NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: ANP 301

COURSE TITLE: INTRODUCTION TO NON-RUMINANT ANIMAL PRODUCTION

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INTRODUCTION

The course consist of 3 Modules, Module 1 is Poultry Management, Module 2 Rabbit Management and Module 3 is Pig Management. The three Modules consist of 20 units.
7 units were dedicated to Poultry, 7units to Rabbits and 6 units to Pig Management.
The material in this course is based on practical approach to what is routinely practice on Poultry, Rabbit and Pig farms. The course has been developed to suit students of Animal Production, small and large scale Poultry, Rabbit and Pig keepers. In order to learn more about this course you are expected to make reference to other sources of information like the Library and Internet.
The course guide tells you all that you need to know about the course, what course material you will be using and more importantly you are encouraged to frequent Poultry, Rabbit and pig farms and offer to participate in the management aspect. This will be organized by your tutor as specified at the end of some units. This will go along way in enriching your knowledge and developing your skills in handling animals.
You will also find self assessment exercises embedded within each unit of the course for you to answer. At the end of each unit you will have standard tutor marked assignment questions(TMAQ) for you to answer and give your teacher for assessment.

What you will learn in the course
The course consists of three Parts which covers basic concept in non- ruminant animal management of Poultry, Rabbits and pigs.
In this course you are going to study the management of breeding stocks, growing and young animals of Poultry, Rabbits and Pigs. You will also study their housing, equipment and feeding principles. Production and management practices, livestock economics as well as health management of stock, processing and marketing of poultry, pigs and rabbits were discussed.

Course Aims
The course aim is to develop and strengthen your understanding of Non-Ruminant Animal Production and to be actively involve in animal management with a view to minimize the protein intake in-balance in Nigeria. The following is the summary of the course aims in which you are expected to be able to:

- Explain the term non-ruminants, their brief history, distribution and development.
- Discuss the advantages and disadvantages of keeping Poultry, Pigs and Rabbits.
- Recognize the problems or constraints of Poultry, Pigs and Rabbits production in Nigeria.
- Know the guide lines on how to improve Poultry, Pigs and Rabbits production in Nigeria.
- Distinguish the different commercial breeds of Chickens, Rabbits and Pigs and their Characteristics
- Understand the production systems and methods used in Poultry, Rabbit and Pigs.
- Know their nutrition, selection, common diseases, parasites, and their preventive and control measures.
- Be familiar with the processing and marketing of Poultry, Rabbits and pig products.

Course Objectives

To achieve the aims stated above, each unit has stated objectives at the beginning of the unit. You should Endeavour to read them before working through the course.
At the end of each unit, find out from the objectives if you have done what is required of the unit.

On successful completion of the course you should be able to
1. Explain with suitable examples, the term non-ruminants their historical background and distribution around the world.
2. Identify based on their physical appearance the different breeds of Poultry, Rabbits and Pigs.
3. Explain the procedure of processing and system of marketing poultry, Rabbit, Pigs and their products.
4. Take part in the management of Poultry, Rabbits and Pigs from day old to point of disposal or slaughter.
5. Identify the signs, of common diseases and parasites of non- ruminants and the measures necessary for their prevention.
6. Understand the Nutrition of non-ruminants, their requirements, sources and types.
7. Explain the adjustments needed in housing, system of production, with a view to improve the productivity of these animals in Nigeria.

Working through This Course
This course is very interesting, and requires you to spend some time to read and understand each unit, I would advice frequent visits to nearby Poultry, Rabbit and Pig Farms will help you to understand and better appreciate the course. Where possible try as much as you can to be involved in the management aspects (feeding, cleaning, disinfection, beak trimming, e.t.c.)

Course Materials
Major components of the course are;
1. Course guide
2. Study units
3. Textbooks
4. Visits to Poultry, Rabbit and Pig Farms

In addition to the above, there are some recommended textbooks for the course which are not compulsory for you to have or read. They are necessary as supplements to the course material.

Study units
The course consists of 20 units and divided into 3 Modules as follows:
Module 1 Poultry Management - 7 Units
Module 2 Rabbit Management -7 Units
Module 3 Pig Management -6 Units

The details of the 3 modules and their content are as follows:

Module 1: Poultry Management

Unit 1: General Introduction of poultry Management
Unit 2: Poultry Production Systems
Unit 3: Feeding principles of Poultry
Unit 4: Incubation and Hatchery practices
Unit 5: Management of day-old growers, layers and broilers
Unit 6: Poultry diseases and their prevention
Unit 7 : Poultry Products and Marketing

Module 2 Rabbit Management

Unit 1: General introduction of Rabbit Management
Unit 2: Principles of Feeding Rabbit and Feed Resources
Unit 3: Rabbit Reproduction
Unit 4: Rabbit Housing and Equipment
Unit 5: Husbandry Skills of Rabbit Production
Unit 6: Rabbit Health and Diseases
Unit 7: Killing and Processing

Module 3 Pig Management

Unit 1: General introduction of Pig Management
Unit 2: Pig Production Systems
unit 3: Principles of Feeding Pigs and Feed resources
Unit 4: Management of Breeding stock, Piglets, Weaners, Growing and Finishing pigs
Unit 5: Swine Diseases and their prevention
Unit 6: Swine Processing and Marketing

Module 1 Poultry Management (7 units)

The first unit in the material discusses the general introduction in Poultry Management including the meaning of poultry ,Taxonomy of the domestic fowl, the advantages and disadvantages of keeping poultry. Problems or constraint of poultry production in Nigeria as well as guidelines to improve poultry production were discussed finally breeds of chicken and their characteristics were explored.

The second unit introduces you to the different systems of Poultry production their advantages and disadvantages. you will also study Breeds of chickens and their characteristic. Poultry Housing, general principles of poultry housing in the tropics were discussed. You will also study poultry equipment and their Maintenance.

The third unit discusses the digestive system of poultry and their nutrient requirement.
You will study the nutrient allowance for poultry under tropical conditions, Feed requirement and body weight of Broilers, their growth rate, feed intake and floor space requirement of pullets.

In the fourth unit you will study the Reproductive system of the hen, avian egg and its composition. You will be exposed to the idea of Incubation its Essential requirements
The Operation of the incubator, hatchability and its Factors were also discussed.

In the fifth unit you will study the basic principles of managing day-old chicks, growers, broilers and layers. Feeding and watering Equipment, Temperature requirement of chicks were also discussed. You will be able to know the characteristics of a good layer and a good broiler.

The sixth unit deals with Poultry diseases and their prevention. Common diseases of parasitic, bacterial, and viral origin were discussed.

The seventh unit is about Poultry Products and Marketing. Exterior and interior qualities used for grading eggs, Egg processing and preservation were discussed.

Module 2 Rabbit Management (7 Units)

The first unit focused on the general introduction of rabbit management. The advantages and disadvantages of keeping rabbits will be studied. Problems or Constrains of rabbits production in Nigeria, guidelines on promoting rabbit production and Biological classification (taxonomy) were also discussed. Different breeds, their comparison and pictures are shown for clarity.

In the second unit you will study the Principles of Feeding Rabbit and Feed Resources.

The digestive system and nutrient requirement of rabbits were discussed. You will study the concept of Caecotrophy and Feeding systems of rabbits.

The third unit focused on Rabbit Reproduction. You will study the Male and female reproductive system, methods of selecting rabbits for breeding, their Mating, Kindling, Sexing and weaning. Pregnancy diagnosis in rabbits is also discussed.

Fourth unit is about Rabbit Housing and Equipment. In this unit you will study Housing requirements, Types of housing, Indoor hutches, Outdoor rabbit hutch and Floor methods of housing. You will also study Hutch equipment, their requirements and Maintenance.

In the fifth unit you will be exposed to Husbandry Skills of Rabbit Production like Observation, Rabbit examination, Weighing, Nail trimming and Identification**.** You will also study Record keeping and analysis which will enlighten you on Financial and Animal record keeping.

In the sixth unit you will learn Rabbit Health and Diseases, Signs of a healthy rabbit Conditions that make a rabbit susceptible to disease including Stress and how to minimize major stresses were discussed. Preventive measures for common diseases like Coccidiosis, Ear mange or skin mange, Snuffles and Myxomatosis are discussed.

In the seventh unit you will study Poultry Products and Marketing for example Egg marketing, Egg grading, Exterior and interior qualities used for grading eggs as well as Egg and bird processing of table birds.

Module 3 Pig Management (6 Units)

In the first unit you will be exposed to the general introduction to pig management, in this unit World pig population their distribution and consumption will be studied. Taxonomy or Biological Classification, Advantages and Disadvantages of pig farming and breeds of pigs will also be studied.

The second unit deals with Pig Production Systems, their advantages and disadvantages will also be studied. General consideration of designing pig house and Pig equipment will be explored.

In the third unit you will study Principles of Feeding pigs and Feed resources, Gastro intestinal tract (G.I.T) and nutrient utilization and Nutrient requirement of pigs for example Water, Energy, Protein, Minerals and Vitamins

Fourth unit deals with Management of Breeding stock, Piglets, Weaners, Growing and Finishing pigs. Management considerations like Stockman ship, Handling and restraint, Hygiene, Management of breeding stock selecting boar for service, Mating conditions, Frequency of use and boar-to-sow ratio, Management of Gilts/ Sows, Pigs breeding cycle and Recommended practices will be studied. You will also study the preparation needed before farrowing, Management of piglets like Creep feeding, Provision of iron, and the Culling of sows.

In the fifth unit you will be exposed to the study of Swine Diseases and their prevention.
External parasite, Endo parasites and common Infectious diseases of pigs will be studied.

The sixth unit is concerning Swine Processing and Marketing and this include Transporting the animals, the care of animals in the Lairage, Slaughter procedure
Bleeding, Scalding and de-hairing, Evisceration, Meat hygiene, Marketing and Uses of pig meat.

Text books

Where applicable the recent editions of these books are recommended for further readings.

- Adi, M. A. (1994) Sheep, Goat and Swine production in Nigeria
- Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) The Tropical Agriculturalist (CTA) Macmillan
- Holness, D.H., Smith, A.J. and Coste, R. (1991) Pigs The Tropical Agriculturalist (CTA) Macmillan.
- Lee, S. and Summers, J. D. (2000) Broiler breeder production.

- McDonald, P.,Edward, R.A., Greenhalgh, J.F.D. and Morgan,C.A. (1998) Animal Nutrition 5th edition.
- McDonald, I. and Low, J. (1985) Livestock rearing in the tropics Macmillan education Ltd.
- Sainsbury, D. (1992) Poultry Health and Management3rd edition Blackwell Scientific publication.
- Williamson, G. and Paye, W. J. A. (1987) An introduction to Animal husbandry in the tropics.

Presentation schedule

The Presentation schedule is included in your course materials and gives you the important dates for the completion of tutor-marked assignments. You are required to submit to your tutor for assessment by the stated dates

Assessment

There are two components of assessment for this course. The tutor marked Assignment (TMA), and the end of course examination.

Tutor marked assignment

There are twenty Tutor Marked Assignments Questions (TMA) in this course; you need to submit fifteen tutor marked assignments, (Five questions from each module) before you are allowed to sit for the end of course examination. The work you submit to your tutor for assessment will count for 30% of the total course mark.
You are expected to complete your assignments from the information and materials
contained in your set books, reading study units, interactions with farmers during your visits and the Internet. You are also advised to read as wide as you can to broaden your knowledge.
After completing each assignment, sent it together with a TMA (tutor marked assignment) form, to your tutor. Make sure each assignment reaches your tutor on or before the deadline given to you. If for other reasons you cannot meet the deadline, contact your tutor for a possible extension

date. Be warned extensions will not be granted after the due date unless for few exceptional cases.

Final examination and grading

This is the end of course examination, it is a three hours' duration and concludes the assessment for the course. It constitutes 70% of the whole course; you will be informed of the time for the examination. It may or may not coincide with the university semester examination.

Table 1: Course marking scheme

Assessment	Marks
Assignment 1-15	30% of course marks
Final examination	70% of course marks
Total	100% of course marks

Course overview

Table 2: course organization

Unit	Title of work	Weeks activity	Assessment (end of unit)
	Course guide	**1**	
	Module 1 Poultry Management		
1	**General Introduction of poultry Management**	**2**	**Assignment 1**
2	**Poultry Production Systems**	**2**	**Assignment 2**
3	**Feeding principles of Poultry**	**2**	**Assignment 3**
4	**Incubation and Hatchery practices**	**2**	**Assignment 4**

5	**Management of day-old growers, layers and broilers**	**2**	**Assignment 5**
6	**Poultry diseases and their prevention**	**2**	**Assignment 6**
7	**Poultry Products and Marketing**	**2**	**Assignment 7**
	Module 2 Rabbit Management		
1	**General introduction of Rabbit Management**	**2**	**Assignment 8**
2	**Principles of Feeding Rabbit and Feed Resources**	**2**	**Assignment 9**
3	**Rabbit Reproduction**	**2**	**Assignment 10**
4	**Rabbit Housing and Equipment**	**2**	**Assignment 11**
5	**Husbandry Skills of Rabbit Production**	**2**	**Assignment 12**
6	**Rabbit Health and Diseases**	**2**	**Assignment 13**
7	**Killing and Processing**	**2**	**Assignment 14**
	Module 3 Pig Management		
1	**General introduction of Pig Management**	**2**	**Assignment 15**
2	**Pig Production Systems**	**2**	**Assignment 16**
3	**Principles of Feeding Pigs and Feed resources**	**2**	**Assignment 17**
4	**Management of Breeding stock, Piglets, Weaners, Growing and Finishing pigs**	**2**	**Assignment 18**
5	**Swine Diseases and their prevention**	**2**	**Assignment 19**
6	**Swine Processing and Marketing**	**2**	**Assignment 20**
	Revision	**3**	
	Total	**44**	

How to get the most from this course

Most of what you will study in this course has practical application on the farm. If you run into any problem, telephone your tutor (you will be provided with the telephone number, e-mail or how to contact your tutor). It is your tutor's responsibility to help you when you need help, don't hesitate to call and ask your tutor to provide it.

The course overview is your reference for the time needed for each unit and the assignment related to the units.

Organize you study schedule and follow it strictly, refer to the course overview for the time you are expected to spend on each unit and also the assignment related to the units.

Work through each unit at the time required, where you are instructed to visit a nearby farm, you tutor will arrange for the visits and you are expected to observed the practical aspect of what you are learning. Feel free to discuss with your tutor and the farm keeper all your problems regarding what you have learnt.

Review the objectives for each study unit to make sure that you have achieved them. Incase of any difficulty you may contact your tutor. You also have self assessment exercise which you are required to answer on your own. Your ability to answer them is an indication of your understanding of the unit concerned. Try as much as you can to answer the questions.

When you are sure that you have achieved a unit's objectives, you can then start on the next unit. When you submit an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Always keep to your schedule. Pay serious attention to comments, corrections e.t.c from your tutor after collecting your assignments. Contact your tutor if you have problems.

After completing your last unit, review the course and prepare yourself for the final examination. Check to make sure you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed to this course guide)

Summary

This course, Non-ruminant animal management intends to strengthen your knowledge on the history, taxonomy, distribution, methods of production, selection, nutrition, marketing and processing of poultry, rabbits and pigs.

By the end of this course you will be able to answer endless questions about the management of non-ruminants. You will be able to:

- Discuss the advantages and disadvantages of keeping poultry, Rabbits and Pigs
- Compare and contrast the extensive/free range and the intensive system of poultry, rabbit and pig production.
- Explain the reasons for providing suitable housing for poultry, rabbits and pigs.
- Explain the term 'nutrition' and comment on the requirement of Energy, Protein, Minerals, Vitamins and water in non-ruminants.
- Describe management practices of day-old chicks, growers, layers and broilers in a poultry farm. The same applies to pigs and rabbits as the case may be.
- Describe the precautions to be taken by poultry, rabbit and pig farmers to prevent the spread of diseases.
- Discuss common diseases of poultry, rabbit and pigs and their control and prevention.

It is our sincere hope you find the course interesting and very useful. We wish you success in your studies and your future.

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3.2 Feeding and watering Equipment

3.2.1 Temperature requirement of chicks

3.3 Broiler Management

3.3.1 Signs of a good Broiler

3.4 Management of growers

3.5 Management of layers

3.5.1 Characteristics of good layer

3.6 Calculating Productivity of laying flock

4.0 Conclusion

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Unit 6: Poultry diseases and their prevention

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3.2 Diseases of poultry

3.3 Disease Prevention

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3.1.5 Egg processing and preservation

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Introduction to Non - Ruminant Animal Management

1.0 Introduction

What are Non-Ruminants?

Non-ruminant animals are those animals that have simple stomach. They possess no rumen, reticulum and omasum. They have abomasum as the only true stomach. Examples include Poultry, Rabbits and pigs.

Meaning of poultry

Poultry generally refers to domesticated birds that are used mainly as food to man. These include domestic fowl, ducks, turkeys, guinea fowl, pheasant, quails, ostrich, pigeons, doves etc. many species, breeds and strains of poultry are used in the service of man. Some of these species are of limited importance examples are guinea fowl, goose, ducks and the ostrich, others and particularly *Gallus domesticus* (domestic fowl) have assume a world wide importance.
Domestic fowl are believed to have been domesticated in Asia around 2500 $_{BC}$,
Geese in Egypt 1500 $_{BC}$, turkey in Mexico 2500 $_{BC}$, ducks in China 2500 $_{BC}$, Muscovey ducks were found in Peru in the sixteenth century and were probably domesticated at about that time. Most modern breeds of poultry were developed from 1850 onwards. Modern breeding programmes to produce hybrids started in 1950s and 1960s.

2.0 Objectives

By the end of this unit you should be able to:
a) Explain the terms poultry and non-ruminants.
b) Know the advantages and disadvantages of keeping poultry.
c) Understand the problems or constraints of poultry production in Nigeria.
d) Know the guide lines on how to improve Poultry production in Nigeria.
e) Distinguish the different commercial breeds of Chickens and their Characteristics.

3.0 Main Content

3.1 Taxonomy of the domestic fowl

It is important to trace the taxonomy of the domestic chicken in the animal kingdom considering its importance as a supplier of meat and eggs to ever growing population of the world.

Below is the taxonomy of the domestic chicken:

Kingdom - *Animalia*
Phylum - *Chordata*
Class – *Aves*
Subclass - *Neomithes*
Order - *Galliformes*
Family - *Phasinidae*
Genus – *Gallus*
Specie – *Gallus domesticus*

3.2 Advantages of poultry keeping

1) They have comparatively small body size which makes it reasonably possible to be raised in a confinement. The success of the extensive range of systems and methods that have been developed to produce chickens in widely varying environments is an important step to the success of poultry keepers.
2) There is a low cost of production and quick return from poultry compared to other farm animals.
3) Poultry meat and egg are high quality animal protein sources. Eggs are the most nutritive and have the best amino acid profile known to man.
4) Poultry are efficient feed converters to meat and egg (i.e. they have high feed efficiency)
5) Poultry production can be used to minimize the protein intake in-balance in Nigeria.
6) There is excellent product acceptance with respect to social and religious traditions, in other words no strong taboo against the eating of poultry product, thereby ensuring ready market for the products.
7) Curative and preventive drugs are available for most poultry diseases.
8) Poultry birds assist in scientific research.
9) Poultry also gives useful by-product like feathers and droppings (feaces).Their droppings contain more nitrogen, phosphorus, and potassium than other animal wastes.
10) From a genetic standpoint, the short inter-generation interval of this species (about 1 year) has favoured the rapid selection of breeds which meet more of the specific demands of consumers.

3.3 Disadvantages of keeping poultry

1) The digestive tract of birds is relatively short compared to other farm animals and can only utilize high quality concentrate feeds. These are also use as feed for human making them to be in direct competition with man.
2) They are highly susceptible to extreme weather conditions and diseases.

Self assessment exercise 1.1

1a. Explain the term ‘non-ruminants’ using suitable examples.
b. Discuss the advantages and disadvantages of poultry keeping.

3.4 Problems or constraint of poultry production in Nigeria

1) Because of the competition with man the cost of feed ingredient is high.
2) Housing, diseases and parasitic problems.
3) The nutrient composition of available feed ingredient not well understood.
4) The nutrient requirement of birds for maintenance and production is not well known.
5) Unavailability of adaptable egg laying and broiler birds.

3.5 Guidelines to improve poultry production

1) Farmers should provide balance ration to improve the birds diet.
2) Farmers should follow sound management practices.
3) Farmers should adopt proper vaccination programmes and effective disease control measures.
4) Farmers should renew their stock regularly.
5) Farmers should raise birds of imported breed that are more productive.

3.6 Breeds of chickens and their characteristics.

All breeds and varieties of chicken are due to natural selection. Many are commercially exploited. These include:

3.6.1 Egg type

These are breeds raise for egg production. They have small body size and slow growth rate. Examples are Harco, Ancona, Rhode island Red, black leghorn white leghorn.

3.6.2 Meat type:

They are breeds raised for meat production. They have large body size, they are also heavy breed, and they have faster growth rate. Examples are light Sussex, white Sussex, white Wyandotte, Plymouth rock and Anak.

3.6.3 Dual purpose:

These are birds that are raised for both meat and egg production. Examples are Light Sussex, Rhode Island Red, Plymouth Rock, New Hampshire etc.
In today's economic reality, in developed countries dual-purpose breeds are regarded as in efficient, producing neither meat nor eggs very efficiently. However in Nigeria dual-purpose birds can be very useful especially in less intensive systems of production.
For example the cocks are used for meat production and the hens for the production of both eggs and meat. Both are considerably older when slaughtered than are broilers and there fore, have more flavour.

3.6.4 Rhode Island Red

The Rhode Island red originate from America the feather is red with some black feather in part of the wing. It has yellow skin and lays large brown eggs.

3.6.5 Leghorn

The white leghorn has white feather and is use mainly for egg production. It is small in size and lays over 300 white shell eggs in a year.
The brown leghorn produces brown shells eggs and is not as productive as the white leghorn.

3.6.6 Light Sussex

It is an important English breed which grows rapidly. It is large with good fleshing property. It is good as a broiler but poor as a layer. Some exotic breeds of chicken are shown below.

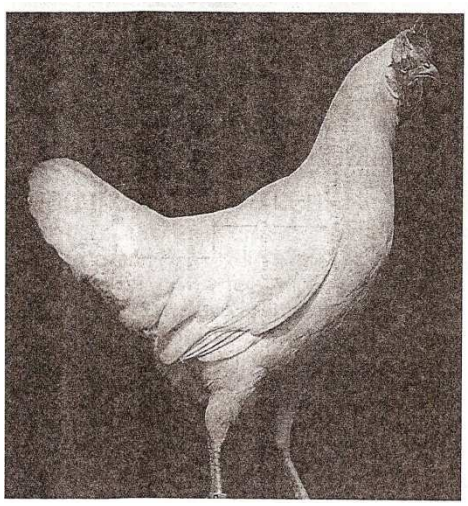


Fig 1.1 White leghorn

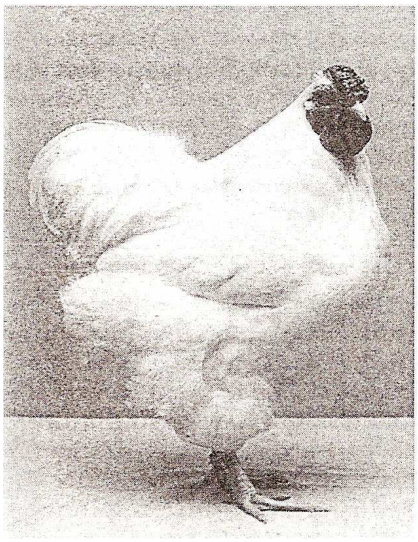
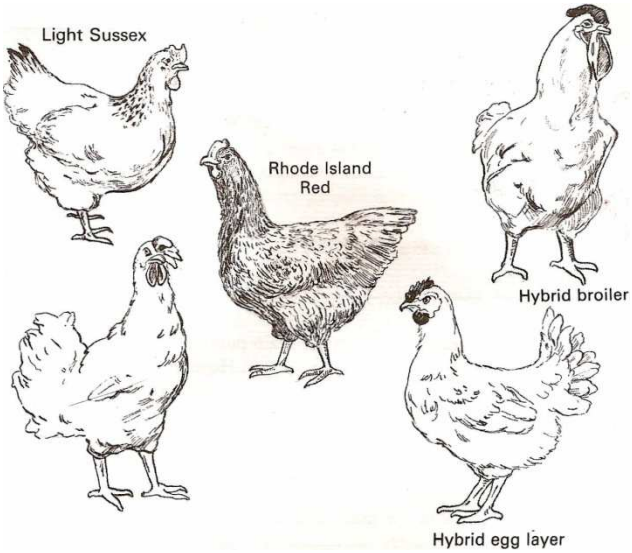
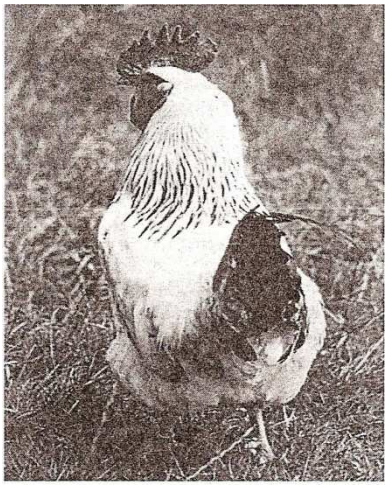


Fig 1.2 White Wyandotte

Source: Poultry - Tropical Agriculturalist by A. J. Smith, page14 &15





Source: *Poultry - Tropical Agriculturalist by* A. J. Smith, page 15

Fig 1.3 Light Sussex

White leghorn

Fig 1.4 Poultry breeds

Source: *Livestock rearing in the tropics by I. McDonald and J. Low, page 90*

3.6.7 Barred Plymouth Rock

The feather colour is grayish black with white underneath, while the sides are black with prominent streaks of white spots. They are heavy breeds and are used for dual purpose. They lay brown eggs.

