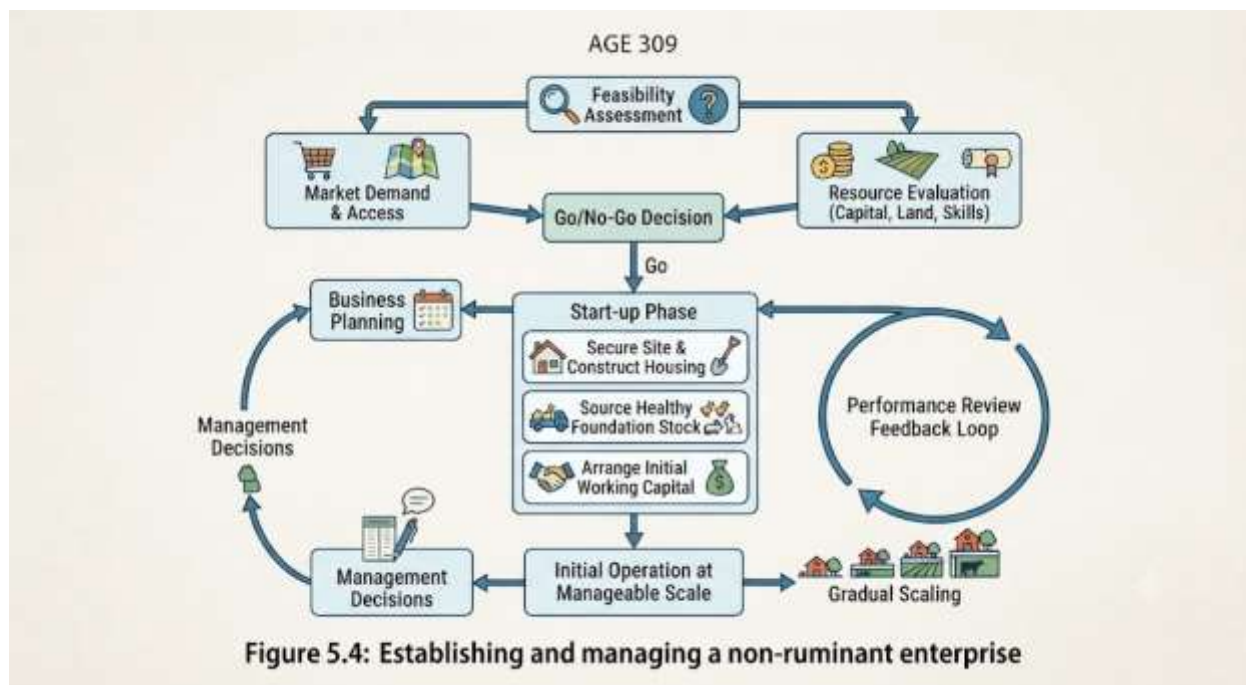


Figure 5.4: Establishing and managing a non-ruminant enterprise

Pilot questions 5.4

1. Name three factors to assess in enterprise feasibility planning.
2. Explain the purpose of a basic business plan.
3. Name three start-up requirements for a non-ruminant enterprise.
4. Explain why starting at a manageable scale is generally advisable for new entrants.
5. Explain how record keeping supports ongoing business management.



Series Summary

This Series examined **livestock-product processing as the conversion of animals and eggs into safe, marketable products while preserving quality and reducing losses**. Poultry processing involves pre-slaughter handling, stunning, bleeding, scalding, plucking, evisceration, and chilling, while egg handling includes collection, cleaning, candling, grading, and packaging. Pig processing requires dehairing, whereas rabbits are commonly skinned before chilling. Products may be preserved through chilling, freezing, smoking, salting, or drying.

The Series also covered **quality assurance and livestock-enterprise establishment**. Quality control requires ante-mortem and post-mortem inspection, carcass grading, hygiene, sanitation, and maintenance of the cold chain, under the supervision of agencies such as NAFDAC, veterinary services, SON, and local authorities. Establishing an enterprise requires a feasibility study, business plan, suitable site, housing, stock, equipment, and adequate capital. Farmers should begin at a manageable scale, expand gradually, and maintain accurate production and financial records to support planning and decision-making. By completing this Series, students should achieve SLOs 5.1–5.4 and all AGE 309 course outcomes.

Glossary of Terms

- **Ante-mortem inspection:** inspection of live animals before slaughter to check for disease or abnormality.
- **Candling:** examining eggs against a light source to assess quality or developmental status.
- **Cold chain:** the continuous maintenance of safe low temperature from processing through distribution to final sale.
- **Dehairing:** removing bristles from a pig carcass during dressing, by scalding/scraping or skinning.
- **Post-mortem inspection:** inspection of a carcass after slaughter to check for disease, contamination, or abnormality.



- **Scalding:** immersing a poultry or pig carcass in hot water to loosen feathers or bristles for removal.
- **Stunning:** rendering an animal unconscious before slaughter to reduce pain and improve worker safety and bleed-out quality.