3.6.8 Harco:

Harco is a heavy American breed and has been commonly used to develop the present day breeders. It is a good egg laying bird.
Other breeds like the Ancona, Andalusian and Spanish white are all of the Mediterranean origin and are early maturing between 150-160 days, producing 240-250 white shell eggs per year.

3.6.9 Local breeds

These are breeds peculiar in the west African sub-region they are generally small with tough flesh. They are poor layers but good brooders. Their feather varies in colour from white to black including multi-colour mixtures.

3.6.10 Hybrids

They are commonly seen and use in commercial farms. They are generally high yielding in both meat and egg production. They are fast replacing most standard birds.

4.0 Conclusion

There are many advantages of keeping poultry, the few problems associated with their keeping can be corrected by following some few guidelines. Several breeds of chickens are available and can be commercially exploited.

5.0 Summary

In this unit w have learnt that:

- Poultry generally refers to domesticated birds that are used mainly as food to man. These include domestic fowl, ducks, turkeys, guinea fowl, pheasant, quails, ostrich, pigeons, doves etc.

- Advantages of keeping poultry include-their small body size, low cost of production, high quality protein, feed efficiency, not associated with taboos, useful by-products, short generation interval and help to improve protein intake.
- Problems associated with poultry keeping includes, feed competition with man, housing, diseases, parasites and lack of adequate knowledge in their nutrition.
- To improve poultry production we need to improve birds diet, sound management practices, vaccination programs e.t.c.
- There are several breeds of chickens that are available and all can be exploited commercially.

6.0 Tutor Marked Assignment

1a) List the problems and constraints of poultry production in Nigeria and suggest ways of their improvement.
b) Name five improved breeds of chickens that are found in Nigeria.
c) Briefly explain the characteristics of any three breeds mentioned above.

7.0 References and Further readings

Lee, S. and Summers, J. D. (2000) *Broiler breeder production.*
McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics* Macmillan education Ltd.
Sainsbury, D. (1992) *Poultry Health and Management*
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Introduction to Non-Ruminant Animal Management: Poultry Management

Unit 2: Poultry Production Systems

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1.0 Introduction

There are several production systems employed by poultry farmers in different parts of the world. Examples include: Extensive or Free range system, Semi-intensive or Restricted range system and Intensive system. Each of these systems has its merits and demerits.
Poultry of various classes are kept either for meat or egg production. For example white leghorns are normally used for egg production while broiler strains are based on crosses between Cornish white, New Hampshire and white Plymouth Rock.
Large poultry units are being increasingly developed in areas of high temperature that are not traditional to advanced methods of husbandry and special techniques are needed for satisfactory management of poultry under these conditions.
In a tropical environment the design and construction of poultry houses must take into consideration the climatic and weather conditions of the environment. The guiding principle is to keep poultry productive throughout their producing life. This involves the provision of optimum conditions of temperature, humidity, ventilation and light.
Another important principle relates to design and durability. Poultry house should be structurally strong, durable, and cheap.

2.0 Objectives

By the end of this unit you should be able to:
a) Know the different systems used in the production of poultry.
b) Understand the advantages and disadvantages of each production system of keeping Poultry.
c) Understand the guide lines on how to improve on our Poultry production system in Nigeria.
d) Distinguish the different commercial breeds of Chicken that are suitable for each production system based on their Characteristics.

3.0 Main content

3.1 Extensive /free range system

This system involves the rearing of chickens in an open unrestricted environment with or without artificial shelter. This is the most common system of poultry production in Nigeria. It has the following advantages

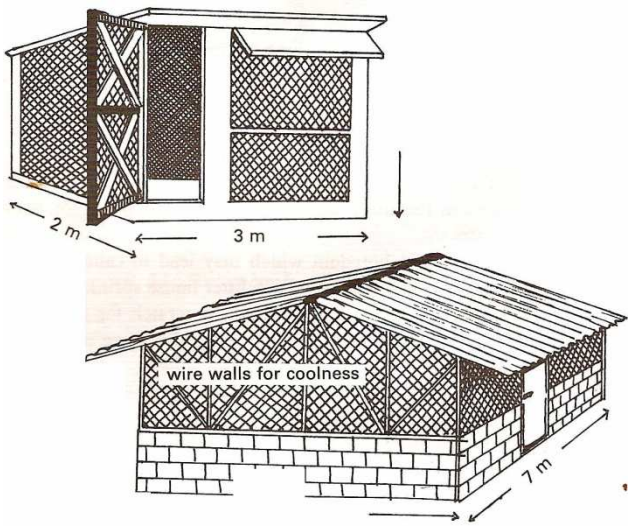
3.2 Advantages

1) Reduce cost of feeding.
2) Nutritional deficiencies rarely occur because of access to green feed, grains, white ants and other insects.
3) It involves low capital investment.
4) It eliminates cannibalism among the birds.

3.3 Disadvantages

1) Difficulties in controlling birds, especially during disease outbreak, breeding and proper feeding.
2) Loss of eggs and birds through accidents, theft and predators.

3) Requires large area of land.



3.4 Semi – intensive/restricted range system

This system involves the use of poultry rum which is an area of land enclosed by fence of wire netting. The birds are allowed to wonder about during the day and at night they are kept in poultry house.

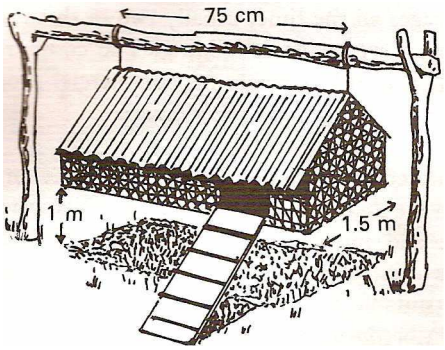


Fig 2.1 Suspended poultry house for about 10 birds

Source: *Livestock rearing in the tropics by I. McDonald and J. Low page 92*

a)

b)

Fig 2.2 a) Simple chicken house for hot areas for 10 birds.

b) Deep litter house for 200 layers, warm climate

Source: *Livestock rearing in the tropics by I. McDonald and J. Low page 92*

3.4.1 Advantages

This system has the advantages that the birds are under strict control e.g. prevented from crossing with inferior cocks. The birds are protected from predators and accidents.

3.4.2 Disadvantages

The disadvantages include high cost of production and large space or land requirement.

3.5 Intensive system

3.5.1 Deep litter system.

In the deep litter system, the birds are confined to a large permanent house. The floor is kept covered with finely cut straw, rice hall or sawdust. Troughs of dry mash and water are always made available for the birds.
An initial litter layer of 2-3 inches is recommended for young birds, this is build up to 9 inches for the adult birds. The litter is normally renewed ones every year or when it becomes lumpy. Floor space per bird is 1 square feet or 30.5cm.^{2}
This system can be use to raise broilers and layers. In addition to feeding and water troughs, perches and nest boxes are provided for the layers.

3.5.2 Advantages

1) No risks of trouble from predators.
2) With proper condition, there is less risk of parasitic infection.

3.5.3. Disadvantages

1) Increase chances of nutrient deficiency especially when bird are not well fed, incidence of cannibalism also increases.
2) Difficulties of keeping the floor clean especially during the rainy season when humidity is very high.
3) It involves high capital investment.
4) It predisposes birds to social vices such as fighting, cannibalism, broodiness in laying birds.

3.6 Battery cage system

The birds are housed or kept in cages within the house. The cages varies in size, type and form but they are all designed with facilities to provide water and feed as well as egg and droppings collection. The system is very efficient for raising layers. The cages are either constructed entirely of wire or wire and wooden frames. Most cages are about 18 inches high and 8 inches deep. The width of individual cages varies depending on whether they are designed to hold one, two or more birds(14 inches for one layer or two light breeds).
The floor is of wire mesh to allow droppings drop through. The floor slopes from behind into which eggs roll as they are laid. The cages are usually arranged in blocks of 3 or 4 tiers. See fig 2.3a. Modern cages incorporates some forms of mechanical feeding.

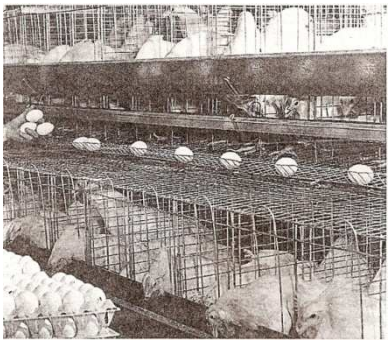


Fig. 2.3a Intensive *Battery house*

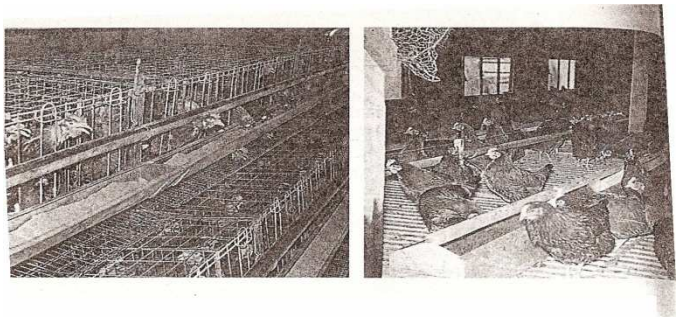


fig 2.3bHouse with a slatted floor

Source: *Tropical Agriculturalist by A. J. Smith page 132*

3.6.1 Advantages

1) The birds are easy to manage.

2) It is also very easy to cull unproductive birds.
3) Better control of parasites and minimal incidence of diseases.
4) It also prevents cannibalism and broodiness in birds.
5) High production and low mortality rate.

3.6.2 Disadvantages

1) It involves high capital investment.
2) There is need for a well balance ration.

3.7 fold system

The fold system has a house made together with the run to form one unit. This unit can be moved from one place to another. (see fig 2.4)

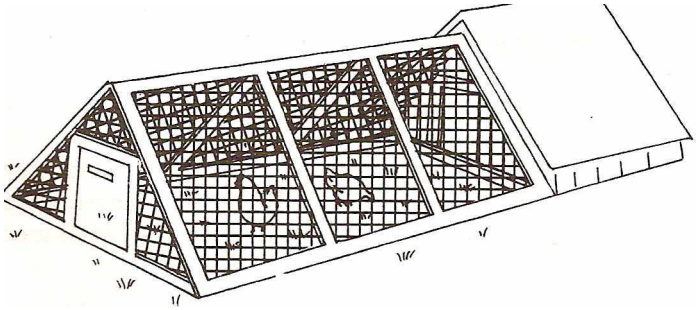


Fig 2.4 Fold unit, should be moved daily

Source: Livestock rearing in the tropics by I. McDonald and J. Low page 92

3.7.1 Advantages

1) The birds can be examine and attended to individually when necessary.
2) The birds dropping improves the soil fertility.
3) Farmers can combine poultry keeping and crop rotation.
4) There is reduced build-up of parasite because the unit can be moved from one place to another.

3.7.2 Disadvantages

1) The system is only suitable for small or backyard poultry business.

3.8 Poultry Housing

Reasons for providing suitable housing for poultry

1) To protect the birds from bad weather.
2) To protect the birds from thieves and predators.
3) To be able to control the birds.
4) To be able to keep the birds in age group

3.8.1 General principles of poultry housing in the tropics

In a tropical environment the design and construction of poultry houses must take into consideration the climatic and weather conditions of the environment. The guiding principle is to keep poultry productive throughout their producing life. This involves the provision of optimum conditions of temperature, humidity, ventilation and light.
Another important principle relates to cost and durability. Poultry house should be structurally strong, durable, and cheap.

3.8.2 General guidelines:

The following guide lines will help a poultry farmer in providing simple and adequate housing for poultry under tropical conditions.

1) External wall should be low(about 0.6m-1m) with a chicken wire mesh(1-2cm) extending from the wall to height of 2m leaving some margin under the roof for un impeded or free air flow.
2) The roof should be of corrugated material or thatched.
3) There should be enough roof overhangs to prevent rain from entering the pens.
4) Internal partitions when necessary should be made of wire mesh to aid unrestricted air circulation.
5) The poultry house should be clear of other buildings or structures which may obstruct the free flow of air.
6) The poultry house should not be too wide (more than 9m) as this tend to cut down fresh air movement in and out of pen.
7) The house should be constructed in an east west direction, to protect the birds from the direct rays of the sun.
8) Water reservoir should be located under shades to prevent excessive heat up of water during hot days.
9) Stocking density for tropical areas should be 10-20% lighter than the temperate environment.
10) Poultry houses should be located on a well-drained ground to prevent flood.
11) The poultry house should be accessible by road to facilitate evacuation of produce or delivery of feed and other supplies.

3.9 Poultry equipment

It is very important that food troughs should not be overfilled and neither should the tube feeders be too widely opened (fig.2.5 and fig. 2.6) the construction of the food trough is also important and there exist types that reduce spillage and so reduce food wastage by up to 20 percent. Food wastage can turn a profitable enterprise into one making a considerable loss.

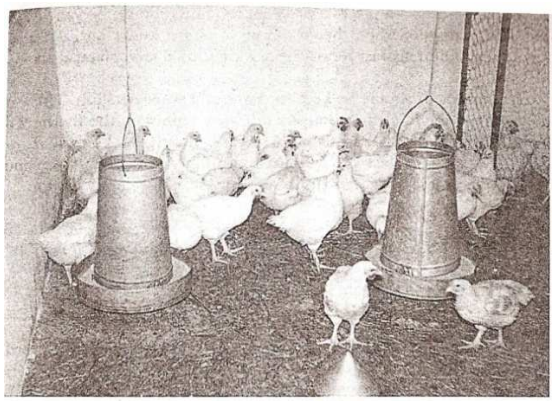


Fig 2.5 Growing birds in pens where the food s is provided in tube feeders

Source: *Tropical Agriculturalist by A. J. Smith page 129*

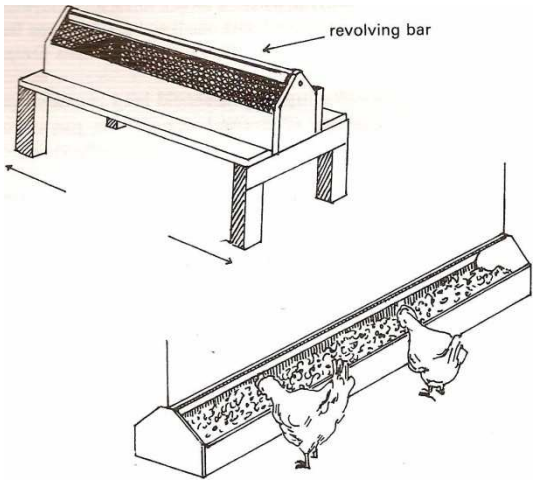


Fig 2.6 Feed trough and suspended feed tray for poultry

Source: *Livestock rearing in the tropics by I. McDonald and J. Low page 98*

Table 2.1 Floor space and trough space requirement per 100 chicks

Age (weeks)	**Floor space (m^2)**	**Trough space (m)**
0-4	4	1.5
5-8	9	3.0
9-20	12	6.0

For drinkers and food troughs the requirements are
1. It should be impossible to tilt over.
2. It should have adequate size and depth.
3. It should discourage scratching out of contents.
4. It must not cause injury to the bird.
5. It should be cheap and can be constructed locally.
6. It should allow the bird full access and not limit food intake.

3.9.1 Maintenance of poultry equipment

Proper maintenance includes the following:
- cleaning of feeders and drinkers and emptying them every day in case of deep litter system;
- Complete cleaning using soap and water and if possible disinfectants. This should be followed by complete drying and disinfection in direct sunlight;

Self assessment exercise 1.2

a. Discuss the general principles of poultry housing under tropical conditions.
b. List the qualities of good feeders and drinkers on a poultry farm

4.0 Conclusion

There are several production systems employed by poultry farmers in different parts of the world, these are Extensive or Free range system, Semi-intensive or Restricted range system and Intensive system. Each of these systems has its merits and demerits.
However, In a tropical environment the design and construction of poultry houses must take into consideration the climatic and weather conditions of the environment.

5.0 Summary

In this unit we have learnt that:
- Poultry has proved to be particularly versatile domestic bird that is adapted to almost all environments and system of production.
- Poultry production makes it an open choice for the farmer to decide which system of production he is interested based on his capital, skills, and needs.
- In a tropical environment the design and construction of poultry houses must take into consideration the climatic and weather conditions of the environment.
- The guiding principle is to keep poultry productive throughout their producing life. This involves the provision of optimum conditions of temperature, humidity, ventilation and light.
- Another important principle relates to cost and durability. Poultry house should be structurally strong, durable, and cheap.

- It is very important that food troughs should not be overfilled and neither should the tube feeders be too widely opened. The construction of the food trough is also important and there exist types that reduce spillage and so reduce food wastage by up to 20 percent.
- Food wastage can turn a profitable enterprise into one making a considerable los.

6.0 Tutor Marked Assignment (TMA)

1a. Compare and contrast the extensive/free range system and the intensive system of poultry production.
b. Explain the reasons for providing suitable housing for poultry.

7.0 References and Further readings

Lee, S. and Summers, J. D. (2000) *Broiler breeder production.*
McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics* Macmillan education Ltd.
Sainsbury, D. (1992) *Poultry Health and Management*
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Williamson, G. and Paye, W. J. A. (1987*) An introduction to Animal husbandry in the tropics.*

roduction to Non-Ruminant Animal Management:

Poultry Management

Unit 3: Feeding principles of Poultry

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1.0 Introduction

The digestive system of the fowl is simple but well-organized. Food is picked up by the beak and selected on the basis of feel and appearance rather than tastes. However, birds do have a functional olfactory system and the influence of taste and smell cannot be entirely overlooked.

To understand the principles behind the feeding of the chicken it is useful to look at the way the birds digest its food.

Poultry are monogastric they are unable to manufacture essential amino acids or the B vitamins, and they cannot exist on high fibre diets. The diets of birds which are intensively housed and which have access to neither soil, grass, nor sunshine must contain the materials essential for the processes of maintenance, production and reproduction.

The essential nutrients can be conveniently grouped under the following:

- Water
- Carbohydrates } sources of
- Fats and oils } Energy
- Protein (amino acids)
- Vitamins
- Minerals

2.0 Objectives

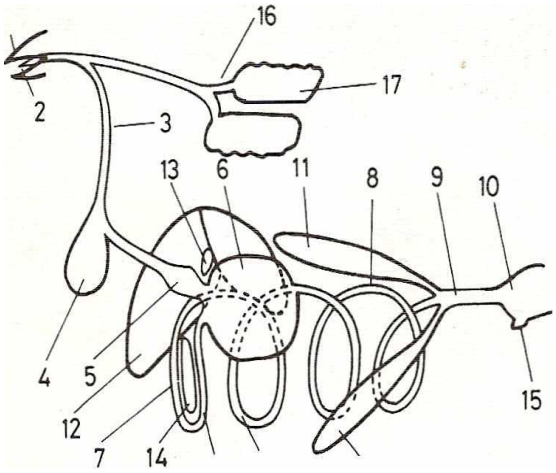
By the end of this unit you should be able to:

a) Understand how digestion takes place in the poultry.
b) Learned the nutritional requirement of poultry in terms of their energy, protein vitamin and mineral needs.
c) Know the plant and animal sources of proteins and other types of feed available to poultry.
d) Appreciate the recommended nutrient allowance for poultry under tropical conditions.
e) Be familiar with growth rate, feed intake and floor space required of pullets, broilers etc.

3.0 Main Content

3.1 Digestive system of poultry

1



1. Beak
2. Tongue
3. Oesophagus
4. Crop
5. Proventriculus
6. Gizzard
7. Duodenum
8 Small intestine
9. Large intestine
10. Cloaca
11. Caeca
12. Liver
13. Gall-bladder
14. Pancreas
15. Bursa of fabricus
16. Bronchus
17. Lung

Fig : 3.1

Source: *Poultry Health and Management by D. Sainsbury page 24*

The fowl is a simple stomach animal. Digestion starts from the mouth. The beak is adapted for picking of the feed. The tongue is an arrow shaped barbed like structure which forces feed into the oesophagus. Salivary glands secrete saliva which lubricate the feed and facilitate the downward movement into crop. The crop act as a storage pouch which retain feed for gradual passage into the stomach (proventriculus). The feed acted upon by enzymes and amylase which break down carbohydrate. In the stomach, feed mixed with gastric juice containing enzyme pepsin and hydrochloric acid. The Pepsin breakdown protein into amino acid. The feed particles then moves into the gizzard which is a bean shaped strong muscular organ, which crushes or breakdown feed particles by its rhythmic contraction into pulp. This process is assisted by the presence of insoluble grit, the feed then passes into the duodenum loop which is the first part of the small intestine where most of the enzymatic digestions of feed take place. The pan crease secret various amylotic, proteolitic and lipolitic enzyme into the duodenum. The liver also produces bile which hydrolyses fats. Digestion is completed in the small intestine and the nutrients are absorbed through its wall. At the junction of the large and small intestine are two blind sacks known as caeca. Their main function is for fibre digestion and water absorption.

Large intestine is also responsible for water absorption and storage of feacal matter or digesta which passes into the cloaca where they are secreted.

3.2 Nutrients requirements of poultry

3.2.1 Nutrition:

Nutrition is the process which provides nourishment to a living organism. This implies the provision of certain food elements (nutrients) which the body of the organism absorbs and uses to perform its normal function associated with life as well as storing the excess in its tissue. The nutrients required by poultry include:

1) Energy
2) Protein
3) Vitamins
4) Minerals
5) Water

3.2.2 Energy

Energy requirement by poultry are supplied from carbohydrate and lipids. In adverse condition, protein can also be broken down to supply energy. The energy in poultry is normally expressed in unit of metabolizable energy per unit weight e.g. kilo joule/gram (KJ/G) or requirement in terms of metabolizable energy per day (KJ/day).

The metabolizable energy refers to that portion of the feed which is available to the bird for the production of meat and egg and for the maintenance of vital function and body temperature.

Birds are usually given free access to feed and they eat to satisfy their energy requirement. The more increase in energy value of feed the less its intake and the reverse is true.

Sources of energy

Maize; Sorghum; Millet; Wheat; Barley; Maize bran; Wheat bran;
Brewers dried grain (BDG); Cassava; Yam; Vegetable oils (groundnut coconut, soybean cotton seed e.t.c.)

3.2.3 Protein

Proteins are nitrogen containing compounds. They promote growth and flesh formation. Proteins are made up of units of amino acids. The synthesis of proteins in the body requires about twenty different amino acids. Ten of these amino acids can not be synthesis by the birds and must be provided in the diet.These are termed essential amino acids. Examples include:

Phenyl alanine; Valine; Threonine; Tryptophan; Isoleucine; Methionine; Histidine; Arginine; Leucine; Lysine

The non essential amino acids are:

Alamine, Aspartic acid, Glycine, Proline, Hydroxyl praline, Tyrosine, Serine,
Cysteine, Cystine, Glutamine

Of all the essential amino acids. Lysine, methionine and tryptophan are called critical amino acids because they are the most limiting amino acids in feed stuff.

In general deficiency of essential amino acids leads to poor growth, poor egg production and low feed utilization.

Sources of proteins

Sources are of two types, plants and animal sources.

Plant sources

Sunflower meal, Palm kernel meal, Soya bean, Bambara nut, Cotton seed cake
Ben seed meal, Bambara nut meal, Locust bean meal, Shear butter meal
Groundnut cake, Soybean meal, Cowpea e.t.c.

Animal sources

Fish meal, Meat meal, Maggot meal, Termite meal, Chicken offal meal, Grasshopper meal, Feather meal, Meat and bone meal, Blood meal e.t.c.

3.2.4 Water

Water is the most important nutrient of farm animals. The body of chicken is composed of at least 70% of water so also the egg. It is usually made freely available to poultry.
The water intake of birds varies with age, temperature, size, diet and rate of egg production.

Table 3.1 Estimated water intake (at 21°C) of chicken of various ages:

Age (week)	**water intake/100 birds (litre/day)**
0 - 2	4 - 5
2 - 5	7 - 10
5 - 10	15
10 - 20	18 - 22
Adult layers	20 - 30

Lack of water can seriously retard growth rate and impaired egg production. In tropical countries water deprivation can lead to death within a very short period of time

3.2.5 Minerals

Minerals are inorganic substances required by farm animals to build their skeleton and perform various metabolic function in the body. Minerals are classified into two groups based on their level of requirement.

1) Macro or major elements which are minerals required in relatively large quantity which are calcium, potassium, magnesium, sodium chlorine and sulphur.
2) Micro or minor elements which are required in small quantities. These are iron, zinc, copper, molybdenum, selenium, iodine, manganese, cobalt and fluorine.

The major minerals in poultry feeding are calcium and phosphorus.
The common sources of minerals include:
Bone meal
Oyster shell
Limestone
Di calcium phosphate
Common salt
Wood ash
Green grass etc
The micro minerals are usually in corporated as pre-mix in which form they contains most of the trace minerals in the right proportion required by the various classes of chicken.

3.2.6 Vitamins

Vitamins are organic compounds not synthesis by the body but essential for normal growth and good health. They are required in small amount. There are thirteen vitamins required by poultry. They are the fat soluble and water soluble vitamin.

Fat soluble vitamins include:
Vitamin A, D, E, K
Water soluble vitamins include:

Thiamine (B1)
Riboflavin (B2)
Pyridoxine (B6)
Pantothenic acid
Nicotinic acid
Biotin
Folic acid
Cobalamine (B12)
Ascorbic acid
Some of these vitamins are available in green feeds, grains and animal proteins.
All are available in synthetic form (vitamin premix).

3.2.7 Feed additives:

1) Anti oxidants: examples include ethoxyquine or butylated hydroxytoluene at the rate of 112g per tone of feed to prevent oxidation of vulnerable vitamins especially vitamin A.
2) Coccidiostats: This is usually introduced at prophylactic levels in broilers diet according to the recommendation of the manufacturers. It is completely withdrawn towards the end of the fattening period

3.2.8 Types of poultry feed

Table 3.2 Types of poultry feed

Classes of poultry	**Age (weeks)**	**Ration**
Broilers	0-6	Broiler starter
Broilers	7-10	Broiler finisher
Layers, Breeders & pullets	0-8 9-16 17 and above	Chicken starter mash Growers mash layers mash.

3.3 Recommended nutrient allowance for poultry under tropical climatic conditions.

Table 3.3 Nutrient allowance for poultry under tropical climatic conditions

Nutrients	**Chicken ration**	**growers ration**	**Layers ration**	**Broiler starter**	**Broiler finisher**
Crude protein (%)	19.5	15.0	16.5	22.0	20.0
Crude fibre (%)	5.0	6.0	5.0	5.5	5.5
Metabolizable energy(kcal/kg)	2700	2650	2600	850	2900
Calcium (%)	1.0	0.80	3.20	1.0	0.80
Phosphate (%)	0.45	0.50	0.50	0.70	0.50
Sodium (%)	0.15	0.10	0.15	0.15	0.12
Vitamin A (iu)	5000	3500	4000	5000	3500
Lysine (%)	100	0.65	0.70	1.30	1.10
Methionine (%)	0.40	0.30	0.35	050	0.40
Tryptophan (%)	0.20	0.15	0.18	0.25	0.20

3.3.1 Feed requirement and body weight of Broilers

Table 3.4 Feed requirement and body weight of Broilers

Age (weeks)	Average weight/bird (Kg)	Feed requirement/ 100 birds (kg)	Feed requirement cumulative/100 birds
1	0.036	10	10
2	0.080	18	28
3	0.140	21	49
4	0.200	26	75
5	0.350	39	140
6	0.510	52	166
7	0.90	58	224
8	1.5	67	286
9	2.1	67	358
10	2.5	71	424

3.3.2 Growth rate, feed intake and floor space requirement of pullets

Table 3 .5 Growth rate, feed intake and floor space requirement of pullets

Age week	Body weight(g)	Feed/bird/Day (gm)	Floor space cm^2/ bird
1	45	10	232
2	90	16	232
3	126	22	232
6	270	44	464
10	427	63	0.10
15	652	69	0.18
18	780	75	0.30
20	850	79	0.30

Note *An average layer would consume 100gm of feed per day or up to 130gm for heavy breeds.*

Self assessment exercise1.3

1a) With the aid of a diagram briefly explain the process of digestion and absorption in poultry.
b) Explain the term 'nutrition' and comment on the requirement of Energy, Protein, Minerals, Vitamins and water in poultry.

4.0 Conclusion.

Poultry nutrients is made up of Water, Carbohydrates, Fats and oils, Proteins (amino acids), Vitamins and Minerals, when these nutrients are ingested by poultry is capable of being digested, absorbed and utilized to supply us with eggs and poultry meat.

5.0 Summary.

In this unit we have learnt that:

- The fowl is a simple stomach animal and digestion starts in the mouth, ends in the small intestine and nutrients are absorbed through its wall.
- Caecum is for digestion of fibre and water absorption, while the large intestine is for absorption of water and storage of faecal matter.
- Energy required by poultry is supplied from carbohydrates, lipids and sometimes proteins.
- Essential amino acids are those amino acids that cannot be synthesized by the bird and must be provided in the diet. In poultry, lysine, methionine and tryptophan are the critical amino acids because they are the most limiting amino acids in feed stuff.
- Minerals are classified into macro or major and minor or micro elements. Those minerals required in large quantities are the major or macro minerals while those required in small quantities are the micro or minor minerals
- 13 vitamins are required by poultry, they are either fat or water soluble.

6.0 Tutor marked assignment

1a) What are proteins, Minerals and Vitamins?

b) Discuss proteins, Minerals and Vitamins under the following:
i) classification
ii) examples of each class
iii) common sources

7.0 References and Further reading

Lee, S and Summers, J. D. (2000) *Broiler breeder production.*
McDonald, P., Edward, R.A., Greenhalgh, J. F. D. and Morgan, C.A. (1998) *Animal Nutrition 5th edition.*
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Introduction to Non-Ruminant Animal Management:

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Unit 4: Incubation and Hatchery practices

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1.0 Introduction

Incubation is the management of fertilized eggs to ensure normal development of embryo into normal chick. Incubation can be achieved naturally (when the hen sits on the eggs for a period of time and keeps the eggs warm until hatching) or artificially by using machines known as incubators which provide the necessary heat until hatching. Some essential requirements of incubation include temperature, humidity, turning of the eggs, candling e.t.c.

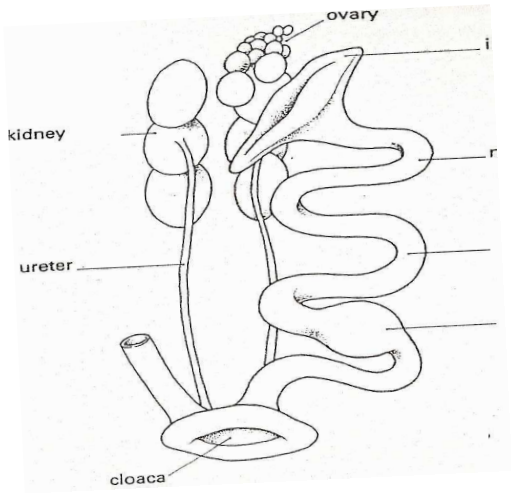
2.0 Objectives

By the end of this unit you should be able:

1. To be familiar with the anatomical features of the hen's reproductive system.
2. To know the composition of the egg and factors affecting the egg size.
3. To understand the term 'incubation' its types, its essential elements as well as the basic operations of the incubator.
4. To be exposed to the concept of hatchability and it's application in calculating the overall productive performance of the farm.
5. To recognized the techniques used in sex separation of young chicks.

3.0 Main Content

3.1 Reproductive system of the hen



infundibulum

magnum

isthmus

shell gland

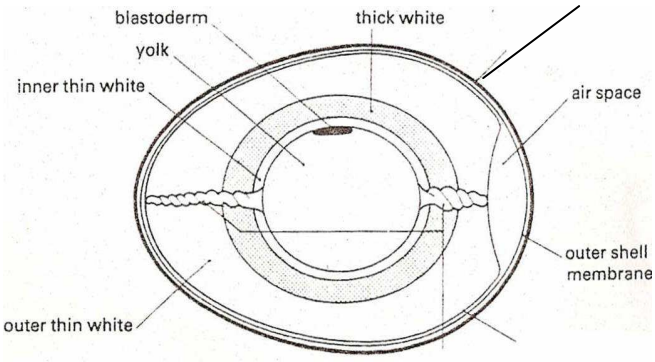
Fig 4: 1Urogenital and reproductive systems of a laying hen.

Source: *Tropical Agriculturalist by A. J. Smith page 131*

The left ovary produces numerous ova. Mature ova are released into the infundibulum where fertilization takes place. The ovum then migrates down to magnum where it receives its albumen, then to the isthmus where the shell membranes, some albumen, water and mineral salts are added. The shell is formed in the uterus for 18-21 hours.
From ovulation to laying takes 24-26 hours.

3.2 The avian egg

shell



Chalazae inner shell

Fig 4:2 Diagrammatic representation of an egg

Source: *Tropical Agriculturalist by A. J. Smith page159*

The avian egg is described as irregular ovoid and it is divided into three main parts
Shell and shell membrane 12%
Albumen and Chalazae 56%
Yolk 32%

3.2.1 Composition of the egg

Nutrients	**Yolk**	**Albumen**	**Shell**
Water	48	86	2
Protein	17	12	5
Fat	33	12	-
Ash	1	1	93
Carbohydrate	1	1	-

Factors affecting Egg size

1) Genetic factors
2) Age of the birds
3) Protein level of the diet
4) Environmental factors
5) Size of the birds
6) Ovum size
7) Intensity of egg laying

3.3 Incubation



Incubation is the process of aiding the development of a fertilized egg into a life chick by providing such factors as adequate temperature, humidity, ventilation and turning. There are two methods of incubation.

1) Natural incubation

That is getting the hen to sit on fertilize egg to incubate the egg.

2) Artificial incubation

Artificial incubation is carried out with incubator using fuels such as kerosene, gas, coal etc.

3.3.1 Essential requirement of artificial incubation

1) Adequate ventilation- there should be sufficient oxygen to supply the respiratory need of the embryo. Also carbon dioxide resulting from embryonic metabolism should not be allowed to accumulate.
2) Relative humidity of 60-65% should be provided to prevent excessive water loss by the egg.
3) Adequate temperature should be provided to ensure that life within the egg is maintained at the optimum level. The temperature of 37.5°C is ideal.
4) Turner: There should be a turner to prevent the embryo getting stucked shell. This should be done at least three times daily.

3.3.2 Operation of the incubator

This is divided into two phases
1) Setting of the eggs 0-18 days.
2) Hatching of the eggs 19-21 days.

Some incubators combine the two operations while others are separate.
The selected eggs are set on trays with the large ends up and placed in the incubator.

Fig 4:3 Eggs in incubating compartments

Source: *Tropical Agriculturalist by A. J. Smith page 170*

The temperature requirement during the first week is 38°C, 39°C for the second week and 40°C for the third week.
The relative humidity requirement is 60-65%. There should also be free passage of air in the incubator. The egg should be turn at least three times daily up to the 18th day. On the seventh and sixteenth day of incubation the eggs are checked for infertile eggs and dead embryo by candling. Candling is the process of testing incubated eggs for fertility and development of the embryo. This is done by holding the egg before a strong shaded light see fig 4.4 or placing a strong hand torch under the tray.

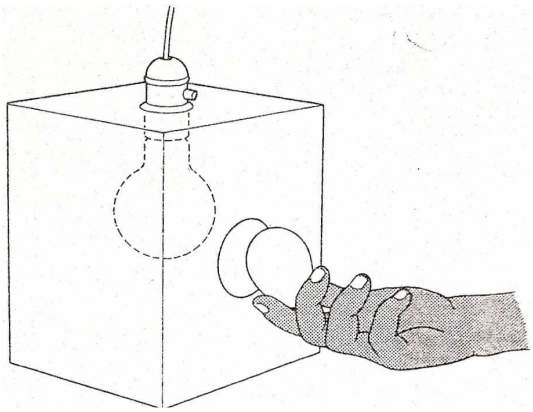


Fig 4 :4 A simple candling device (Chris Mc Kinnell)

Source: *Tropical Agriculturalist by A. J. Smith page 170*

3.4 Hatching

The eggs are moved from the incubator to the hatching compartment on the 18 day. The eggs are layed (Placed) flat in preparation for hatching. The relative humidity should be higher (70%) in hatching compartment.

3.4.1 Hatchability

Hatchability refers to percentage of eggs that were hatched, it should be about 80-90% from a good flock

Hatch of fertile

This refers to percentage of fertile eggs that were hatched.

Hatch of total

This refers to percentage of total eggs that were hatched.
Example: supposing 500eggs were incubated, after 7 days. 450 were found to be fertile. If 400 of the fertile eggs hatched into chicks. Calculate hatch of fertile and hatch of total?

Solution: Total eggs = 500
Fertile eggs = 450
Hatched eggs = 400
%hatch of fertile = 400/450 x 100 = 88.89%
% hatch total = 400/500 x 100 =80.0%

Note:
1) Hatch of fertile is usually higher than hatch of total.
2) Hatch of fertile is more precise because fertility is considered.
3) Hatch of fertile is of practical importance as it refers to the performance of the breeder stock.

3.4.2 Factors affecting hatchability

There are six factors affecting hatchability.
1) Fertility
2) Genetic
3) Nutrition
4) Diseases
5) Egg selection
6) Management practices

3.4.3 Fertility

Percentage fertility is the percentage of egg that are fertile and should be about 90-95% for a good flock.

Fertility is affected by the following
a) Mating ratio: mating ratio of 10 : 1 is recommended. If the ratio is higher the fertility of the egg will be lower.
b) Age of breeders: Fertility declines with age
c) Length of period between mating: A mated hen stores sperm and uses it up to 2 weeks.
Generally it requires 2 weeks after mating the flock before satisfactory fertility is achieved. The removal of the male from the flock is followed by decline in fertility within 2 weeks and few if any fertile eggs will be produced after 3 weeks.

3.4.4 Genetic factors

Hatchability is an inherited trait so strains (breeds) that possess high hatchability should be selected.

i) In-breeding without selection for hatchability has been shown to lower hatchability in poultry.
ii) Cross breeding usually result in increase hatchability.
iii) Lethal or semi- Lethal genes may affect either fertility, hatchability and livability (life).
iv) Rate of egg production: Eggs layed by hen producing at a high rate are more fertile than eggs layed by low producers.
v) Age: Hatchability is maximum half way into the second laying year for females. While for male is one year after sexual maturity.

3.4.5 Nutrition

The egg must contain the entire nutrients needed by the embryo for development. Breeder hen must be fed ration which supplies adequate quantities with the nutrients needed for the embryo to develop.

3.4.6 Disease

Eggs for hatching should be collected from healthy flocks. Disease causing organisms like *Salmonella* and *Mycoplasma* are transmitted from infected hen chiefly through the egg. Breeding stocks should be tested regularly to prevent infection.

3.4.7 Egg selection

Certain physical characteristics of eggs are related to hatchability among these are size, weight (50-60g), shape, shell quality and internal quality.

3.4.8 Management practices

Eggs for hatching should be collected immediately and stored below $20^{o}C$ to arrest embryonic development. Fertile eggs deteriorate in quality after 4 days.
Fertile eggs should be stored at a temperature around $10^{o}C$ and humidity 80%. Eggs should be stored with the broad end upward. Proper hygiene should be maintained in the hatchery. Eggs should be collected at least 3 times daily. Soiled eggs should be rejected or fumigated with formaline solution.

Self assessment exercise 1.3

1a) What are the factors affecting the size of an egg?
b) In Lamido farm, 5,000 eggs were incubated, after 7 days 4,600 eggs were Found to be fertile, if 4,200 of the fertile eggs hatched into chicks calculate hatch of fertile and hatch of total and comment on your result.

c) Discuss in detailed the factors affecting hatchability of poultry eggs.

3.5 Sex separation

The early separation of the sex of young chicks is important economic factor. There are several ways of sexing chicks

1) By manual vent inspection at day old. At the center of the vent of a male chick is located a pin edge size structure called the process. This can be easily seen with aid of the magnifying lens. A female vent shows no such structure.
2) Sexing can also be done when the chicks are five to eight weeks old. Such a separation is based on larger size combs and wattles, longer tail feathers, stouter shanks, with prominent scales and generally larger body size in cockerels than in pullets.
3) Sex-linked colour differentiations: for example at day old, golden comet breed have dark gold coloured pullets while the cockerels look white.

4.0 Conclusion

The avian egg therefore, can be divided into three main parts as shell and shell membranes, albumen and chalazae and the yolk. The egg can be incubated either naturally or artificially. Hatchability as well as fertility is affected by genetic factors but again it is management which go above genetics in its effect.

5.0 Summary

In this unit we have learnt that:

- Factors affecting egg size include; genetic factors, age of the birds, protein level of the diet, environmental factors, size of the birds, ovum size and intensity of laying.
- The essential requirements of artificial incubation are adequate ventilation, relative humidity of 60-65%, temperature of 37.5˚C and turning at least three times daily.
- Incubator operation is divided into setting and the hatching phase.
- Hatchability refers to percentage of eggs that were hatched; it should be about 80-90% from a good flock.
- Factors affecting hatchability are fertility, genetic, nutrition, diseases, egg selection and management practices.

6.0 Tutor Marked Assignment

1a) What do you understand by the term incubation?
b) Explain artificial incubation and its essential requirements.
c) Draw and label (i) the reproductive system of the hen
(ii) the avian egg

7.0 References and Further readings

Lee, S. and Summers, J. D. (2000) *Broiler breeder production.*
McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics* Macmillan education Ltd.
Sainsbury, D. (1992) *Poultry Health and Management*
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Williamson, G. and Paye, W. J. A. (1987*) An introduction to Animal husbandry in the tropics.*

Introduction to Non-Ruminant Animal Management:

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Unit 5: Management of day-old growers, layers and broilers

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1.0 Introduction

The management of day old chicks is an important and delicate operation. Any mismanagement at this stage will show up later as heavy financial loss to the farmer through

excessive mortality, disease outbreak and poor productivity. Growers refers to growing pullets of 9-20 weeks of age. The birds may be kept in the same pen that was used for the initial rearing of the chicken but there should be enough floor and feeding space. At this stage the birds are changed from chick mash to growers mash. Layer is a matured female chicken meant for egg production. Layers are normally moved to the laying quarters at 18 weeks of age. They are either reared in battery cages or deep liter. The diet of the birds should be changed to layer mash.

2.0 Objectives

By the end of this unit you should be able to:

a). Acquire knowledge and understanding of growth rate and development of birds under confinement .

b) Recognize a good layer from a bad layer and also signs of a good broiler .

c). Raise birds from day old to table weight for broilers and or point of lay for layers as the case may be.

d) To better understand the nutritional requirement and approximate daily feed intake of different classes of birds(Day-old, Growers, Layers, Broilers etc)

3.0 Main Content

3.1 Management of day old chicks

The management of day old chicks is an important and delicate operation. Any mismanagement at this stage will show up later as heavy financial loss to the farmer through excessive mortality, disease outbreak and poor productivity. The management starts before the arrival of the chicks. Two weeks to the arrival of the birds, the brooding pen should be clean and disinfected. Litter material should be spread to about 6-8 cm. of height.

3.2 Feeding and watering Equipment

Feeding and watering equipment of small sizes should also be provided.
Twenty four hours before the arrival of the birds, brooder should be set to required temperature(35^oC).
Feed and water should be put in place before birds arrival. On arrival dead and weak chicks should be removed. Chicks destined or meant to be layers should be fed chick starter mash while broilers should be fed broiler starter mash.

3.3 Temperature requirement of chicks

Table 5.1 Temperature requirement of chicks

Age of chick	Temperature

Day old - 1 week	35°C
1 - 2 weeks	30°C
2 - 3 weeks	26°C
3 - 4 weeks	23°C

Brooder space requirement is 40-60 cm^2 per chick. Overcrowding of the bird should be avoided as this can lead to slow growth rate, disease build up, feather and toe pecking, this can be prevented by debeaking.

3.4 Broiler Management

The broiler is a young chicken of either sex, being intensively fed for meat production. With good strain, diet and management, they reach market weight of 1.5- 2kg live weight in 8-12 weeks. At this stage their meat is tender, juicy and well flavoured.

The broiler pen should be prepared as above prior to arrival of the chicks. When the broilers attend the age of 5-6 weeks, they should be transferred to the broiler finisher pen with free air movement. They should also be changed from broiler starter ration to broiler finisher ration. The broiler starter is a high protein moderate energy ration, while the broiler finisher is a high energy moderate protein ration. At this age the birds should average 500-900g in weight and consume about 58g of feed per day per bird. They should be allowed adequate floor space of about 0.25cm^2 per chick to prevent cannibalism.

Vaccination should be ensured at the right time. Good sanitary condition should be maintained.

Coccidiostat should be included in their feed which should be withdrawn two weeks to marketing time. This is to prevent the transfer of the drug to the tissues of the birds and then further to the consumer. Broilers should have free access to water and feed at all times.

Note

Broilers make economic gains within 10 weeks, beyond 12 weeks, they tend to eat much more than they gain resulting in lowered profitability. It is therefore essential to market them at about 8-12 weeks of age.

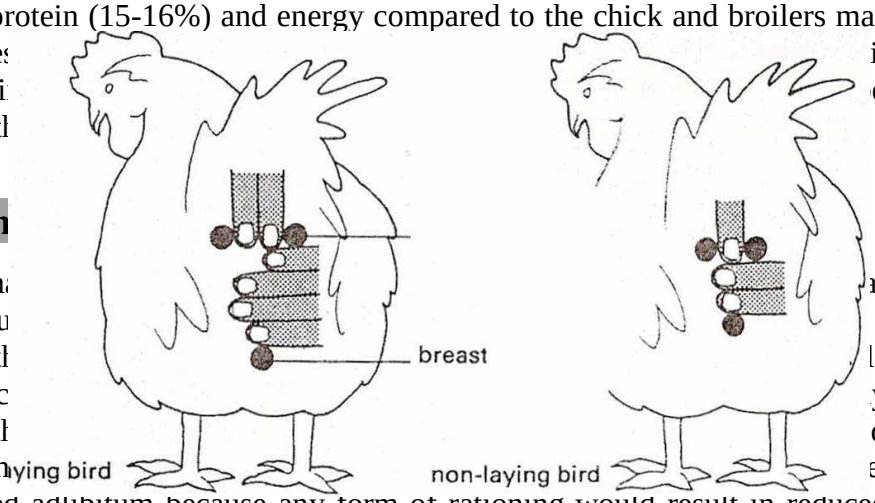
3.5 Signs of a good Broiler

The sign of a good broiler chicken include

1) Constricted pelvic bone
2) Dry and constricted vent
3) Not very bright comb

3.6 Management of growers

Growers refers to growing pullets of 9-20 weeks of age. The birds may be kept in the same pen that was used for the initial rearing of the chicken but their should be enough floor and feeding space. At this stage the birds are changed from chick mash to growers mash. This diet is lower in protein (15-16%) and energy compared to the chick and broilers mash. This is to prevent exces idiostat. Feed wastage duri e reduced by using feeds tl



3.7 Man

Layer is a m ally moved to the laying qu or deep liter. The diet of tl lcium, energy and protein c ying, level of calcium in tl deposition of calcium in th e laying birds should be fed adlibitum because any form of rationing would result in reduced rate of egg production. There should be adequate water supply. This is because lack of water will result in decreased egg production and possibly death.

Perches and nests should be provided on deep liter. To stimulate egg production, the length of artificial day should be increased to 16-18 hours. Eggs should be collected at least twice daily and properly recorded. The most common management problems in laying flocks are broodiness and moulting.

3.7.1 Characteristics of good layer

1) Comb is bright red
2) Bright eyes.
3) Pelvic bone- four fingers width
4) Vent – large, soft, moist and oval vent
5) Good layers are very active and alert.
6) They have prominent, soft, smooth wattles.
7) They have worm soiled and close plumage.
8) They have bright red face

Fig 5:1 A simple means of distinguishing laying birds from non laying birds (Courtesy of ATB)

Source: (Poultry) *Tropical Agriculturalist by A. J. Smith page 139*

3.7.2 Calculating Productivity of laying flock

1. Hen day egg production (HDEP)
This is the number of eggs laid expressed as percentage of the number of layers on hand.

HDEP = Total number of eggs laid / Total number of layers on hand x 100

2. Hen housed egg production:(HHEP)
This is the number of eggs laid expressed as percentage of the number of layers housed at the initial stage.
HHEP = Total number of eggs laid / Total number of layers housed at beginning of lay x 100

Self assessment exercise 1.5

Your tutor should organize a visit to near by poultry farm where can enrich your knowledge with the practical aspect of poultry management. Have a free interaction with the poultry farmer. You are expected to be able to answer the following questions.

2a) What are the precautionary measures to be taken in growers' management?
c) List the signs of good layers and good broilers.

4.0 Conclusion

Chicks may therefore be reared on litter or on the floor from day-old until hey are ready to enter the laying house. Similarly, broiler chickens are reared from day-old to about 46-70 days in controlled environment house on built-up litter of wood shavings or straw or mixture of the two types.