Concept Check Questions [Series 5]

Objective Questions

1. _____, immersing carcasses in hot water, loosens feathers or bristles for removal during processing. (Linked to SLO 5.1)
2. _____, removing bristles by scalding/scraping or skinning, is a species-specific pig dressing step. (Linked to SLO 5.2)
3. _____ inspection checks live animals before slaughter for disease or abnormality. (Linked to SLO 5.3)
4. A basic business _____ estimates start-up costs, operating costs, and break-even timing. (Linked to SLO 5.4)
5. _____, examining eggs against a light source, assesses egg quality and developmental status. (Linked to SLO 5.1)

Short-Answer Questions

1. Name three steps in poultry processing after bleeding. (Linked to SLO 5.1)
2. Name two meat preservation methods. (Linked to SLO 5.2)
3. Distinguish between ante-mortem and post-mortem inspection. (Linked to SLO 5.3)
4. Name two Nigerian regulatory bodies for animal product safety. (Linked to SLO 5.3)
5. Name three start-up requirements for a non-ruminant enterprise. (Linked to SLO 5.4)

Long-Answer Questions

1. Describe poultry slaughter, dressing, and egg handling/processing practices. (Linked to SLO 5.1)
2. Describe swine/rabbit slaughter, dressing, and meat preservation methods. (Linked to SLO 5.2)
3. Explain quality assurance, regulation, and enterprise establishment practices. (Linked to SLOs 5.3, 5.4)



Answers to Concept Check Questions [Series 5]

Objective Questions

1. Scalding.
2. Dehairing.
3. Ante-mortem.
4. Plan.
5. Candling.

Short-Answer Questions

1. Scalding, plucking, and evisceration (or chilling).
2. Chilling and freezing (or smoking, salting, drying).
3. Ante-mortem inspects live animals before slaughter; post-mortem inspects carcasses after slaughter.
4. NAFDAC and veterinary services (or SON).
5. Site/land, housing/equipment, and foundation stock (or working capital).

Long-Answer Questions

1. Poultry processing involves stunning, bleeding, scalding, plucking, evisceration, and chilling. Egg handling involves collection, cleaning, candling, grading, and packaging.
2. Pig processing involves dehairing, evisceration, and chilling. Rabbit processing involves skinning and evisceration. Preservation methods include chilling, freezing, smoking, salting, and drying.
3. Quality assurance involves ante/post-mortem inspection, grading, hygiene, and cold chain maintenance, regulated by NAFDAC, veterinary services, and SON. Enterprise establishment involves feasibility assessment, business planning, start-up requirements, manageable scaling, and record keeping.



Answers to Pilot Questions [Series 5]

Part 5.1

1. Stunning renders birds unconscious before slaughter, reducing pain and improving worker safety and bleed-out quality.
2. Incomplete bleeding affects meat appearance, shelf life, and quality.
3. Carcasses are immersed in hot water (50-60 degrees Celsius) to loosen feathers for plucking.
4. Prompt chilling slows bacterial growth, important for food safety and shelf life.
5. Candling detects cracks, blood spots, or developmental problems in eggs.

Part 5.2

1. Dehairing removes bristles from the pig carcass by scalding/scraping or skinning.
2. A quick, humane method such as cervical dislocation or stunning followed by bleeding.
3. The pelt removed during skinning can be sold separately from the meat.
4. Chilling extends shelf life by days; freezing extends it much further (weeks to months).
5. Smoking (smoke compound deposition) and salting (salt concentration), both inhibiting microbial growth.

Part 5.3

1. Ante-mortem inspects live animals before slaughter; post-mortem inspects the carcass after slaughter.
2. Weight, fat cover, and muscling (or visual defects).
3. Clean equipment/surfaces and proper waste disposal (or worker hygiene practices).
4. Extended time at unsafe temperature allows bacterial growth, risking food safety.
5. NAFDAC and veterinary services (or SON, local government).

Part 5.4

1. Market demand/access, available capital/land, and species/system choice matched to resources.
2. It clarifies whether a proposed enterprise is likely to be financially viable before committing capital.
3. Site/land, housing/equipment, and foundation stock (or working capital).



4. It reduces the risk of being unable to manage challenges effectively at an unfamiliar scale.
5. It allows early identification of underperformance and informs corrective management or business decisions.

References and Attributions

Textual References (Books and External Sources)

- North, M. O., & Bell, D. D. (1990). Commercial chicken production manual (4th ed.). Van Nostrand Reinhold.
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Figures, Plates, Tables, and Boxes

- Figure 5.1: Poultry slaughter, processing, and egg handling Attribution: AI generated. Suggested OER search string: "poultry slaughter processing egg candling grading Nigeria non-ruminant OER".
- Figure 5.2: Swine/rabbit processing and meat preservation Attribution: AI generated. Suggested OER search string: "pig rabbit slaughter dressing meat preservation chilling smoking Nigeria OER".
- Figure 5.3: Quality assurance, hygiene, and regulation Attribution: AI generated. Suggested OER search string: "meat inspection NAFDAC veterinary services food safety regulation Nigeria non-ruminant OER".
- Figure 5.4: Establishing and managing a non-ruminant enterprise Attribution: AI generated. Suggested OER search string: "non-ruminant enterprise establishment business planning record keeping Nigeria OER".