5.0 Summary

- In this unit we have studied that:
  The management of day old chicks starts two weeks before the arrival of the chicks. Brooding pen should be clean, disinfected, liter material should be spread to about a height of 6-8 cm, feeding and watering equipment to be set and temperature set at 35˚C.
- The broiler house should be set as above but the diet should be broiler starter diet and at the age of 5-6 weeks the birds may be transferred to the broiler finisher pen with free air movement. The ration should be change to broiler finisher ration.

- The signs of good broiler include constricted pelvic bone, dry constricted vent, an not very bright comb.
- The growers are between 9-20 weeks of age and their ration should be changed from chick mash to growers mash, this is to prevent excessive fat deposition.
- Layers are normally moved to laying quarters at the age of 18 weeks either in deep liter or battery cage system and their diet changed to layers mash.
- The signs of a good layer are bright red comb, bright eyes, pelvic bone with four finger width, large vent, soft, moist and oval vent, active and alert. Have soft smooth wattles and bright red face.
-

6.0 Tutor marked assignment

1a) Describe the management Practices needed for successful management of day-old chicks in a poultry farm.

b) Compare and contrast the management of a layer in a battery cage to that of a Layer in a deep liter system.

7.0 References and Further reading

Lee, S. and Summers, J. D. (2000) *Broiler breeder production.*
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Unit 6: Poultry diseases and their prevention

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4.0 Conclusion……. 56

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1.0 Introduction

Good management built on the foundation of basically sound units and buildings, not only will disease be far less likely to occur but, in addition, productivity can be enhanced at all stages.

2.0 Objectives

By the end of this unit you should be able to:

1. Know how poultry diseases are broadly classified (pathogenic, management, deficiency, and metabolic) and their examples.
2. Apply practical measures of preventing poultry diseases from spreading.
3. Recognized most important vaccines against some common diseases of poultry in the tropics.
4. Appreciate the means of transmission, causative agents, signs, prophylaxis and treatment of some bacterial, viral and parasitic diseases of poultry.

3.0 Main Content

3.1 Disease and Disease Prevention

Disease is any deviation from the normal physiological state of health. It is always better to prevent a disease than to cure it. It is necessary to aimed at disease prevention by planning a disease control programme with a veterinarian. Poultry birds should be vaccinated against prevalent diseases. It is important to maintain strict sanitation practice by cleaning the poultry house and surroundings regularly. Prevent birds, personnel, vehicles and stray birds from entering the farm unless disinfection is properly carried out. Where there is an out break of a disease immediately contact a veterinarian

3.2 Diseases of poultry

Diseases of poultry can be broadly classified into:

a.) Pathogenic diseases :

These are diseases brought about by the presence of one or more pathogenic or causative organisms.

b.) Management diseases:

Bad management can be caused of pathogenic invasion and can also cause diseases directly e.g. overcrowding can lead to rapid transfer of disease from sick animals to healthy ones. It can also cause inadequate access to feed and water. Other examples of poor or bad management that can lead directly to diseases are

i) Failure to vaccinate at the right time.
ii) Failure to remove dead birds promptly.
iii) Poor or old litter.
iv) Failure to remove droppings regularly
v) Overcrowding
vi) Poor ventilation
vii) Poor incubation hygiene
viii) Uncontrolled access to poultry farms and lack of foot baths
ix) Indiscriminate transfer and mixing of eggs, stock and poultry equipment.

c.) Deficiency diseases

These are diseases caused by lack of one or more essential nutrients needed for growth and development in the body.

d.) Metabolic diseases

These are group of diseases which are caused by a faulty metabolic process in the body. This is caused by the absence in the body of certain fat carrying substances resulting in the accumulation of fat in the liver, intestines, gizzard, kidneys and heart.

3.3 Disease Prevention

The following precautions can be taken by poultry keepers to prevent the spread of diseases.

i) The setting and management of poultry houses: this is very important in any disease control programme. It is necessary to ensure that birds of different ages are not kept in close proximity, this is to prevent diseases spreading from older birds to younger ones.
ii) The poultry house should be thoroughly clean and disinfected and a gap of at least 2 weeks allowed before bringing in a new batch of birds.
iii) Sick birds should also be removed promptly to prevent them becoming a source of infection to other birds.
iv) Dead birds should be buried or incinerated.
v) Control by vaccination: Birds should be vaccinated against the common diseases in a locality.
vi) Control by Chemotherapy or prophylaxis: Another way of preventing diseases is by the use of good management associated with prophylactics such as Coccidiostats and sulpha drugs.

Table 6.1 The most important vaccinations against common diseases in the tropics:

Disease	**Vaccination**	**Age of bird**
New castle	Intra occular Lasota Komorov	Day old 3-4 weeks 6 weeks
Mareks disease (infectious bronchitis)	*MD-Vaccine *IB- Vaccine Via water Or Intra occular	Day old *7-10ddays **2-3 weeks again 24 weeks
Infectious bursal disease (Gumboro) (IBD)	Gumboro vaccine	10-14 days 5 weeks
Fowl pox	Chicken N.P.X Fowl pox vaccine poxine and poxinet Re- Vaccinate	Day old 3 weeks 12-14 weeks
Fowl typhoid	fowl typhoid vaccine	4 weeks
Fowl cholera	Fowl cholera vaccine Repeat	12 weeks again 17 weeks

* Broilers * MD Marek's disease

** Pullets * IB Infectious Bronchitis

3.4 Common Diseases of Chicken

Table 6.2 Common diseases of Chickens

Name	**Means of Transmission**	**causative Organism**	**Signs**	**Prophylaxis**	**Treatment**
New castle Disease	Bird to bird by droplet in air	Virus	Paralysis difficulty in breathing greenish diarrhoea	Vaccination either dead or live vaccine	None
Infectious bronchitis	Bird to bird	Virus	Respiratory problems large decrease in egg production.	Vaccination	Antibiotics to control secondary infections
Fowl cholera or pasteurellosis	Through water and food to nose and mouth	Bacterium .	Severe diarrhea Blue combs and wattles reduction in food intake	Annual vaccination with live vaccine	Remove, slaughter and destroy infected birds. Clean infected premises

Names	**Means of Transmission**	**Causative organism.**	**Sings**	**Prophylaxis**	**Treatment**
Marek's disease and leukosis	Bird to bird	Virus	Affected birds 12-24 weeks old. Causes paralysis and death of 10-30% of flock	Vaccination Isolation	None
Fowl pox	Mosquitoes and other biting insects and through damaged skin	Virus	Scabs on the comb, wattles, eyelids Death	Vaccination Isolation	Cull clinically affected birds. Vaccinate uninfected ones.
Gumboro disease (infectious bursitis)	By direct contact especially in young birds	Virus	Prostration of birds Diarrhoea	Isolation vaccines are available	None
Pullorum disease	From hen to chick through egg	Salmonella bacterium	High death rate in chicks. White diarrhea	Adult carriers should be removed	Sulphur drugs or furazolidone

Name of Disease	**Means of transmission**	**Causative organism**	**Signs**	**Prophylaxis**	**Treatment**
Coccidiosis	From the droppings of infected birds	Protozoa of infected *eimeria* spp	Watery and bloody diarrhea High death rate	Feed coccidiostat Separate young and adults	Sulphanamide, pyrimidine or prolium in water

Self assessment exercise 1.6

1a) List the poor management practices that can lead to disease in a poultry farm.
b) Describe the precautions to be taken by poultry keepers to prevent the spread of diseases.

4.0 Conclusion

Diseases of poultry can be broadly classified into pathogenic, management, deficiency and metabolic diseases, there control and prevention is of paramount importance to ensure both maximum profitability and productivity.

5.0 Summary

In his unit we have studied that:

- It is always better to prevent a disease than to cure it, this is done through good management practice, strict sanitation, adequate nutrition vaccination against prevalent diseases, prompt removal of dead and sick birds,
- The common diseases of poultry in the tropics include: New castle disease, Infectious bronchitis, Fowl cholera, Mareks disease, Fowl pox, Gumboro disease, pullorum disease and coccidiosis.

6.0 Tutor Marked Assignment

1. Discuss Newcastle, Fowl cholera and Gumboro diseases under the following:
i) Vaccination programme
ii) Causative agents and signs
iii) Means of transmission
iv) Prophylaxis and treatment

7.0 References and Further readings

McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics* Macmillan education Ltd.
Sainsbury, D. (1992) *Poultry Health and Management*
Smith, A. J., and Coste, R. (2001) (Poultry) *The Tropical Agriculturalist* (CTA) Macmillan

Introduction to Non-Ruminant Animal Management:

Poultry Management

Unit 7 : Poultry Products and Marketing

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1.0 Introduction

Any farmer who's production capacity is more than what he can eat with his family and relatives, he must fine a market for the surplus otherwise it becomes a burden on him.
The need for poultry meat or egg varies from Country to country and from locality to locality. The marketing of poultry meat is different from the marketing of poultry eggs.
In developing countries like Nigeria, where there is shortage of animal protein, marketing of broilers depend on their market price. For farmers near a town or a city, setting the market price at a level which the consumer will be prepared to pay , will be met with people eager to buy and disposal of products will not be a problem. For farmers from rural areas that are away from the main market, the cost of transporting his product to the market may make his product more expensive with no profit.

2.0 Objectives

By the end of this unit you should be able:

- To understand how the poultry egg are processed preserved over time.
- To be familiar with external and internal egg quality characteristics that are used in grading of an egg.
- Be aware of the procedure of processing table birds for marketing purposes.

3.0 Main Content

3.1 Poultry products and marketing

It is of no value to produce poultry commodities (egg and Meat) without serious effort to secure a market for them.

3.2 Egg marketing

The egg is a highly perishable product and if not given proper care between the time it is laid and time it is consumed, it may deteriorate markedly in several respects for example

- Gross changes in weight as a result of evaporation of moisture through the shell mostly from the albumen.
- Flavour and odour changes also occur in storage either due to internal chemical changes or to the absorption of extraneous odour by the egg.
- Relative changes in size and form of egg components such as yolk and albumen can indicate age in storage.
- Other changes are inter conversion of minerals and organic contents, specific gravity, permeability, viscosity, gaseous concentration and microbial changes.

3.3 Egg grading

The most important point considered in egg for consumption is quality. In general the interior and exterior factors are considered.

3.3.1 Exterior qualities used for grading eggs

1. Soundness of shell
2. cleanliness
3. size
4. colour
5. shape and texture

3.3.2 Interior qualities used for grading eggs

1. Condition of the yolk
2. condition of the shell
3. condition of the air cell.

3.4 Egg processing and preservation

Eggs are processed to prolong their keeping or storage life. Methods of prolonging edible life of an egg include:

i) Prevent contamination with faeces and other dirt
ii) Chilling at temperatures between -0.5^{o}C and -2°C and relative humidity of 88% (can store for 2-3 months)
iii) Chemical treatments aimed at sealing the shell pores and thus preserving the egg contents from environmental changes and gaseous diffusion using example. Vegetable oils, Vaseline, lard, gelatin, agar-agar and alum as coating agents.
iv) Heat treatment: egg can be momentarily (5 seconds) dipped in boiling water to coagulate the thin film of albumen enclosing the egg membrane.
v) Dehydration: usually applied to the shelled eggs to produce powdered products or flakes.

3.5 Marketing table birds

Table birds are broilers, old hens cockerels and cocks. They can be marketed live or dressed and ready to cook. Consumers in the southern part of Nigeria buy very little live poultry but in the northern part of the country, live birds are commonly sold in the markets.

3.5.1 Processing of table birds.

It involves the following stages:

i) Killing and bleeding.
ii) Scalding
iii) Plucking or picking
iv) Dressing and evisceration.

3.5.2 Killing

Birds are killed by any of the following methods.
i) By hatching off the head from the live chicken.
ii) By cutting the head off with a knife.
iii) By cutting the jugular vein.

After killing, the chicken is allowed to bleed.

3.5.3 Scalding

scalding is the used of hot water (50-55°C) to soften the skin and facilitate the removal of the feathers.

3.5.4 Picking or plucking

the scalded bird is then de feathered by hand picking. However, in commercial processing units, mechanical pluckers consisting of rotating drums with several stickers usually of rubber or plastics are used.

3.5.5 Dry plucking:

Chickens can also be de feathered by plucking of the feathers by plucking of feathers without scalding. Though laborious the method preserves a good colour of the skin and keeps longer than scalded carcass.
The birds can also be de feathered by means of fire or Wax plucking.

3.5.6 Dressing and Evisceration

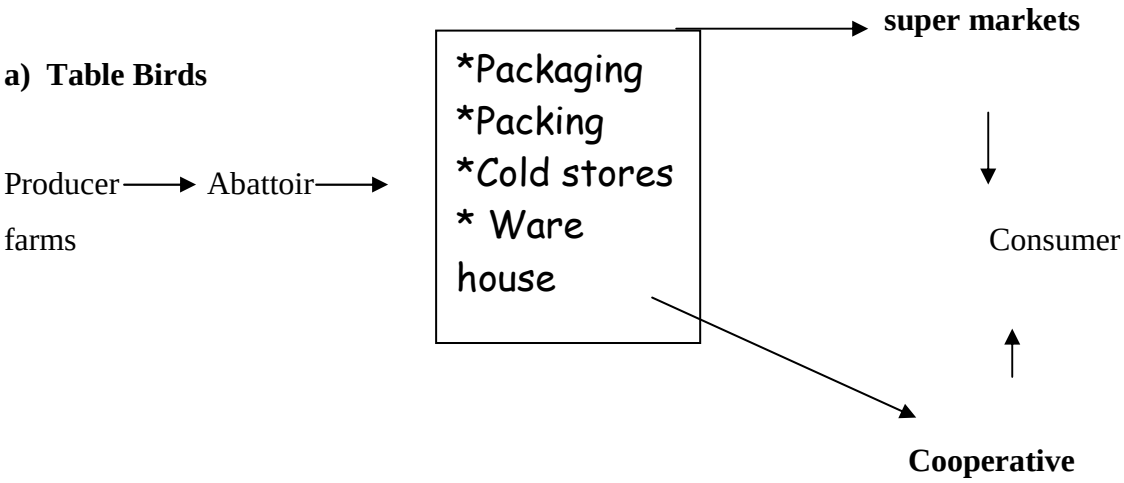
Dressing entails the removal of the head, neck, feet, gizzard, lungs, liver, intestine, crop, legs and other intestinal tissues. The internal evisceration is done by slitting between the end of the keel bone and the rectum and then plunging the hand to remove the contents of the body cavity. The dressed chicken is sold whole or in parts.

3.5.7 Chilling:

Dressed chickens are usually chilled to prevent bacterial growth and enzymatic activities. This is achieved by placing the carcass in a cold chamber with temperature of 1-5°C.

3.5.8 Storage:

The temperature depends on the length of time that the carcass are to be stored. For a day or two temperature of 2°C is ideal. If for a long period of time, they should be frozen to -5°C to -18°C.
In Nigeria the prices of poultry products is determine by the forces of demand and supply. A typical market organization of poultry products in a developing economy is as follows:



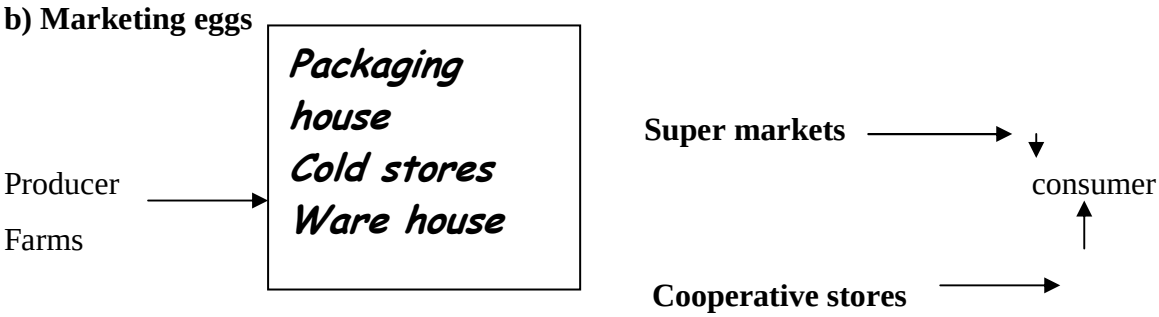


Fig. 7.2 *Diagrammatic representation of marketing table birds and eggs*

In underdeveloped economy like Nigeria, the scheme represented above does not operate. Consequently there are no accurate trends on production, supply and demand; price changes are violent and difficult to control. Couple with this , the poor cold storage facilities makes the handling of poultry products precarious and the prices unstable.

Self assessment exercise 1.7

Your tutor should organize a visit to a poultry farm where you will have the opportunity to enrich your knowledge on the practical aspect of poultry management.

1a) Briefly explain how table birds are processed and marketed.

4.0 Conclusion

In developing countries like Nigeria, where there is shortage of animal protein, marketing of broilers depend on their market price. For farmers near a town or a city, setting the market price at a level which the consumer will be prepared to pay , will be met with people eager to buy and disposal of products will not be a problem. For farmers from rural areas that are away from the main market, the cost of transporting his product to the market may make his product more expensive with no profit.
It is therefore of no value to produce poultry commodities (egg and Meat) without serious effort to secure a market for them.

5.0 Summary

In this unit we learnt that:

- Egg shelf life deteriorates over time causing gross changes in weight, flavour and odour changes, relative changes in size and form also inter conversion of minerals and organic contents.
- Methods of prolonging edible life of an egg are prevention of contamination with faeces and dirt, chilling at -0.5˚C and -2˚C and relative humidity of 88%, sealing the hell pores with vegetable oil or vaseline, heat treatment etc.
- Exterior qualities used for egg grading are soundness of shell, cleanliness, size, shape and texture while interior qualities include conditions of yolk, shell and air cell.
- Table birds can be marketed live or dressed and they are processed by killing, bleeding, scalding, plucking, dressing and evisceration.

6.0 Tutor marked Assignment

1a) Explain how the avian egg is processed and preserved over time.
b) List all the interior and exterior egg qualities used for grading eggs.

7.0 References and Further reading

Lee, S. and Summers, J. D. (2000) *Boiler breeder production.*
McDonald, I. and Low, J.(1985) *Livestock rearing in the tropics Macmillan education Ltd.*
Smith, A. J. and Coste, R (2001) (Poultry) *The Tropical Agriculturalist (CTA) Macmillan*

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1.0 Introduction

Rabbit are used for meat, for vocational projects, as laboratory animals, as teaching tool, as animal research model and for pets. Because of their use in a wide range of enterprises, it is necessary to have a good knowledge of the different aspect of their management and nutrition. The domestic rabbit descended from wild rabbit found in the Mediterranean countries and was introduced in to England in the late 11th and early 12th century. The different breeds of modern domestic rabbit have evolved as far back as the 18th century. In early 1960, united state department of Agriculture (USDA) was involve in introducing more rabbit to western states of Nigeria. Rabbit can be quickly grown and are a cheap source of protein. They can be reared for consumption or commercial undertaking.

2.0 Objectives

By the end of this unit you will be able:

- To understand the advantages and disadvantages of keeping rabbits.
- To be familiar with the problems or constraints of rabbit production in Nigeria.
- To know the guidelines of promoting rabbit production.
- To know the different breeds of rabbits, their physical characteristics and their comparison.

3.0 Main Content

3.1 Advantages of keeping rabbits

1) They have fairly small body size which makes it relatively possible to be raised in a confinement. There is a low cost of production in other words starting requires modest production compared to other farm animals.
2) Rabbit meat is of high quality animal protein which can be relied upon where other protein sources are absent.

3) Rabbit are efficient feed converters to high quality protein, they uses local forages and food wastes that are of no direct value to humans.
4) Rabbit production can be use to minimize the protein intake in-balance in Nigeria.
5) There is excellent product acceptance with respect to social and religious traditions in other words it is not restricted by any strong taboos or particular beliefs that prevent the eating of rabbit meat or its promotion as food.
6) Curative and preventive drugs are available for most rabbit diseases.
7) Rabbit is a small body size animal and convenient for 'one meal size' with no need for storage.
8) Rabbit also gives useful by-product like the fur which is useful for making cardigans.
9) It is an attractive animal for handicapped children who enjoy being involve in its care and management.

10) Rabbit is a suitable animal for learning basic skills for animal husbandry ; it responds to careful handling but can withstand the sometimes rough handling of the beginner. It also lend itself to simple recordkeeping e.g. of weekly live weight gain and reproduction and so can introduce the idea of management recording to new students of animal production.

3.2 Disadvantages of rabbit keeping

1) Rabbits are highly vulnerable to prey like how persistent a dog can be when trying to break into a rabbit hutch. This constitutes a challenge to the farmer.
2) Rabbit production is not easy it takes a great deal of skill, a lot of hard work and a lot of food.

3.3 Problems or Constrains of rabbit production in Nigeria

1. Most people are not ready for rabbit production that demand daily care and attention and many don't see the reasons for keeping the rabbits anyway.
2. Most people are not aware of the skills needed in rabbit production.
3. Unavailability of improved parent stock that are adaptable to our local conditions

Guidelines on promoting rabbit production

Two methods of promoting rabbits include formation of rabbit clubs or groups and organizing competitions, some of the suggestions is to study the people and the situation; for instance, are the people ready for rabbit that demand daily care and attention or they rather go for another animal? consult with village leaders to get their approval and explain your plans for a meeting with interested people. Encourage an open discussion and agree on the objectives of the club and the reasons for keeping the rabbits. Don't talk about rabbits all the time, consider inviting extension officer or other suitable organization to act as an adviser. Don't be disappointed if a club fails; think why it didn't succeed and in a few months try again, perhaps with other people in a different village.

Competitions are a useful method of encouraging good rabbit husbandry. People always like to be the best; the best hutch builder, the best rabbit keeper the best rabbit skinner and cleaner, the owner of the best rabbit e.t.c.

3.4 Biological classification (taxonomy)

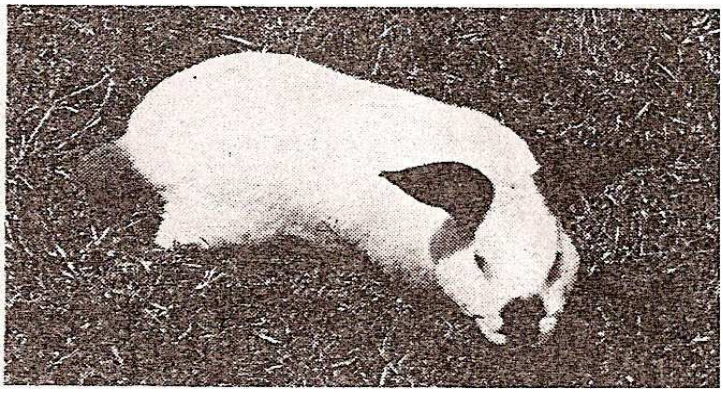
Kingdom *Animalia*

Phylum	*Chordate*
Sub-phylum	*Vertebrata*
Class	*Mammalia*
Order	*legomorpha*
Family	*Leporidae*
Genus	*Oryctolagus*
Specie	*Oryctolagus cuniculus*

3.5 Commonly used terminologies

Buck - mature male rabbit
Doe - mature female rabbit
Littler or kittens – young or new born
Caecotrophy- the practice of eating a type of faecal pellet produced in the caecum of the large intestine

3.6 Breeds of rabbits



Common international breeds of rabbit

3.6.1 California breed

This is the second most popular breed for meat production. The colour is all white but with black tipping on the nose, ears, feet and tail. The weight range for the mature Californian is 3-4.5 kg fig 1.1

Fig. 1.1California breed

Source (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 99

3.6.2 New Zealand white

This breed is the one used most widely throughout the world for meat production. It is all white in colour and usually weighs 3-5 kg when mature. Fig.1.2

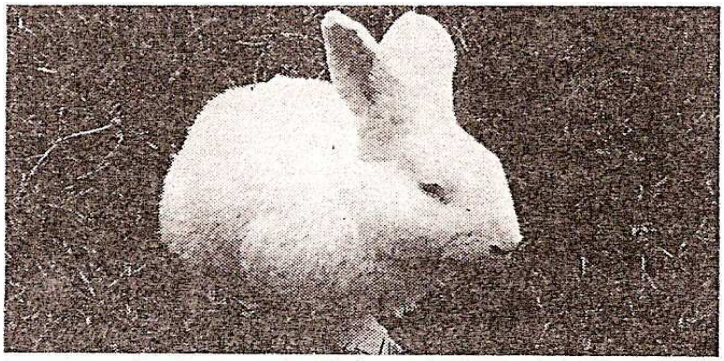


fig1.2 New Zealand white breed

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 99

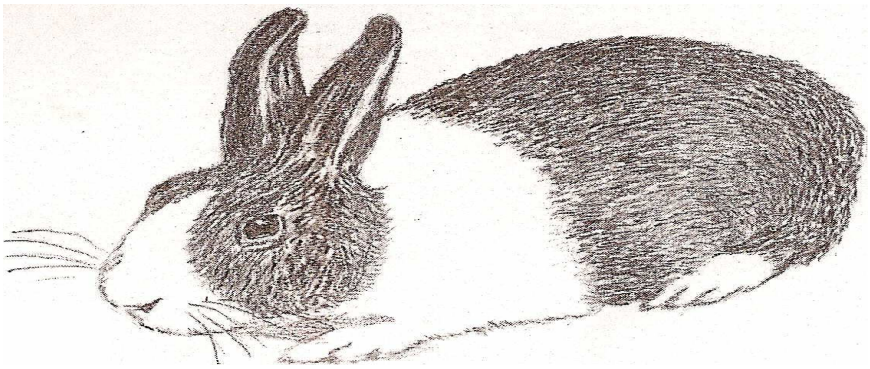
3.6.3 American chin chilla

This breed is blue-grey in colour with a white belly. It has a characteristic ruff or dewlap. This is a thick fold of skin around the front of the chest which is very obvious when the rabit is in good condition and sitting in a resting position. The weight range for the mature Chinchilla is 3-4.5 kg. Fig 1.3



Fig. 1.3 American chin chilla

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 100



of

of

3.6.4 Dutch

The Dutch is a small breed with a mature live weight 2.5-3.5 kg. It has a wide white band fur around its body at the shoulders as well as a white stripe down the middle of its face. Its front feet fall within the white and the tips of its back feet are also white. See fig.1.4

Fig 1.4 Dutch

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 100

3.6.5 Flemish giant

This is a giant breed which at maturity can weigh well over 6 kg. It is usually light grey in colour but may also be sandy blue or white. This is not a suitable breed for the beginner.

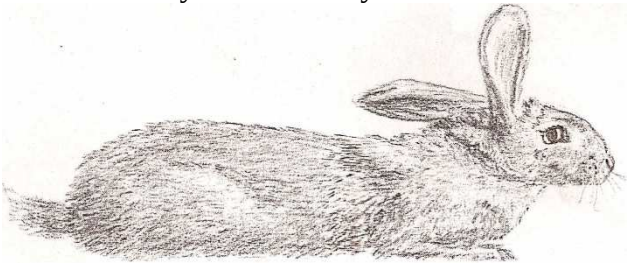
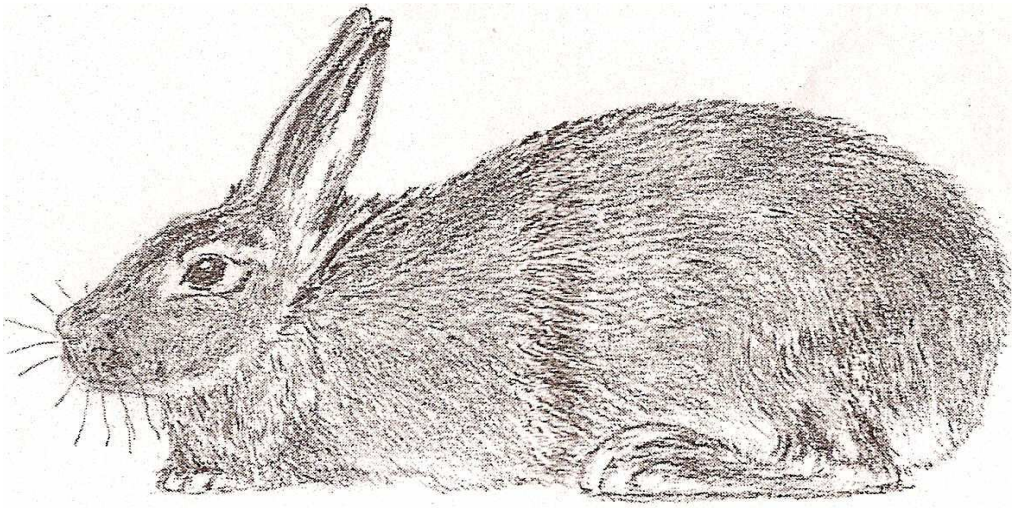


Fig 1.5Flemish giant

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 101



3.6.6 New Zealand red

This breed is essentially a red New Zealand white type which has not been as intensively selected for growth rate. Mature live weight is lower than the white type, at 3-4.5 kg.

Fig 1.6New Zealand red

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 101

Other breeds

There are over 40 recognized breeds of domesticated rabbit in the world. Other common breeds include Champagne d' argent, English spot, Simon ire, Lop e.t.c.

3.6.7 Comparison between some popular breeds of medium and heavy Weight of rabbits

Table 1: Comparison between some popular breeds of medium and heavy weight rabbits

Breeds	**Weight at maturity (kg)**	**Litters/doe/year**	**Body colour**
California	3.5-5.0	48	The colour is all white but with black tipping on the nose, ears, feet and tail.
New Zealand White	4.1-5.4	50	It is all white in colour
American-chinchilla	4.1-5.5	38	This breed is blue-grey in colour with a white belly. It has a characteristic ruff or dewlap.
Dutch	2.5-3.5	45-48	It has a wide white band of fur around its body at the

			shoulders, face, font feet and tips of its back.
Flemish giant	5.9-7.3	36	It is usually light grey in colour but may also be sandy blue or white.

Self assessment exercise 2.1

1.) In a tabular form compare the medium and heavy weight breeds of rabbits based on their weight, litters/doe/year, and body colour

4.0 Conclusion

Rabbits grow quickly and are cheap source of protein, they have many advantages, several breeds of them are available and can be reared for consumption or commercial undertaking.

5.0 Summary

In this unit we have learnt that:

- Rabbit are used for meat, for vocational projects, as laboratory animals, as teaching tool, as animal research model and for pets.
- Advantages of keeping rabbits include relatively small body size, meat is of high quality animal protein, efficient feed converters to high quality protein, can be use to minimize the protein intake in-balance in Nigeria, excellent product acceptance, useful by-product, suitable animal for learning basic skills for animal husbandry e.t.c.
- The few disadvantages are vulnerability to prey, and Rabbit production is not easy it takes a great deal of skill, a lot of hard work and a lot of food.
- Constrains of rabbits production in Nigeria include the needed demand of daily care and attention, lack of awareness of the skills needed in rabbit production, Unavailability of improved parent stock e.t.c.
- Guidelines on promoting rabbit production are formation of rabbit clubs or groups and organizing competitions.
- Common international breeds of rabbit include California breed, New Zealand white and red, American chin chilla, Dutch breed, Flemish giant, Champagne d' argent, English spot, Simon ire, and Lop.
-

6.0 Tutor marked assignment

1a) Discuss the advantages and disadvantages of keeping rabbits.
b) How do you promote rabbit production in Nigeria?
c) Mentioned six breeds of international origin found in Nigeria and explain the characteristics of any three.

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7.0 References and Further readings

Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan*

McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics Macmillan education Ltd.*

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1.0 Introduction

Rabbit are used for meat, for vocational projects, as laboratory animals, as teaching tool, as animal research model and for pets. Because of their use in a wide range of enterprises, it is necessary to have a good knowledge of the different aspect of their management and nutrition. The domestic rabbit descended from wild rabbit found in the Mediterranean countries and was introduced in to England in the late 11th and early 12th century. The different breeds of modern domestic rabbit have evolved as far back as the 18th century. In early 1960, united state department of Agriculture (USDA) was involve in introducing more rabbit to western states of Nigeria. Rabbit can be quickly grown and are a cheap source of protein. They can be reared for consumption or commercial undertaking.

3.0 Objectives

By the end of this unit you will be able:

- To understand the advantages and disadvantages of keeping rabbits.
- To be familiar with the problems or constraints of rabbit production in Nigeria.
- To know the guidelines of promoting rabbit production.
- To know the different breeds of rabbits, their physical characteristics and their comparison.

3.0 Main Content

3.1 Advantages of keeping rabbits

1) They have fairly small body size which makes it relatively possible to be raised in a confinement. There is a low cost of production in other words starting requires modest production compared to other farm animals.
2) Rabbit meat is of high quality animal protein which can be relied upon where other protein sources are absent.

3) Rabbit are efficient feed converters to high quality protein, they uses local forages and food wastes that are of no direct value to humans.
4) Rabbit production can be use to minimize the protein intake in-balance in Nigeria.
5) There is excellent product acceptance with respect to social and religious traditions in other words it is not restricted by any strong taboos or particular beliefs that prevent the eating of rabbit meat or its promotion as food.
6) Curative and preventive drugs are available for most rabbit diseases.
7) Rabbit is a small body size animal and convenient for 'one meal size' with no need for storage.
8) Rabbit also gives useful by-product like the fur which is useful for making cardigans.
9) It is an attractive animal for handicapped children who enjoy being involve in its care and management.

10) Rabbit is a suitable animal for learning basic skills for animal husbandry ; it responds to careful handling but can withstand the sometimes rough handling of the beginner. It also lend itself to simple recordkeeping e.g. of weekly live weight gain and reproduction and so can introduce the idea of management recording to new students of animal production.

3.2 Disadvantages of rabbit keeping

1) Rabbits are highly vulnerable to prey like how persistent a dog can be when trying to break into a rabbit hutch. This constitutes a challenge to the farmer.
2) Rabbit production is not easy it takes a great deal of skill, a lot of hard work and a lot of food.

3.3 Problems or Constrains of rabbit production in Nigeria

4. Most people are not ready for rabbit production that demand daily care and attention and many don't see the reasons for keeping the rabbits anyway.
5. Most people are not aware of the skills needed in rabbit production.
6. Unavailability of improved parent stock that are adaptable to our local conditions

Guidelines on promoting rabbit production

Two methods of promoting rabbits include formation of rabbit clubs or groups and organizing competitions, some of the suggestions is to study the people and the situation; for instance, are the people ready for rabbit that demand daily care and attention or they rather go for another animal? consult with village leaders to get their approval and explain your plans for a meeting with interested people. Encourage an open discussion and agree on the objectives of the club and the reasons for keeping the rabbits. Don't talk about rabbits all the time, consider inviting extension officer or other suitable organization to act as an adviser. Don't be disappointed if a club fails; think why it didn't succeed and in a few months try again, perhaps with other people in a different village.

Competitions are a useful method of encouraging good rabbit husbandry. People always like to be the best; the best hutch builder, the best rabbit keeper the best rabbit skinner and cleaner, the owner of the best rabbit e.t.c.

3.4 Biological classification (taxonomy)

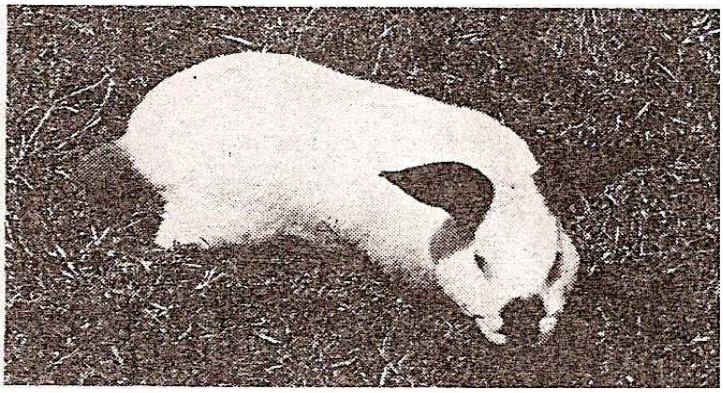
Kingdom *Animalia*

Phylum	*Chordate*
Sub-phylum	*Vertebrata*
Class	*Mammalia*
Order	*legomorpha*
Family	*Leporidae*
Genus	*Oryctolagus*
Specie	*Oryctolagus cuniculus*

3.5 Commonly used terminologies

Buck - mature male rabbit
Doe - mature female rabbit
Littler or kittens – young or new born
Caecotrophy- the practice of eating a type of faecal pellet produced in the caecum of the large intestine

3.6 Breeds of rabbits



Common international breeds of rabbit

3.6.1 California breed

This is the second most popular breed for meat production. The colour is all white but with black tipping on the nose, ears, feet and tail. The weight range for the mature Californian is 3-4.5 kg fig 1.1

Fig. 1.1California breed

Source (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 99

3.6.2 New Zealand white

This breed is the one used most widely throughout the world for meat production. It is all white in colour and usually weighs 3-5 kg when mature. Fig.1.2

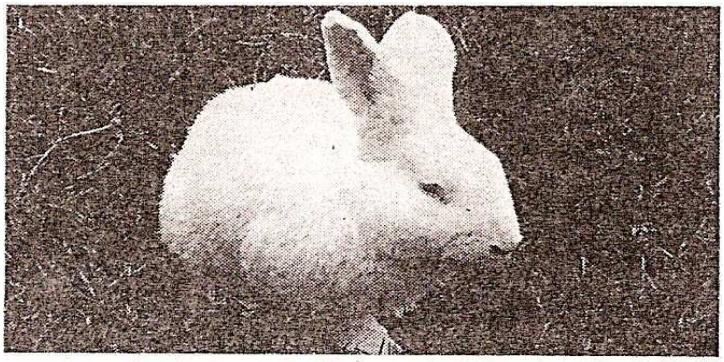


fig1.2 New Zealand white breed

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 99

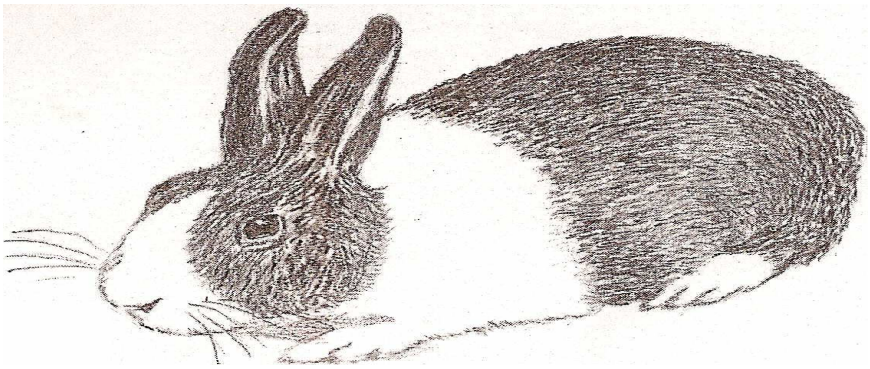
3.6.3 American chin chilla

This breed is blue-grey in colour with a white belly. It has a characteristic ruff or dewlap. This is a thick fold of skin around the front of the chest which is very obvious when the rabit is in good condition and sitting in a resting position. The weight range for the mature Chinchilla is 3-4.5 kg. Fig 1.3



Fig. 1.3 American chin chilla

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 100



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of

3.6.4 Dutch

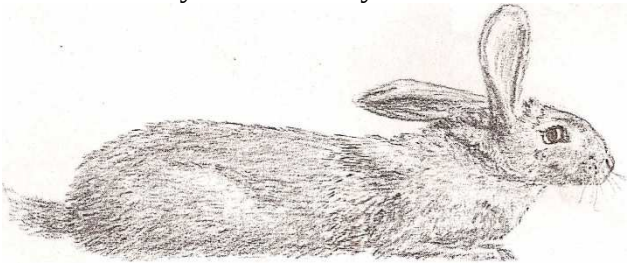
The Dutch is a small breed with a mature live weight 2.5-3.5 kg. It has a wide white band fur around its body at the shoulders as well as a white stripe down the middle of its face. Its front feet fall within the white and the tips of its back feet are also white. See fig.1.4

Fig 1.4 Dutch

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 100

3.6.5 Flemish giant

This is a giant breed which at maturity can weigh well over 6 kg. It is usually light grey in colour but may also be sandy blue or white. This is not a suitable breed for the beginner.



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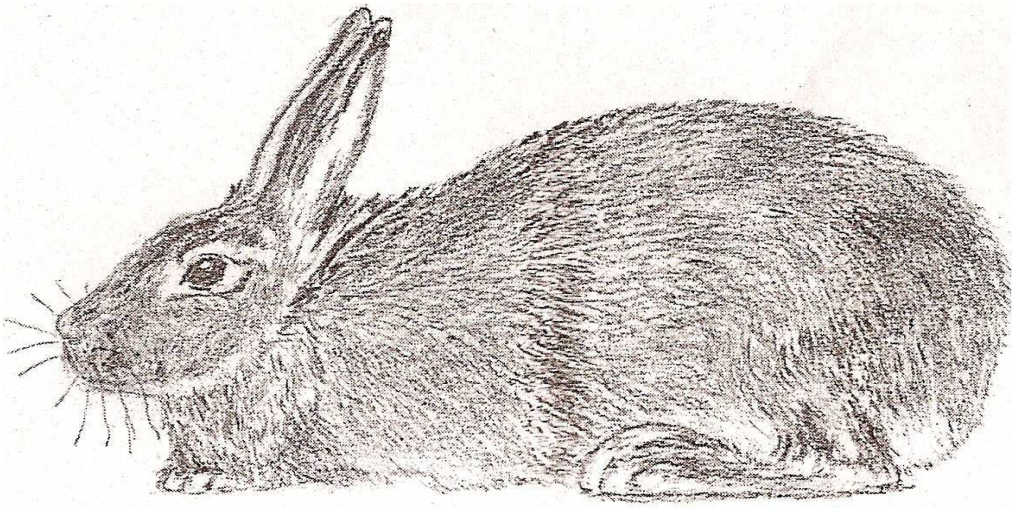

3.6.6 New Zealand red

This breed is essentially a red New Zealand white type which has not been as intensively selected for growth rate. Mature live weight is lower than the white type, at 3-4.5 kg.

Fig 1.6New Zealand red

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste Page 101

Other breeds

There are over 40 recognized breeds of domesticated rabbit in the world. Other common breeds include Champagne d' argent, English spot, Simon ire, Lop e.t.c.

3.6.8 Comparison between some popular breeds of medium and heavy Weight of rabbits

Table 1: Comparison between some popular breeds of medium and heavy weight rabbits

Breeds	**Weight at maturity (kg)**	**Litters/doe/year**	**Body colour**
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			shoulders, face, font feet and tips of its back.
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Self assessment exercise 2.1

1.) In a tabular form compare the medium and heavy weight breeds of rabbits based on their weight, litters/doe/year, and body colour

4.0 Conclusion

Rabbits grow quickly and are cheap source of protein, they have many advantages, several breeds of them are available and can be reared for consumption or commercial undertaking.

5.0 Summary

In this unit we have learnt that:

- Rabbit are used for meat, for vocational projects, as laboratory animals, as teaching tool, as animal research model and for pets.
- Advantages of keeping rabbits include relatively small body size, meat is of high quality animal protein, efficient feed converters to high quality protein, can be use to minimize the protein intake in-balance in Nigeria, excellent product acceptance, useful by-product, suitable animal for learning basic skills for animal husbandry e.t.c.
- The few disadvantages are vulnerability to prey, and Rabbit production is not easy it takes a great deal of skill, a lot of hard work and a lot of food.
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- Common international breeds of rabbit include California breed, New Zealand white and red, American chin chilla, Dutch breed, Flemish giant, Champagne d' argent, English spot, Simon ire, and Lop.
-

7.0 Tutor marked assignment

1a) Discuss the advantages and disadvantages of keeping rabbits.
d) How do you promote rabbit production in Nigeria?
e) Mentioned six breeds of international origin found in Nigeria and explain the characteristics of any three.

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7.0 References and Further readings

Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan*

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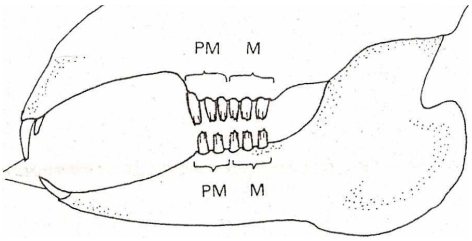
1.0 Introduction

Rabbit nutrition is the single most important aspect of production, well-nourished rabbits can better resist diseases and recover from environmental stresses and any shortcomings by the producer.



2.0 Objectives

By the end of this unit you will be able

- To familiarized yourself with the anatomical features of the digestive system of the rabbit and it's role in nutrient utilization.
- To know the sources of rabbit nutrients like protein, energy, fats, carbohydrates, fibre, minerals, vitamins and their requirements.
- To be familiar with the concept of 'caecotophy' and its significance in rabbit digestion.
- To understand the three feeding systems of the rabbit and their merits and de-merits

3.0 Main Content

3.1 The digestive system and nutrient utilization

liver

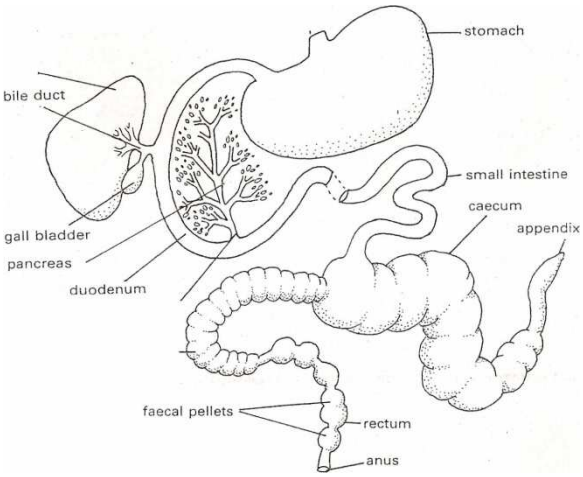


Fig 2.1The digestive system of the rabbit

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 13

Fig2.2 Mouth and teeth

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 12

3.2 Mouth and teeth

The rabbit's teeth is shown on fig.2.2 the incisors are for cutting and the premolars and molars are for grinding. The front surface of the incisors has a thick layer of enamel which forms a sharp edge at the cutting point of the teeth. The incisors are said to be upon rooted, meaning that they continue to grow throughout the rabbit's life as they are worn down by chewing. The food is mixed with saliva as it is ground by the molars to reduce its particle size. After this first processing period the food is swallowed and passes down the oesophagus to the stomach.

3.3 Stomach and small intestine

The stomach represents about 40% of the total volume of the digestive system. Food in the stomach is exposed to acidity and some enzyme digestion begins. Weak muscular contractions in the stomach push the food in to the first loop of the small intestine, the duodenum. The food is first bathed in bile which enters via the bile duct. Bile is produced in the liver and is stored in the gall bladder. The bile salts assist in the digestion of the fats in the food. As the food passes further along the duodenum it is mixed with enzymes produced in the pancreas and which enter via the pancreatic duct. Enzyme digestion is rapid and food proteins are broken down to amino-acids which are absorbed through the intestinal wall into the blood system. Fatty acids, glycerol, glucose and other simple sugars are the end products of fat and carbohydrate digestion and these are also absorbed as the food passes along the small intestine.

3.4 Caecum and large intestine

The rabbit is sometimes referred to as hind-gut fermentr, meaning that food is broken down by bacteria at the end of the digestive system. The major site of this breakdown is the caecum. The large caecum has absorbing and secretory cells throughout its large area. The caecum contains many bacteria that grow and multiply on the partly- digested food. These bacteria are very important because the synthesize B vitamins, particularly thiamin, and because they breakdown plant fibre. The breakdown results in the production of acetic, proprionic and butyric fatty acids, which are absorbed from the caecum and large intestines and used as sources of energy by the rabbit.

The rabbit produces two types of faecal pellet, one soft type containing many bacteria which is re-eaten, and one that is hard and passed out in the normal way.

Water is reabsorbed throughout the caecum and large intestine. This results in the relatively hard, dry faecal pellets which are characteristic of rabbit faeces.

From the above it is clear that the function of the digestive system is to transform the digested food to chemical, physical and biological processes in such away that the organism can use the nutrient of the food for maintenance, growth and reproduction.

The digestive system of the rabbit is well adapted for the utilization of roughages and feed of plant origin. The digestive system occupies the large portion of the body cavity. The development of the digestive system is almost completed at 9 weeks of age, the caecum and the colon start to develop around 3-5 weeks of age when feed ingestion other than milk start to be significant and a micro floral population becomes important in those organs. The size of different part of the digestive system varies with age, breed, physiological status and type of feeds given to the rabbit. The amount of time the feed stays in the digestive system affects the time of enzyme and micro-organism activity.
This time is 17-18 hrs. The longest retention time occur in the stomach and in the caecum. Retention time in the small intestine is relatively low.

3.5 Nutrient requirement of rabbits

The domestic rabbit will eat most type of green vegetables, grain, tuber and root. Therefore, the ration may consist almost entirely of ingredients from plant sources.
Kitchen wastes such as uncooked vegetables, cereals and remain of meals can be fed to rabbits provided certain rules are followed:

1. The waste must be fed when fresh and unsoured.
2. It must be removed after a few hours if it is not eaten.
3. It should represent less than half of the rabbit's daily ration.

3.5.1 Water

Water should be supplied ad.libitum. Rabbits have high requirements for water in relation to their body. Water is necessary for maintenance, production and lactation because dry matter intake is related to water intake. Any restriction in water intake causes a decline in dry matter consumption. However, if feeding is restricted, water intake may increase water should be clear, fresh and free from biological and chemical contaminants.

3.5.2 Protein

The quality and quantity of protein are not critical in rabbit as in poultry because rabbit can adapt to poor and low protein situation but production will not be optimum.
With high and good protein quality, however, optimum production can be achieved. Crude protein is an approximate measure of the total amount of amino-acids. For rabbits the recommended crude protein level in the dry matter of the ration is

- over 18% for newly weaned rabbits;
- 16-18% for rabbits from12 to 24 weeks;
- 15-17% for a breeding doe.
- 12-14% for all other stocks.

3.5.3 Energy

The energy requirement of rabbit are made from fibrous components of the feeds. Energy requirement is between 2390 and 2500kcal of digestive energy. This energy can be supplied from fats grains, maize, cereal bran and fibrous feeds.

3.5.4 Fats

Rabbit can handle up to 20-25% fat in the diet depending on their age. Fat provide energy as well as supplying essentially fatty acids. Fat also provide palatability and reduce dustiness in feed.

3.5.5 Carbohydrates

Grains are the readily available carbohydrates.

3.5.6 Fibre

Rabbit eliminate fibre and digest non fibrous component of the feed. Anti peristalsis wave on the proximal colon in conjunction with normal contraction in the caecum are responsible for the separation and excretion of fibre. The digestion of cellulose is low.

3.2.7 Minerals

Calcium is the bone constituent which is involve in blood clothing controlling excitability of nerve and muscles and in maintenance of acid base equilibrium. Phosphorus is a component of cellular constituent such as adenosine tri phosphate (ATP) and deoxy ribonucleic acid (DNA), ribonucleic acid (RNA) and phospholipids. Phosphorus is also a component of the bone. Calcium absorption is experience by its level in the feed.
Dietary phosphorus and vitamin D factors have not been critically studied in rabbit. Calcium level in the serum (sera) of rabbit is higher than what is obtained in other species, this is because other species maintained a regulated constant level of calcium through a process called homeostasis, since this homeostasis is absent in the rabbit dietary calcium level is directly reflected in the blood unregulated.

3.2.8 Vitamins

Vitamins are chemicals that are required in very small amounts to speed up chemical reactions within the rabbits body. The most important vitamins are the vitamins A and D, and the B vitamins choline and thiamin.

3.6 Caecotrophy

One aspect of rabbit nutrition that is particularly interesting, it is sometimes called refection. Caecotrophy is the eating of faecal –like pellets produced in the caecum.

Types of faeces produced

The rabbit produces two kinds of faeces viz:
1) hard faeces
2) soft faeces or caecotropus

The rabbit has a specialized mechanism that retain ingestion in the proximal colon and caecum for microbial utilization of nutrient and also to allow the formation of the two types of faeces. The faeces suitable for consumption are the soft faeces. It originates from the caecum (cecotropus) while the other which the rabbit don’t eat is called the hard faeces.

Table 2.1 The composition of the two types of rabbit faeces:

Constituents (%)	Hard faeces	Soft faeces
Dry matter	52.7	38.6
Crude protein	15.4	25.7
Ether extract	3.0	5.3
Crude fibre	30.0	17.8
Ash	13.7	15.2
Nitrogen free extract	37.9	36.0
Gross energy(unit)	4.34	4.53

3.7 Feeds and feeding

Rabbits kept in hutches or colonies are totally dependant on the keeper for their food. They can eat only what the keeper provides. Wild rabbits pick and choose their own food. They have instinctive wisdom which helps them to select a good balanced diet. The rabbit keeper does not have this instinctive wisdom and must therefore think carefully about what is the best food for the rabbits.

3.7.1 Feeding systems

There are three possible feeding system and each system has it's own advantages and disadvantages. These are:

- **Extensive system:** total dependence on forages and kitchen wastes.
- **Intensive system:** total dependence on prepared concentrate foods from the feed mill
- **Semi-intensive system:** the use of forages supplemented with prepared concentrate foods.

Table 2.2 the advantages and disadvantages of intensive and extensive feeding systems

System	**Advantages**	**Disadvantages**
Extensive	Cheap, easy to provide the quantity of food required	Everything depends on the keeper to choose the correct foods. Supplies of forage

		may vary throughout the year. Quality is variable and is often too low, for reasonable production needs a lot of labour and may introduce diseases and health problems.
Intensive	Needs little time for feeding. High levels of production can be obtained. Little risk of diseases being brought in with the food	Very costly. Depends on the supplies from the feed mill which may not always be available or of good quality.
Semi- intensive system	Most suitable for the small-scale producer. Make the best use of forages and prepared concentrated foods at the critical times (during last third of pregnancy, lactation and post-weaning**.**	Falls between the extensive and the intensive system

3.8 Feeding skills

This can be achieved by close observation and monitoring. Observation is the skill of seeing and remembering the different sorts of plants and their location in the local area which are useful for rabbit feeding. Observation also helps to see how rabbits react to the different foods they are given, so that you can learn which foods they like and which they do not. Arising out of this observation exercise it would be interesting to make a list of local plant that prove to be useful in rabbit feeding and to discuss this list with other rabbit keepers.

Self assessment exercise 2.2

b) One aspect of rabbit nutrition is caecotrophy, Discuss in detailed the concept of caecotrophy and compare the advantages and disadvantages of the three feeding systems in rabbits.

4.0 Conclusion

It is obvious that rabbit nutrition is most important aspect of their production without which the rabbit will not resist any disease attack and environmental stress.

5.0 Summary

In this unit we have studied that:

- The domestic rabbit will eat most type of green vegetables, grains, tubers and roots. Kitchen wastes such as uncooked vegetables, cereals and remain of meals can be fed to rabbits provided certain rules are followed:
- Water should be supplied ad.libitum. For rabbits the recommended crude protein level in the dry matter of the ration is over 18% for newly weaned rabbits;
  16-18% for rabbits from12 to 24 weeks; 15-17% for breeding does; 12-14% for all other stocks. Energy requirement is between 2390 and 2500 kcal of digestive energy. Rabbit can handle up to 20-25% fat in the diet depending on their age. The digestion of cellulose is low.
- Caecotrophy is the eating of faecal –like pellets produced in the caecum.
- There are three possible fedding systems in the rabbit these are Extensive system which is total dependence on forages and kitchen wastes. Intensive system is total dependence on prepared concentrate foods from the feed mill, while Semi-intensive system is the use of forages supplemented with prepared concentrate foods.

6.0 Tutor Marked Assignment

1. With the aid of a diagram explain the process of digestion and absorption in rabbits.

7.0 References and Further readings

Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan.*
McDonald, P., Edward, R. A., Greenhalgh, J. F. D. and Morgan, C. A. (1998) *Animal Nutrition 5th edition*
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Introduction to Non-Ruminant Animal Management:

Rabbit Management

Unit 3: Rabbit Reproduction

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1.0 Introduction.

Reproduction is a process of giving birth, is a complex process controlled by many substances called hormones which are produced in endocrine glands in the body, and in other

parts of the body like the ovaries. Hormones are produced in very small amounts. They are transported to the organ they controlled (target organ) by the blood circulation system. Different hormones act on different parts of the reproductive system at different times to ensure successful reproduction.

2.0 Objectives

By the end of this unit you will be able to:

- Know the anatomy and physiology of male and female reproductive organs of rabbits
- Select a doe for breeding purposes based on certain quality characteristics.
- Confirm pregnancy from certain characteristic behaviour of the doe.
- Differentiate the male from the female in young rabbits.
- To understand the need for special care during weaning the age of weaning

3.0 Main Content

3.1 Male and female reproductive system

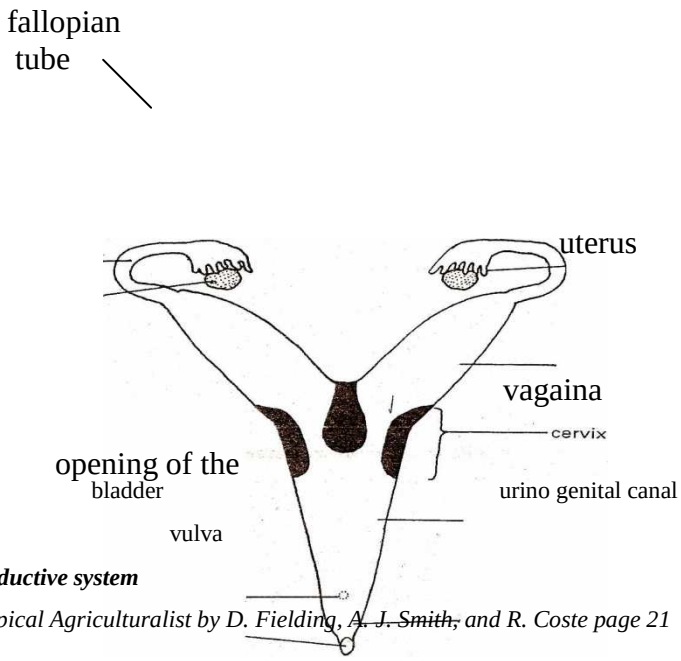


Fig 3.1 Tthe female reproductive system

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 21

3.2 The female reproductive system consists of the following parts

1. ovaries (2);
2. oviducts or fallopian tubes (2);
3. uteri (2);
4. cervix;

5. vagina;
6. vulva;
7. Mammary glands (8-10).

The relative position of the above organs is shown in fig 3.1
The ovaries produce the female eggs- ova- inside follicles which grow on the surface of the ovaries. When released they are led by strands of tissue- the fibriae into the fallopian tubes. Aided by muscle contractions and moving hairs in the tube walls, the ova travel down the fallopian tubes and meet and fuse with the male sperm.
Within hours the fertilized eggs divide to become embryos, which move into the uteri. The uteri have many convolutions and are well supplied with blood. The embryos attach to the uterine walls and develop into fetuses. At the end of pregnancy, after 31 days, the young rabbits pass out through the cervix, the urino-genital canal and the vulva.

3.3 The male reproductive system

The male reproductive system consist of the following parts; their relative positions are shown in fig 3.2

bladder

Vas deferens

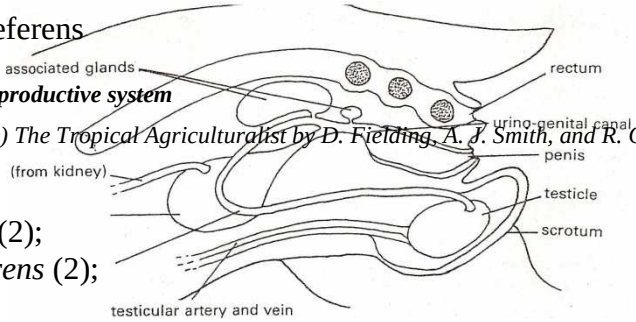


Fig.3.2 Male reproductive system

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 22

1. testicles (2);
2. *vas deferens* (2);
3. penis;
4. associated glands

The male reproductive cells- the sperm- are produced in the two testicles which normally lie outside the body in the scrotum. They descend into the scrotum when the rabbit reaches about 10-12 weeks of age. The testicles need to be cooler than the normal body temperature if they are to produce viable sperm. Each testicle has a tube- the *vas deferens*- for transport of the sperm to the urino-genital canal and onwards to the penis.

3.4 Selection for breeding

Breeding stock should be selected from does who are good mothers and who have good body size and shape. Also to be considered is the live weight of the rabbits, select the heaviest but take account of any differences in age if selecting from more than one litter.
The size of the litter of which the rabbit is a member, give selection preference to rabbits from the largest litters if there are enough liters to give a choice.
Select rabbits free of any signs of ill-health. Males should be checked to confirm that each has two testicles in its scrotum.

3.4.1 Mating

On forage based systems, does are normally ready for mating at about 8-10 months. At this age their growth will be slowing and they will be able to direct a larger portion of available food to reproduction. The weight at mating varies according to breed. Effort should be mad to determine the optimum weight for mating for any breed in question.
The same applies to bucks as to does, but bucks can usually be used for mating from 6-8 months, depending on the condition. The ratio of does to bucks should not exceed
10 : 1. However, for safety, it may be sensible to have two bucks for more than six does and three for more than twelve.
Experience has shown that early morning or evening mating is best. It is advisable to avoid the hottest periods of the day.

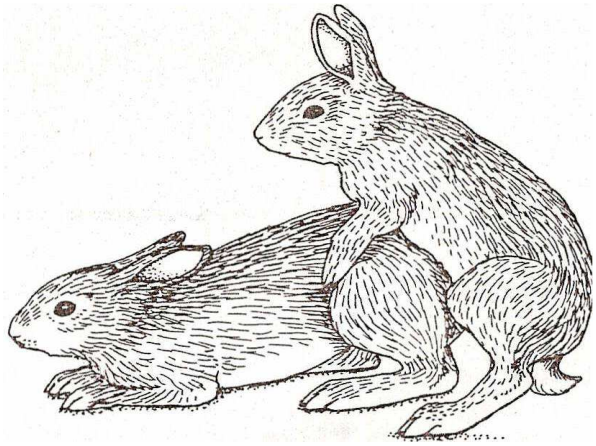


Fig3.4 Rabbit mating
Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 54

For mating , the doe should be taken to the buck's hutch if it is done the other way round the doe may attack the buck and cause injury. If the doe is ready to be mate she will stand still within a few seconds, stretch out and slightly raise her hind quarters so as to allow the buck to mount and mate, as in fig.3.4 successful mating is signaled by the buck thrusting forward and literally falling off the doe. This is very easy to see. If the buck slides backwards off the doe and does not fall, then mating has not taken place. Once mating has taken place the doe is removed from the buck's hutch. The doe may be returned after an hour or so for a second mating. This is good practice for new keepers to follow.

3.4.2 Pregnancy

Pregnant does will often accept the buck during pregnancy, so refusal to mate cannot be used to confirm pregnancy. The first real confirmation of pregnancy can be obtained at about 14 days after mating. The doe should be relax and sitting naturally. If fingers are then gently run along the abdomen, between the back legs small bead-like lumps can be felt if the doe is pregnant as shown above fig.3.3 these are developing foetues.
Inexperienced keepers should practice detecting pregnancy in does that are 20 days pregnant, at5 which stage the fetuses are easy to identify.

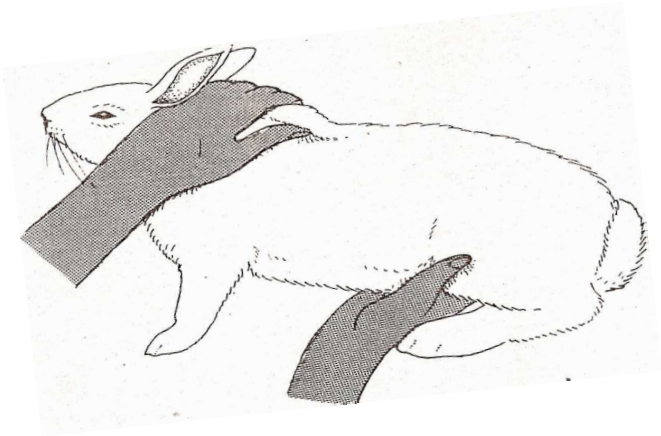


Fig3.3 testing for pregnancy by palpation
Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page55

By around 28 days the mammary gland will have developed significantly and this can be regarded as final confirmation of pregnancy. At around 29 days the doe will begin to remove fur from her abdomen to make a nest.
Pregnancy or gestation is the time from fertilization to the time of kindling or parturition which take 31 or 32 days. On the average, pregnancy period last 30 days in the common commercial breed. During this period the doe should be well fed and protected from stresses such as dogs and general noise.
Gestation period- this is the time from fertilization to the time of kindling or parturition which take 31 or 32 days. On the average, pregnancy period last 30 days in the common commercial breed.
About 4-5 days before kindling a nesting box should be brought in with some wood shaving of fine straw placed on the floor of the box. It will soon be found that the doe begins to remove hair from her abdomen and sides and place them in the box to prepare a warm cushion for the young ones soon to be born. The young ones of rabbit are born naked and blind. Their mother uses the hairs in the box to cover them to keep warm.

3.4.3 Kindling

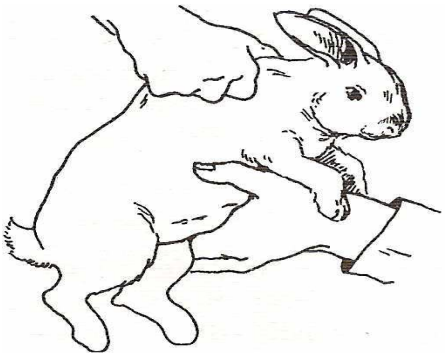
The doe usually kindles or gives birth, at night. Once kindling has finished the doe will pluck more fur from her abdomen and cover the young rabbits. It is best to leave her undisturbed

for 2-3 days after kindling unless there are obvious problems. It is a good practice to have some cotton wool ready to cover the litter if the doe has not done this properly herself.

3.4.4 Sexing

Sexing of rabbit can be done any time as from the moment of weaning. Close to the anal opening is another orifice (opening) which is the sexual aperture. In both sexes, there is no difference of external look of this opening, but when the opening is pressed open with the aid of thumb and forefinger, the difference become quite vivid. In the female, a longitudinal slit will be seen, while in the male a round opening is observed and the penis can be seen protruding out of this opening. If sexing is delayed longer, the testes of the male would have developed fully and could be seen protruding out clearly from the body between the two hind legs. This makes the identification of the male easy. Any rabbit not having these testes protruding out is female.

Another method of identification of fully grown rabbit is the size of the animal. The doe is usually smaller than the buck within the same breed and she is a lot more docile than her opposite sex.



a

b

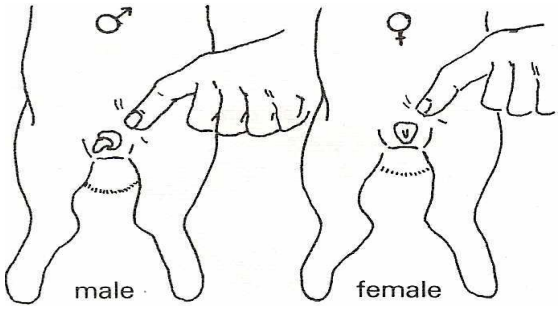


fig 3.5a lift from scruff of neck and support underneath, press gently where indicated

Fig 3.5b showing the male and female reproductive organs of the young rabbit

Source: ***Livestock rearing in the tropics by I. McDonald and J. Low page 112***

Self assessment exercise 2.3

1) Write short notes on the following:
i) Mating in rabbits.
ii) Rabbit pregnancy
iii) Kindling
iv) Sexing of young rabbits

3.4.5 Weaning

Weaning is the separation of the doe and the young. It should be done around 6-8 weeks after kindling. The best method of weaning is to take the doe away from the litter. To do it the other way round will put too much stress on the litter.
The period after weaning is another critical time for the young rabbits and it is a time for feeding some concentrates if available. Small amounts of concentrate at this time will have a big effect on growth rate. As the rabbit grow they may be gradually taken off concentrates but their growth rate will slow as a result. The litter will soon require extra hutch space.
After weaning, the doe should be allowed time to recover her body condition before re-mating. Weekly weighing is the only sure method of checking that she is regaining her body reserves. Does can usually continue breeding until they are 3 to 4 years old.

4.0 Conclusion

Reproduction is a complex process controlled by substances called hormones. Breeding stock should be selected from does who are good mothers and who have good body size and shape to ensure healthy offspring's.

5.0 Summary

- Reproduction is a complex process controlled by substances called hormones which are produced in endocrine glands in the boy, and in other parts of the body like the ovaries. Hormones are transported to the organ they controlled (target organ) by the blood circulation system.
- The female reproductive system consists of the ovaries (2); oviducts or fallopian tubes (2); uteri (2); cervix; vagina; vulva ad Mammary glands- (8-10). While The male reproductive system consist of the testicles (2); *vas deferens* (2); Penis and associated glands
- Breeding stock should be selected from does who are good mothers and who have good body size and shape. The ratio of does to bucks should not exceed 10 : 1
- The first real confirmation of pregnancy can be obtained at about 14 days after mating. The doe should be relax and sitting naturally. If fingers are then gently run along the abdomen, between the back legs small bead-like lumps can be felt if the doe is pregnant, these are developing foetues.
- The doe usually kindles or gives birth, at night. Sexing of rabbit can be done any time as from the moment of weaning. Weaning is the separation of the doe and the young. it should be done around 6-8 weeks after kindling.

6.0 Tutor marked assignment

1a) Draw and label the buck and the doe reproductive systems.
b) Explain the criteria used in selecting does for breeding

7.0 References and Further reading

I. McDonald, J. Low (1985) *Livestock rearing in the tropics Macmillan education Ltd.*
D. Fielding, A. J. Smith, and R. Coste (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan*

Introduction to Non-Ruminant Animal Management: Rabbit Management

Unit 4: Rabbit Housing and Equipment

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1.0 Introduction

Rabbit housing (hutches and cages) and equipment differ from country to country. Factors governing their design include climate, availability and cost of raw materials, scale and system of production and the expertise of the rabbit keeper. There are, however, some basic requirements which all hutches an equipment should satisfy and any new or existing hutches and equipment should be assessed against these requirements.

2.0 Objectives

By the end of this unit you will be able to:

- Know the basic requirements of a rabbit house in terms of, space needed, protection, convenience and ease of management e.t.c.
- Understand indoor and outdoor hutches, their advantages and disadvantages.
- Exposed to the idea of floor system of keeping rabbits, it's requirements and problems.
- To be familiar with hutch equipment, their requirements, types, uses and maintenance.

3.0 Main Content

3.1 Housing requirements

Any rabbit hutch should provide adequate space and protection for the rabbit and also convenience to the rabbit keeper.

Space

Since the rabbit is going to be in the hutch for life there is need to provide enough space to minimize restriction of movement. For the rabbit to be able to stretch it self and carry out its normal activities then horizontal and vertical space are all important. Space is also critical for good ventilation and temperature regulation within the hutch. These are necessary to maintain good health and prevent diseases.

Protection

For the farmer to be successful, it is necessary to provide adequate protection to his rabbits. This protection is against injury within the hutch, from direct sunlight, rain, direct and indirect wind, sudden noises, predators like dogs, cats, rats, snakes, safari ants and human thieves.

Convenience to the rabbit keeper

For a successful operation on the farm, the house should be designed in such away to assist the keeper to carry out routine practices like observation, examination, handling, feeding, mating the rabbits, cleaning and disinfection. Also there should be room for expansion when the number multiplies.

3.2 Types of housing

Basically there are two types of housing these are

1. **outdoor hutches -** this are kept outside all the time
2. **indoor hutches -** this are kept inside a house or open shed.

.

Outdoor hutches and indoor hutches

The requirements of space, protection and ease of management can be achieved through appropriate design, construction and siting

Typical hutch dimensions for a general purpose hutch are as follows:

- 1 m above the ground approximately;
- height of hutch: 60 cm at the front, 50 cm at the back;
- width: 50-60 cm;
- length: 90-120 cm

3.2.1 Indoor hutches

The hutches within the house can be much simpler than outdoor hutches and simple boxes made from wired frames can be used. These can be hung in a number of ways

Indoor hutches are appropriate for the established keeper with good markets to justify the expenses in setting them up.

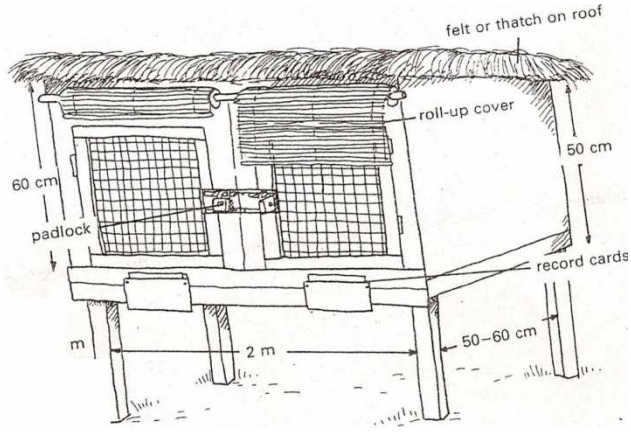


Fig 4.1A ***typical rabbit hutch***

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 37

Indoor hutches and their inside arrangements are shown below:

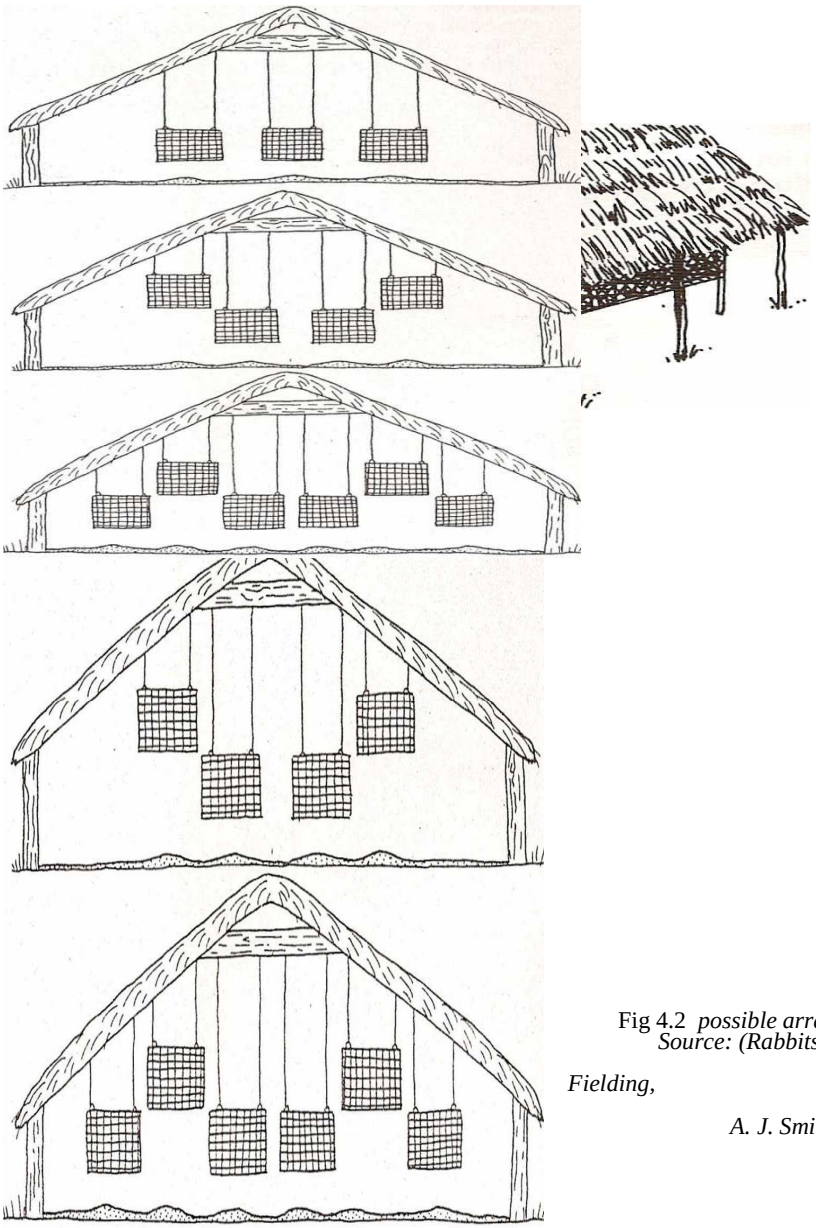


Fig 4.2 *possible arrangements of indoor hutches*
Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 33

3.2.2 Out door rabbit hutch

fig. 4.3 Outside rabbit hutch

Source: *Livestock rearing in the tropics by I. McDonald and J. Low page 113*

Table 4.1 The advantages and disadvantages of outdoor and indoor hutches.

Type of hutches	Advantages	disadvantages
Outdoor	Relatively cheap. Appropriate when starting production	Impossible to met all the protection requirements all the time e.g. in storms Hutches difficult to clean and keep dry. Not easy to increase the number of hutches quickly.
Indoor	Good conditions for the rabbits and the rabbit keeper. Rabbits are more easily observed. Individual hutches are easier to keep clean and use particularly useful where many rabbits are kept. It is easier to protect rabbits from predators.	Requires a major initial investment, too costly for the beginner

3.3 Floor methods of housing

This method involves keeping the rabbits on the ground, in a fenced area provided with simple boxes for shelter. In this system several does are kept in the same area. This method is particularly suited to very dry areas and or where producers cannot obtain or afford the materials to build proper hutches. In this method one of the most important requirement is to keep the floor dry. An alternative method is to make a deep layer of dried straw, rice husks or wood shavings. Mud or wooden shelters that can be secured at night can be constructed to provide protection from predators. Rabbits may be allowed to burrow in floor system and may rear their young in these burrows, but kindling boxes are preferable. Bucks should be kept separate from the does and young rabbits unless there is plenty of space. To avoid fighting between does provide enough space at least 1 m^2 per doe. For floor methods to be successful, observe strict hygiene and avoid overcrowding.

These methods of rabbit keeping are not widely practiced and need a lot of management attention to be successful.

Self assessment exercise 2.4

1) Discuss the floor method of housing rabbits and its limitations.

.

3.4 Hutch equipment

Hutch equipment consist of four items
Some home-made rabbit drinkers and food troughs are shown in fig. 4.4 below

1. water trough;
2. food trough;
3. roughage rack;

kindling box

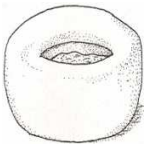
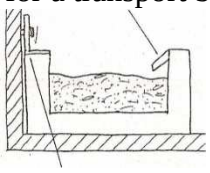
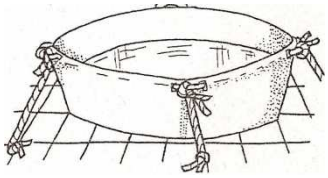
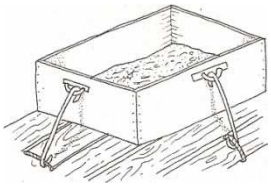


Fig.3.4 Home made food troughs and drinkers
*Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page*34

In addition there may be need for a transport box and a storage facility for food and other items







3.4.1 Equipment requirements

For water and food troughs the requirements are

7. It should be impossible to tilt over.
8. It should have adequate size and depth.
9. It should discourage scratching out of contents.
10. It must not cause injury to the rabbit.
11. It should be cheap and can be constructed locally.

Forage racks should be fitted inside the hutch and

12. it should allow the rabbit full access and not limit food intake.

Kindling boxes should:

13. provide a secure, draught proof dry container in which the doe can kindle;
14. prevent the young rabbits leaving until they are at least 2-3 weeks old

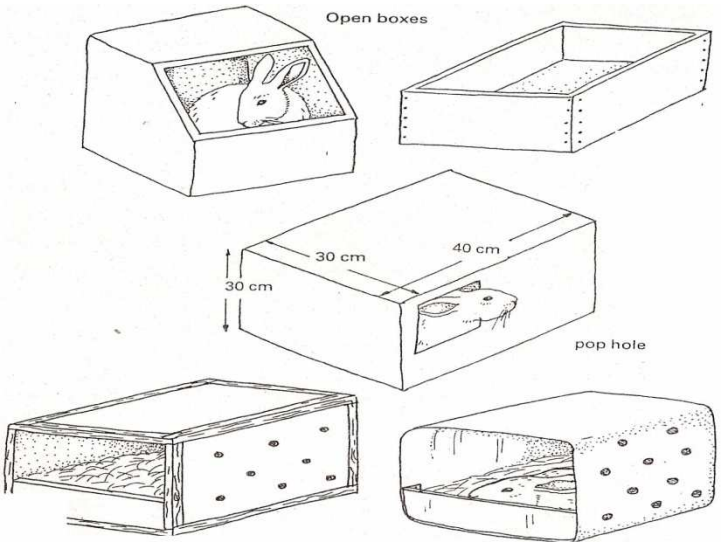


Fig4.4 open and closed kindling boxes[35]

Source: Fielding, A. (Rabbits) The Tropical Agriculturalist by D. J. Smith, and R. Coste page

3.4.2 Maintenance of hutches and equipment

Proper maintenance includes the following:

- cleaning of hutch and equipment every 2-3 days;
- complete cleaning between litters using soap and water and if possible disinfectants. This should be followed by complete drying and disinfection in direct sunlight;
- checking and repairing loose boards, tins or wires which may allow the rabbits to escape or drop through or predators to enter.
- checking for the development o sharp edges in hutches and on equipment which may cause injury.

4.0 Conclusion

Regardless of the type of housing method and the equipment used the above mentioned requirements on housing and equipment has to be fulfilled.

5.0 Summary

By the end of this unit you learnt that:

- Any rabbit hutch should provide adequate space and protection for the rabbit and also convenience to the rabbit keeper. Basically there are two types of housing these are outdoor hutches - this are kept outside all the time. Indoor hutches - this are kept inside a house or open shed.
- Hutch equipment consist of four items, water trough; food trough; roughage rack; kindling box .
- Equipment requirements For water and food troughs are it should be impossible to tilt over. it should have adequate size and depth. it should discourage scratching out of contents. it must not cause injury to the rabbit. it should be cheap and can be constructed locally. Forage racks should be fitted inside the hutch andit should allow the rabbit full access and not limit food intake. kindling boxes should: provide a secure, draught proof dry container in which the doe can kindle; prevent the young rabbits leaving until they are at least 2-3 weeks old
- Maintenance of hutches and equipment include cleaning of hutch and equipment every 2-3 days; complete cleaning between litters using soap and water and if possible disinfectants. This should be followed by complete drying and disinfection in direct sunlight; checking and repairing loose boards, tins or wires which may allow the rabbits to escape or drop through o predators to enter;
  checking for the development of sharp edges in hutches and on equipment which may cause injury.

6.0 Tutor Marked Assignment

1a) In a tabular form compare the outdoor and indoor type of hutches.
b) Discuss the housing requirements of Rabbits.

7.0 References and Further readings

Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan*
McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics Macmillan education Ltd.*



Introduction to Non-Ruminant Animal Management:

Rabbit Management

Unit 5: Husbandry Skills of Rabbit Production

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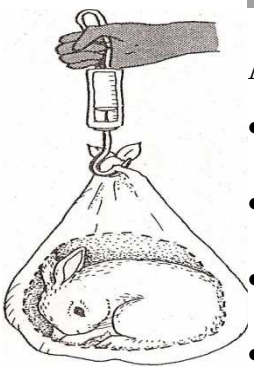
1.0 Introduction

Many skills are needed if rabbit unit is to succeed. Observation, examination, record keeping, hutch design, building and siting, food identification, selection, production and storage, good management e.t.c. are all part of the skills needed for a successful operation.



2.0 Objectives

After this unit you should be able to:

- Observe critically with interest any changes in behaviour or activity of your rabbits
- Examine systematically your rabbits for any abnormality by asking some relevant questions.
- Practice periodic weighing of your rabbits to check their growth and general condition.
- Appreciate the significance of routine management practices e.g. nail trimming to avoid injuries.
- Know the different methods of rabbit identification.
- Recognized the importance of record keeping in rabbit farming.

3.0 Main Content

3.1 Husbandry skills

3.1.1 Observation

This means not only looking but bearing in mind. It is an important ability for all animal keepers. It depends on the rabbit keeper having real curiosity and compassion for the rabbits. It is a talent that comes with practice but can be developed with the help of questions to be used each time you visit the rabbit unit. Questions like is everything the same as the last time I came? Are the hutches as normal? Is there any food left? Are there any signs of blood? Is the fence wire coming loose? Is there lots of hair in the hutch, suggesting moulting? This questions are only a guide you may ask yourself as many questions as you can with the aim of identifying any anomaly or problems.

3.1.2 Rabbit examination

Rabbit examination is required after a new rabbit is being bought or rabbits are being checked prior to selection for breeding. Examine for the following:
Does it look healthy? Is its head on one side? Is it isolating itself from the other rabbits? Are there scabs on the skin? Are the nostrils clear or running with other fluid? Are the hard faeces normal? Are there any sores in the ears? Is the gait normal? How is the weight compared with the age?

3.1.3 Weighing

This is done to check on their growth and their general condition. Rabbits can be weight by two methods: either by the use of a pan-scale or a spring balance as shown in fig. 5.1

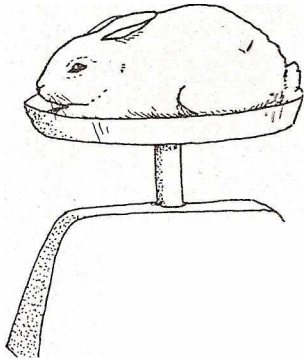


Fig 5.1 pan-scale and a spring balance weighing

Source: (Rabbits) the Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 65

3.1.4 Nail trimming

Rabbit's nails need to b trim from time to time because rabbits in hutches do not wear down the nails on their feet by burrowing or running about. The nails can scratch the keeper, and can injure the rabbit too. A pair of sharp scissors or human nail clipper ca be used to trim the nails as shown in fig.5.2

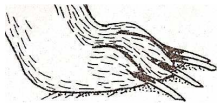




fig 5.2 *holding a rabbit for nail-trimming*

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 65

3.1.5 Identification

This is a way and means of recognizing ones animals (rabbits) and differentiating between one's animals (rabbits) from another farmer's own and differentiating between individual animals (rabbits). There are several methods employed to achieve this.

- Writing in the ear
- Labels
- Ear-notching

3.1.6 Writing in the ear

For rabbits that has light-coloured skin in its ear, a coloured or indelible pen can be used to write a number inside the ear. This will last a week and will have to be renewed regularly.

3.1.7 Labels

With care labels or leg bands can be fitted around the back leg of a rabbit for identification. This labels are hand made from in or plastic. Care should be taken to avoid injury or cutting the leg. see fig 5.3

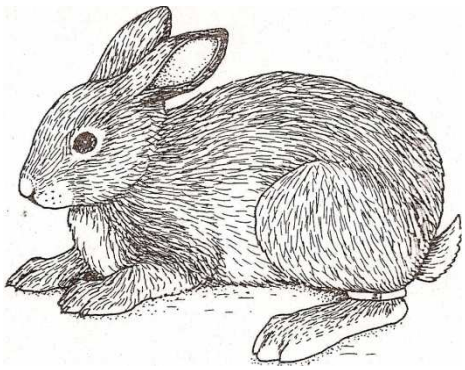


Fig 5.3 Identification using a leg band

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 66

3.1.8 Ear-notching

This means clipping little pieces out of the rabbit's ears at different places, to indicate different numbers. One such code is shown on fig.5.4 ear –notching is a permanent and effective method but requires a special notching instrument a livestock officer will assist the rabbit keeper.

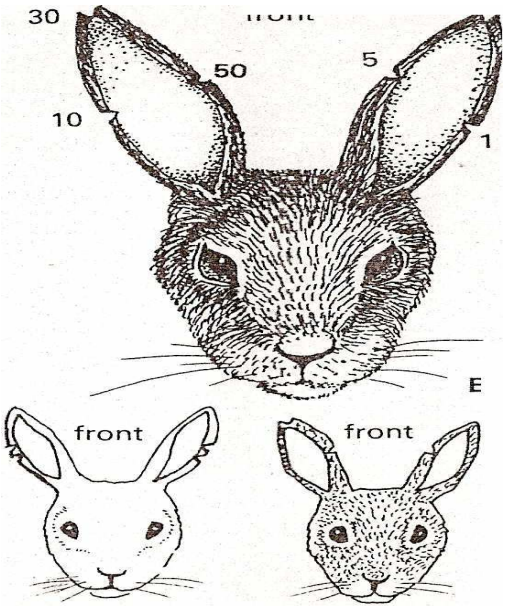


fig5.4 A key for identifying rabbits by ear-notching. Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page66

3.2 Record keeping and analysis

A rabbit keeper with one or two rabbits recording may seem unnecessary, but it is necessary to keep records as the number increases. Two types of records are required.

1. **Financial records**
2. **Animal records**

3.3 Financial records

Financial records can be kept in a small notebook. With label on one page ‘Expenditure’ and another page ‘Income’. All the money spent on the rabbit is to be entered under expenditure and all the money earn from them under income. If you eat a rabbit then enter the equivalent of its cost in the market under income but be honest.

3.4 Animal record

Table 5.1 an example of a doe record card

Doe name---------- date of birth----------

Date mated	**Buck used**	**Date kindled**	**No. born alive/dead**	**Date weaned**	**Number weaned**	**Notes**

The column for 'notes' is for recoding any health and husbandry details e.g. total litter weight at weaning. Other animal record can be constructed for growing litters to monitor their live weight gain, or how often they have been used for mating e.t.c.

Self assessment exercise 2.5

In order to appreciate the husbandry skills needed in rabbit production your tutor need to organize a visit to a rabbit farm (where available)
Try to enrich your knowledge by observing, and asking the rabbit keeper on the daily management practices. You will be able to:

1a) Describe hutch equipment, their requirements and maintenance in a rabbit farm.
b) Describe the different systems of managing rabbits.

3.5 First aid

Occasionally rabbits may suffer from injuries caused by fighting or by sharp edges on wire floors or on feeders. It is important to treat these injuries as soon as possible, to prevent them from becoming more serious.
First aid involves several steps as follows:

1. cleaning the injury with antiseptic solution;
2. dying;
3. treating with antiseptic cream;
4. protecting from further injury and infection.

It can be helpful to have a first aid box. This could include the following items:

- a bowl for holding antiseptic solution;

- a clean cloth;
- antiseptic concentrate;
- antiseptic cream;
- cotton wool;
- scissor or razor blade;
- bandage
- a syringe for dosing medicine

4.0 Conclusion

Skills needed for a successful rabbit operation therefore include Observation, examination, record keeping, hutch design, building and siting, food identification, selection, production and storage, and good management.

5.0 Summary

- Observation is a skill that comes with practice but can be developed with the help of questions to be used each time you visit the rabbit unit.
- Rabbit examination is required after a new rabbit is being bought or rabbits are being checked prior to selection for breeding.
- Weighing is done to check on their growth and their general condition.
- Nail trimming, rabbits nails need to be trim from time to time.
- Identification: This is a way and means of recognizing ones animals (rabbits) and differentiating between one's animals (rabbits) from another farmer's own and differentiating between individual animals(rabbits). There are several methods employed to achieve this. Writing in the ear, Labels, Ear-notching
- Record keeping and analysis: It is necessary to keep records as the number increases. Two types of records are required. Financial records and Animal records.

6.0 Tutor marked Assignment

1a) Discuss in detailed the skills needed for a successful rabbit production.
b) Give an account of the types of records available in a rabbit farm.
c) List all the components of a first aid box and explain why it is needed in a rabbit farm.

7.0 References and Further reading

Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan*
McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics Macmillan education Ltd.*



Introduction to Non-Ruminant Animal Management: Rabbit Management

Unit 6: Rabbit Health and Diseases

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1.0 Introduction

The healthy rabbit may become unhealthy and diseased if exposed to stress and disease organism. It is the responsibility of the rabbit keeper to maintain a healthy rabbit that is not stressed and in whose environment there are as few disease organisms as possible.

2.0 Objectives

By the end of this unit you will be able to:

- Know the signs of a healthy rabbit with a view to understand the diseased ones.
- Be familiar with conditions that favour disease development in rabbits
- Learned how to reduce stress in rabbit farming.
- Know some common diseases of rabbits for example internal and external parasites, bacterial and viral infections.
- Advice in prevention and control measures of the above mentioned diseases.

3.0 Main Content

3.1 Signs of a healthy rabbit

To understand the diseased rabbit you should know a healthy one very well through the signs of a healthy rabbit and this include:

1. Normal eating and drinking.
2. Self –grooming.
3. Alertness, interest and curiosity.
4. Shiny, smooth, lean fur, specially on the front paws and around the anus.
5. A normal temperature of 37ºC-39.5ºC.
6. Normal silent breathing; 40-65 breath per minute.
7. Clear bright eyes without discharge.
8. Clear nostrils without discharge.
9. Normal caecotrophy, no soft faeces on the hutch floor.
10. Gaining weight or, if an adult maintaining its weight.

3.2 Conditions that make a rabbit susceptible to disease include

1. Insufficient water.
2. Insufficient food.
3. Toxic or poisonous food.
4. An unbalanced diet deficient in energy, protein, minerals or vitamins.
5. High fibre-only foods that can cause the rabbit to ‘blow-up’ like a ball;
6. Sour dirty foods that cause diarrhoea.
7. Dirty hutches and badly ventilated hutches that promote an increase in the number of disease organisms.

3.3 Stress

Stress is any challenge to any system of the rabbit system for example its temperature control system, its digestive system, its normal behaviour pattern. Pregnancy, giving birth, lactation, weaning and mating are all periods of natural and unavoidable stress.

3.3.1 How to minimize major stresses

- Correct hutch design-windproof and waterproof;
- Correct placement of the hutch;
- Routine management steps to avoid heat stress;
- Avoidance of overcrowding in hutches;
- Exclusion of dogs, snakes and noisy visitors;
- An adequate well balanced diet;
- Overall good management, particularly ensuring clean dry floors and sufficient bedding.

3.4 Preventive measures for common diseases

Cleanness is very important in rabbit keeping. Waterers, feeders
Should be washed and dry in the sun every few days. Wash and disinfect cages when they become empty, separate any sick animal from the healthy ones.

3.5 Internal parasites

3.5.1 Coccidiosis

Caused by a protozoan called coccidia. Affects both liver and intestine. Occur in overcrowded and dirty condition. Rabbit have swollen stomach and diarrhea leading to dehydration, lack of appetite and dullness. Coccidia are commonly found in the intestine without causing any obvious effects, but a period of stress, such as weaning or bad weather may result in them multiplying rapidly. The ensuing diarrhea dirties all the fur around and below the anus. If action is not taken flies may lay ther eggs in the matted fur and the resulting maggots can eat away at the flesh of the abbit leaddig invariably to death.
Young rabbits are most frequently affected with coccidiosis just after weaning. The disease can develop very quickly and high mortalities are common. In older rabbits there may be chronic coccidiosis resulting in dullness and poor growth.

Control: Coccidioststs may be added to the drinking water to prevent coccidiosis occurring or to cure it as required. Hutch cleanliness is an important preventive measure. Avoid contamination of feed and water.

3.6 External parasites

3.6.1 Ear mange or skin mange

This is caused by external parasites such as mites. This cause a variety of skin and ear conditions. With ear mange the entire ear may become filled with crusty scabs, without proper attention it can spread onto and over the face. Rabbits with ear mange may shake their heads a great deal.

Control: by use of acaricide drops and creams. This are usually expensive. In many cases we used flowers of sulphur lightly powdered into the ear on a daily basis. Body mange can be cured by dipping the rabbit in an appropriate acaricide solution as recommended by a veterinarian.

3.7 Snuffles

Is a bacterial infection of the respiratory system, similar to a cold in humans. Out breaks are more common where there is lack of ventilation, over-crowding and a build up of ammonia from accumulated urine. The signs are sneezing, noisy breathing, a runny nose and wet and mated fur on the face and inside of the front legs, as a result of the rabbit using its font legs to wipe its nose and face. Affected rabbits should be isolated from other rabbits. Treatment with antibiotics may appear to be effective but mortality is usually high and those rabbits that recover are often affected again if exposed to some new stress.

3.8 Myxomatosis

This is a viral infection and the signs include swelling of the eyes and convulsions. The disease spreads rapidly and is usually carried from rabbit to rabbit by fleas. There is no treatment and mortality is very high. It is possible to vaccinate rabbits against myxomatosis if the disease is reported in the area.

Self assessment exercise 2.6

1a) How do you identify a healthy rabbit?
b) What are the various conditions that makes a rabbit susceptible to diseases?

4.0 Conclusion

There are several bacterial, viral and parasitic diseases that can affect rabbits. It is the responsibility of the rabbit keeper to maintain a healthy rabbit that is not stressed and in whose environment there are as few disease organisms as possible.

5.0 Summary

- signs of a healthy rabbi are normal eating and drinking, self –grooming, alertness, interest and curiosity, shiny, smooth, lean fur, specially on the front paws and around the anus, a normal temperature of 37ºC-39.5ºC, normal silent

breathing; 40-65 breath per minute, clear bright eyes without discharge, clear nostrils without discharge, normal caecotrophy, no soft faeces on the hutch floor, gaining weight or, if an adult maintaining its weight.

- Conditions that make a rabbit susceptible to disease are Insufficient water, insufficient food, toxic or poisonous food, an unbalanced diet deficient in energy, protein, minerals or vitamins, high fibre-only foods that can cause the rabbit to 'blow-up' like a ball, sour dirty foods that cause diarrhea, dirty hutches and badly ventilated hutches that promote an increase in the number of disease organisms.
- Stress is any challenge to any system of the rabbit system for example its temperature control system, its digestive system, its normal behaviour pattern. Pregnancy, giving birth, lactation, weaning and mating are all periods of natural and unavoidable stress.
- Preventive measures for common diseases include sanitation of Waterers, feeders every few days. Wash and disinfect cages when they become empty, separate any sick animal from the healthy ones.
- There are several bacterial, viral and parasitic diseases that can affect rabbits. It is the responsibility of the rabbit keeper to maintain a healthy rabbit that is not stressed and in whose environment there are as few disease organisms as possible.

6.0 Tutor Marked Assignment

1a) Stress is a challenge in rabbit production, how do you minimize it?

b) Give one example of the following diseases that affect rabbits and explain any two:

i) External parasite
ii) Internal parasite,
iii) Bacterial disease
iv) Viral disease

7.0 References and Further reading

Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan*

McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics Macmillan education Ltd.*

Introduction to Non-Ruminant Animal Management: Rabbit Management

Unit 7: Killing and Processing

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1.0 Introduction

Rabbits are to be slaughtered regardless of the circumstances that are involve (party, family reunion, other celebrations e.t.c.). Rabbits that are on forage feeding reach table weight

around 6-7 months of age. Regular weighing is the best way to determine when this point has been reached.

2.0 Objectives

By the end o this unit you should be able to:

- Know the necessary preparation and requirement for slaughtering and processing rabbits.
- Be familiar with the killing methods and their procedure.
- Apply the modern way of skinning and cleaning of rabbits after slaughter.
- Compare the chemical composition of rabbit meat with that of other livestock

3.0 Main Content

3.1 Requirement for slaughter and processing

1. A generally clean place away from any obvious source of flies or dogs.
2. Something from which to hang the rabbit whilst cleaning it e.g. a branch or a specially placed pole or set of hooks.
3. A sharp knife
4. A bowl or source of clean water.
5. A container for the blood and guts and any thing that is being kept separate from the meat.
6. A clean container with cover for the rabbit carcass.
7. Some string or thin wire
8. A skin drying frame as in fig vv
9. A stick the thickness of a pencil smoothly rounded at on end.

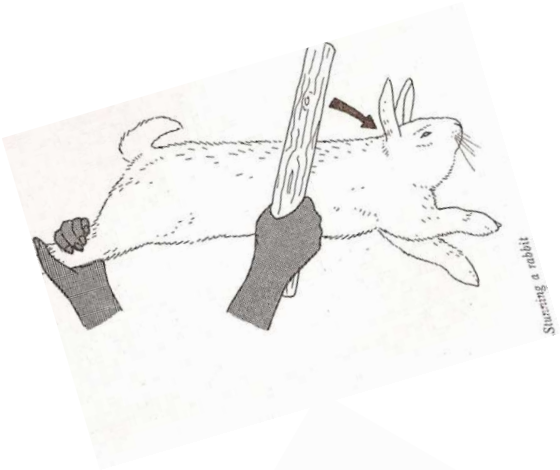
3.2 Killing procedure

Rabbit should receive water but no food in the 12-hour period before killing. This will help in partly emptying the digestive system and will reduce the risk of it breaking during cleaning of the carcass. If it breaks there is the possibility that the meat will be dirtied by the contents of the digestive tract. This in turn may lead to food poisoning in the people that consume the meat.
Killing should be carried out as quickly as possible and as efficiently as possible, with the minimum pain to the rabbit. There are two methods of killing rabbits. Both involve making the rabbit unconscious and then removing the head to allow bleeding.

3.2.1 Neck breaking

In this method the rabbit's neck is broken in the same way as that used for killing hens in some areas. For a right-handed person, both the rabbit's back legs are held in the right hand. The rabbit's neck is then held from above between the first and second fingers- or the thumb

and first finger – of the left hand. The rabbit is stretched over the upper part to the left leg and the rabbit's neck is pushed down, whilst at the same time its head is bent back as in fig 7.1



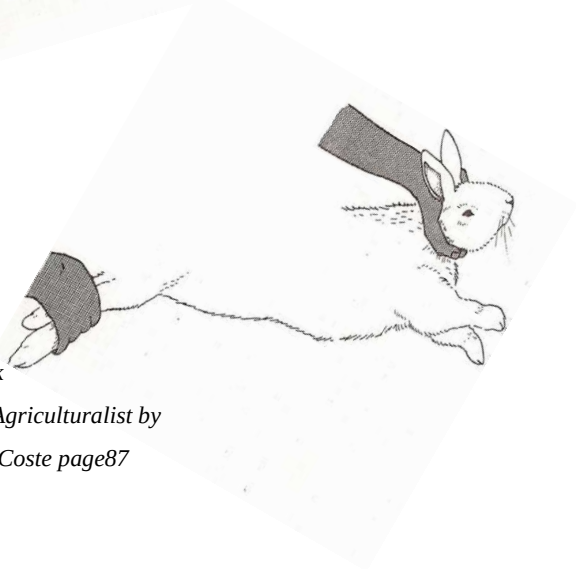


Fig7.1 Breaking a rabbit's neck

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page87

With moderate force the neck will suddenly give way indicating that the neck has bee broken by dislocation. The rabbit should be immediately hung upside-down by its back legs as in fig.7.2 the head is then removed to allow the blood to drain out of the body.
This method requires more skill, alternatively, the fist step is to make an incision into the side of the neck and the followed by cutting the jugular vein and allow blood to drain away.

3.2.2 Stunning method

The neck-breaking method requires a little strength. Those without the necessary strength may prefer to use the stunning method. For a right-handed person, the rabbit should be held upside-down by its back legs with the left hand. It should be held so that the ears fall forward exposing the back of the head. The point at the base of the ears should then be hit sharply with a good-sized piece of wood o metal, as in fig 7.3 this will stun th rabbit and make it unconscious.

Fig7.3 stunning a rabbit

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 87

The rabbit should then be immediately hug p and its head should be cut of to allow bleeding. It should be noted that this methods of killings has a limitation for the fact that they are not acceptable by some believes, example Islam advocate the use of a sharp knife in cutting the throat and the jugular veins as swiftly as possible with minimum pain inflicted to the animal**.**

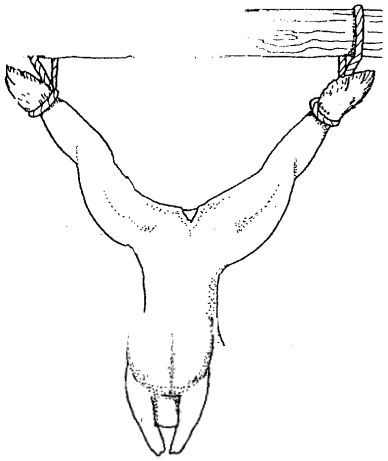


Fig. 7.2 A rabbit hung f or dressing

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page 88

3.2.3 Skinning

Skinning is done easily when the rabbit is hanging y its back legs at shoulder height. Cut off the front legs at their midpoint, and then the tail. Next, cut the skin around each hook below where the string is tied. Cut from the inside of one hock down, around the anus and tail area and similarly down the inside of the other leg from the hock. No, using the round stick and with care gently work the skin downwards and off the body. The stick is used to separate the skin from the body without cutting it as would occur if a knife were used. Place the skin over the skin drying frame. It can be cleaned later.

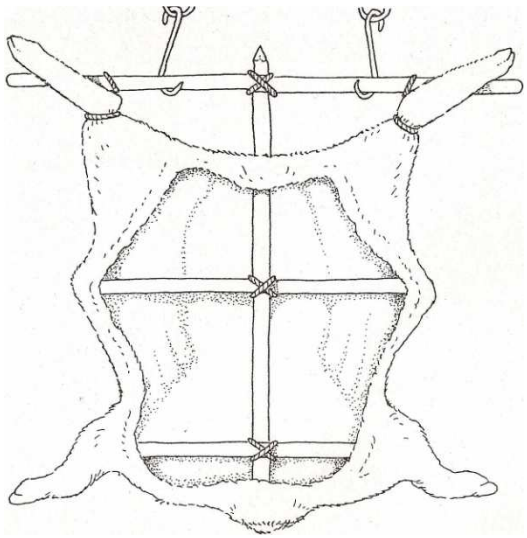


Fig7.4 Drying a skin on a wooden drying frame
Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page

3.2.4 Cleaning

The body is cut open and care is taken not to cut the intestines. The rabbit gut can now be pulled out. The heart, kidneys and liver can be separated together with other parts required for eating. It can then be taken down from the hanging position and tidied up, ready for passing to the cook. Once this is done the skin on the drying frame can be scraped clean, taking care not to cut it in the process.

3.3 Rabbit meat

Table 7.1 Comparison between the chemical composition of rabbit and some other meats

Meat	Dry matter %	Protein %	Fat %	Energy MJ/kg
Rabbit	20-23	20-22	10-12	7-8
Chicken	20-23	19-21	11-13	7-8

Turkey	38-42	19-21	20-22	10-12
Beef	40-50	15-17	27-29	11-14
Lamb	40-50	14-18	26-30	11-14
Pork	50-55	10-12	42-48	17-20

Source: (Rabbits) The Tropical Agriculturalist by D. Fielding, A. J. Smith, and R. Coste page

As shown in table 7.1 rabbit meat is especially high in protein and low in fat. Also, the fat in rabbit meat is mainly unsaturated, which is believed to be a more healthy type of fat than saturated fat which is common in other meats. Rabbit meat has a lower cholesterol content than most other meats, which is also believed to b a health promoting characteristic.

Self assessment exercise 2.7

1a) Compare the chemical composition of rabbit meat and other meats of domestic animals.
b) Explain the advantages of rabbit meat over other meats.

3.4 Cooking

Rabbit meat is relatively soft meat which needs little cooking. It is ideal for cooking in a dry heat or frying. It can be used in stews but it should not be overcooked as it may disintegrate. It is ideal for people who have digestive upsets and for those with few teeth. Smoking can be used to preserve rabbit meat in the same way that it is used to preserve other meats.

4.0 Conclusion

Rabbits are to be slaughtered regardless of the circumstances that are involve (party, family reunion, other celebrations e.t.c.). This process therefore should be carried out under some laid down procedure and all sanitary measures taken to avoid food poisoning to those eating the meat.

5.0 Summary

- Rabbits that are on forage feeding reach table weight around 6-7 months of age. Regular weighing is the best way to determine when this point has been reached.

- Requirement for slaughter and processing include a clean place away from any obvious source of flies or dogs, something from which to hang the rabbit whilst cleaning it, a sharp knife, a bowl or source of clean water, a container for the blood and guts and any thing that is being kept separate from the meat, a clean container with cover for the rabbit carcass, some string or thin wire a skin drying frame, a stick the thickness of a pencil smoothly rounded at on end.
- Killing should be carried out as quickly as possible and as efficiently as possible, with the minimum of pain to the rabbit. There are two methods of killing rabbits. Both involve making the rabbit unconscious and then removing the head to allow bleeding the methods are Neck breaking and Stunning method.
- For easy skinning of rabbits, cut off the front legs at their midpoint, and then the tail. Next, cut the skin around each hook below where the string is tied. Cut from the inside of one hock down, around the anus and tail area and similarly down the inside of the other leg from the hock. Now, using the round stick and with care gently work the skin downwards and off the body.

6.0 Tutor marked assignment

1a) what are the requirements to be fulfilled before slaughtering and processing of rabbits?
b) Explain the methods used in killing rabbits and their limitations.

7.0 References and Further reading

Fielding, D., Smith, A. J. and Coste, R. (1991) (Rabbits) *The Tropical Agriculturalist (CTA) Macmillan*
McDonald, I. and Low, J. (1985) *Livestock rearing in the tropics Macmillan education Ltd.*

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1.0 Introduction

The origin of the pig is difficult to understand, it is possible that it is mainly derived from the European wild boar. Pigs were thought to have been domesticated as early as 200BC. Since then man has developed the pig as meat animal.

World pig population

The estimated world pig population of 826 million (FAO, 1988) means that there is approximately one pig for every six people in the world. A comparison of the meat produced by pig with other domestic species has revealed that more pig meat is produced than any other meat despite the fact that pigs are numerically fewer than other domestic species.

Table 1.1 A comparison of the main livestock species in the world in terms of numbers and meat production

Domestic species	**Numbers (million head)**	**Meat output (000 metric tonnes per year)**
Cattle	1 253	50 098
Buffalo	137	
Sheep	1 174	8 801
Goat	521	
Poultry	10 050	11 495
Pigs	826	63 917

(Source: **FAO** *Quarterly bulletin of statistics, 1989)*

Distribution and Consumption

The distribution of pigs around the world is not the same. Almost half the world's pig population is in Asia, 30 percent in Europe and the former USSR. The population of pigs in large parts of the tropical and sub-tropical developing regions for example Africa and Latin America is relatively small. See fig.1.1

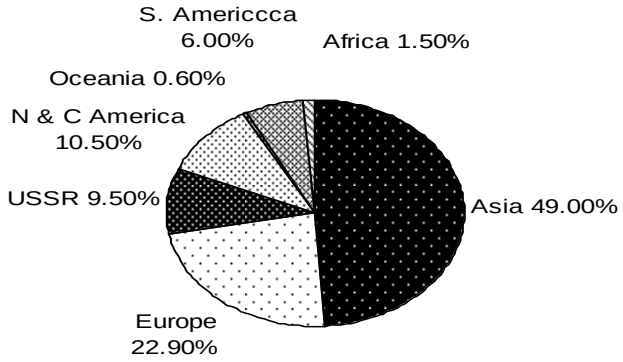


Fig 1.1 *Regional distribution of the world pig population (FAO 1988)*

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 2

It is important to note that most of the world pigs population is located in China.
There is marked differences in the consumption patterns of pig meat throughout the world. In some parts of Europe, annual per capita consumption of pig mea is over 50kg, and represents some 60 percent of the total meat consumed. In he developing countries and particularly in Africa, estimated annual per capita consumption ranges from
1 to 3 kg, and forms less than 10 percent of the total meat diet.
The reasons for the un even distribution of pigs throughout the tropical and sub-tropical world are many. In Asia and parts of China, pork is the predominant component of the diet. While in areas where the Islamic religion prevails, e.g. the Middle East, Pakistan and parts of Africa, Muslims are forbidden to eat any pig meat, similarly, believers in the Jewish faith are instructed not to eat pork meat, and many Zionist sects obey the same rules. Social factors also play an important role in pig population for example in some pacific islands, pigs are highly regarded as a source of wealth and associated with marriage customs.

Self assessment exercise 3.1

1. Give an account of world pig population, their distribution and consumption around the world.

2.0 Objectives

By the end of this unit you should be able to:
a) Explain the significant role played by pigs in meat production.
b) Compare pig meat production capacity with other domestic species
c) Understand the advantages and disadvantages of keeping pigs.
d) Know the distribution and consumption of pigs around the world.
e) Recognize the problems or constraints of pig production in Nigeria.

f) Make a distinction between the different commercial breeds of pigs and their characteristics.

3.0 Main Content

3.1 Taxonomy (Biological Classification)

Below is the taxonomy of the pig:
Kingdom - *Animalia*
Phylum - *Chordata* (Animas with back bones)
Class – *Mammalia* (Warm blooded animals that suckle their young)
Order - *Artiodactyy* (Even toed hoof)
Family - *Suidae* (non-ruminant or single stomach system)
Genus – S*us* (Restricted wild European boars with which domestic pigs are bred From)
Specie – *Sus Scrofa* and *sus Vitatus*

3.2 Advantages of pig farming

1) They have the potential to be highly prolific. Because they are cable of producing large litters after a relatively short gestation period, and have a short generation interval and grow fast.

2) Their productivity in terms of yield of meat per tonne of live weight of breeding females per year is in the region of six times that of cattle.
3) There body size makes them more flexible for Marketing and consumption compared to cattle.

4) Pigs meat is suitable for processing and some of the processed products have a longer shelf life than fresh meat, and can thus be distributed to a wider section of the population.
5) Pigs are efficient feed converters to meat twice as efficiently as ruminants.(i.e. they have high feed efficiency)
6) Pig production provides quick turn-over on investment compared with cattle.
7) Curative and preventive drugs are available for most swine diseases.
8) Pigs also gives useful by-product like their feaces can be used as a good source of manure.
9) Pigs can be reared almost any where given suitable housing and management although their management in extreme temperature can be expensive.
10) They produce meat without contributing to the deterioration of the natural grazing lands. This is important considering the steady desertification, soil erosion and loss of productive land in some areas of the tropics.

3.3 Disadvantages of pig farming

1) There is poor product acceptance in areas where the Islamic religion prevails, e.g. the Middle East, Pakistan and parts of Africa, Muslims are forbidden to eat any pig meat, similarly, believers in the Jewish faith are instructed not to eat pork meat, and many Zionist sects obey the same rules. In other words there is strong taboo against the eating of poultry product, thereby negatively affecting the market for the products.

2) While Social factors play an important role in their acceptance, the pig has historically been considered an un clean animal, wallowing in filth, an object of dislike and a risk to human health.
3) The digestive tract of pigs and Birds is relatively short compared to other farm animals and can only utilize high quality concentrate feeds (E.g. staple grains and oilseeds) These are also use as feed for human making them to be in direct competition with man.
4) They cannot provide a source of drought power for farming operations.
5) They are raised close to human habitation and thereby making heir waste product a pollution problem.

II) Terminology

1) Boar - mature uncastrated male.
2) Barrow: - mature castrated male before puberty.
3) Hog: - castrated male.
4) Stag: - adult male castrated later in life.
5) Shoat: - swine of both sex weighing 30-80kg
6) Gilt - young female swine before farrowing**.**
7) Sow: - adult or mature female after one or two pregnancies
8) Barrener: - sterile female
9) Farrow: - giving birth to young ones.
10) Herd: - group of swine
11) Litters: - young ones (piglets).

3.4 Breeds of pigs

There are over 90 recognized breeds and an estimated 230 varieties of pigs in the world. They can be broadly classified into indigenous or unimproved types or the more modern exotic types which have been selected and developed for specific commercial purposes.

3.4.1 Indigenous breeds (unimproved)

These are mostly found in developing countries and have evolved a variety of shapes and sizes in order to survive in a range of different environments. Generally they are smaller and shorter of leg than the exotic types (mature weight of females 40- 120 kg), with the typical unimproved conformation of a large head, well- developed forequarters and relatively light hindquarters. This renders them more mobile and better able to forage and root for themselves. They are early sexually maturing and females may show first oestrus as early as three months of age. There are many variations of coat colour, but black and brown are most common and white is infrequent. The degree of hairiness also varies, and both hairless and relatively long –haired types are found. Within the major regions of the tropics, the main breeds and types are as follows:

Africa

Pigs are not characterized into specific breeds in most African Countries. They are known as 'indigenous,' 'local' or unimproved pigs.

In some parts of Africa more specific use is made of pigs for meat production and the bakosi in the Cameroons and the Ashanti Dwarf in Ghana are examples of indigenous breeds. Their characteristics include small with mature female size of 40-60kg, and are mainly black in colour with prick ears.

The unimproved pigs of East, Central and Southern Africa are mostly descended from stock introduced by early European travelers, and therefore not truly indigenous, they are relatively wide spread.

The productivity of these unimproved breeds in Africa is influenced by their environment and some typical reproductive performance figures are shown in Table 1.2

The trials indicated that although litter sizes tended to be smaller, total live weight of the litter as a proportion of the weight of the sow at farrowing was of the same order as exotic sows (11 percent).

Table 1.2The reproductive performance of unimproved breeds of pigs in Africa

	Nigeria	Zimbabwe	South Africa	Ghana (Ashanti) (Dwarf)
Litter-size at birth	6.5	7.9	7.2	6.3
Litter-size at weaning	5.5	7.5	-	-
Pre-weaning mortality (%)	15.0	5.0	-	-
Average weaning age (wks)	9.0	8.0	8.0	8.0
Average weaning mass (kg)	-	7.6	9.0	7.0

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 23

3.4.2 Exotic breeds in the tropics

3.4.3 Duroc

This has droppy ears and is deep red or rusty colour. It is a fast growing large breed.
The Duroc produces a very good carcass and is said to be an excellent meat producer.
Also it has the ability to grow to heavier weights without depositing too much fat.
. The duroc is a hardy animal which survives well in tropical climate. It is generally used for cross-breeding.

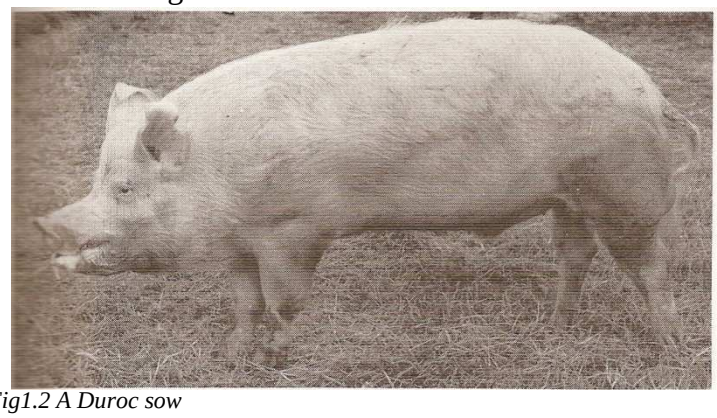


Fig1.2 A Duroc sow

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 29

3.4.4 Large white (Yorkshire)

This breed was first developed in Yorkshire, England. It has erect ears and is white in colour and females are prolific. It is renowned for its strength of leg. The breed can be used for both pork and bacon production. It is a fairly hardy animal but will suffer from sun-burn if it is not kept in a building out of the sun.

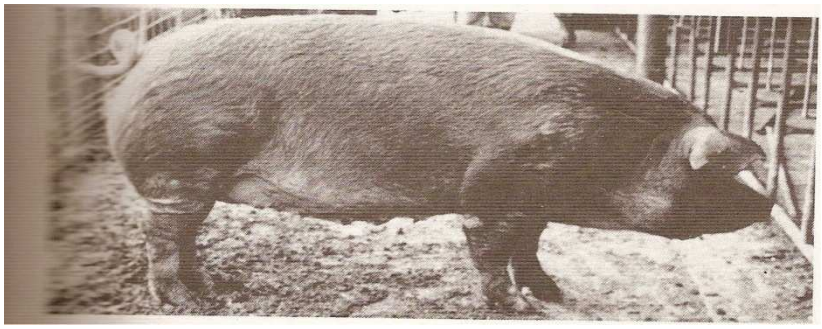
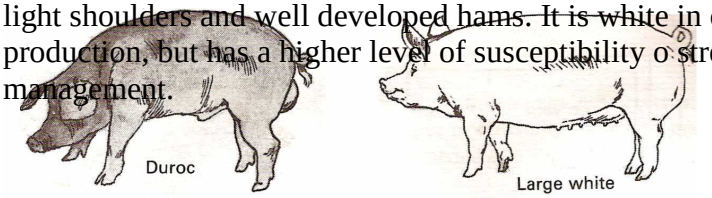


Fig1.3 A large white (yokshire) boar

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 29

3.4.5 Landrace

It is characterized by its forward-pointing lop ears and possesses a long, smooth body with light shoulders and well developed hams. It is white in colour, this swine is good for bacon production, but has a higher level of susceptibility o stress and requires a high level of management.



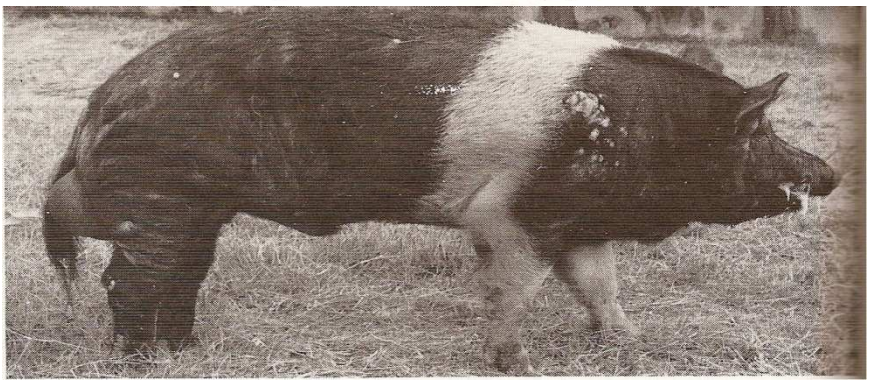


Fig1.4 A landrace boar

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 29

3.4.6 Hampshire

This swine is black with distinct white saddle which encircles the forequarter. They are prolific, good mothers, and good milking ability. It has more meat than the large white and landrace. It is probably best kept for cross breeding.

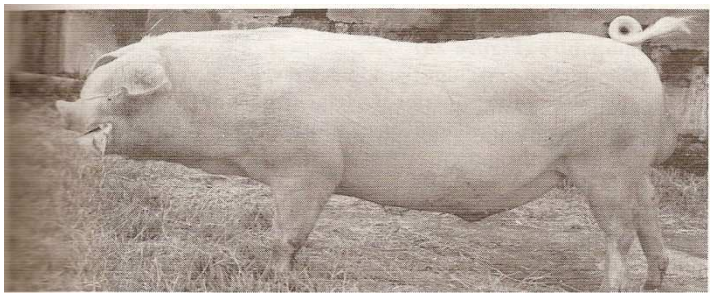


Fig 1.5 A Hampshire boar

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 30

Tamworth

.

Fig1.6 Breeds of pigs

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 55

3.4.7 Tamworth:

This hardy animal is reddish colour and with erect ears. It is an efficient converter of feed. The breed is relatively slow-maturing. In the past it has been very popular for cross-breeding purposes in tropical regions.
Other exotic breeds include the Chester white, the large black, the middle white e.t.c.

4.0 Conclusion

The estimated world pig population of 826 million (FAO, 1988) means that there is approximately one pig for every six people in the world. A comparison of the meat produced by pig with other domestic species has revealed that more pig meat is produced than any other meat despite the fact that pigs are numerically fewer than other domestic species.

5.0 Summary

- The distribution of pigs around the world is not the same. Almost half the world's pig population is in Asia, 30 percent in Europe and the former USSR. The population of pigs in large parts of the tropical and sub-tropical developing regions for example Africa and Latin America is relatively small.
- Advantages of pig farming include: the potential to be highly prolific, body size makes them more flexible for Marketing and consumption compared to cattle, Pigs meat is suitable for processing and the processed products have a longer shelf life than fresh meat, efficient feed converters, useful by-product e.t.c. while their disadvantages include poor product acceptance, social and religious factors, pollution e.t.c.
- There are over 90 recognized breeds and an estimated 230 varieties of pigs in the world. They can be broadly classified into indigenous or unimproved types or the more modern exotic types which have been selected and developed for specific commercial purposes.
- Bakosi in the Cameroons and the Ashanti Dwarf in Ghana are examples of indigenous breeds. While the exotic breeds include: Duroc, Large white (Yorkshire), Landrace, Hampshire, Tamworth.

6.0 Tutor marked Assignment

1a) Discuss the advantages and disadvantages of pig farming.
b) Name six exotic breeds of pigs found in the tropics and describe the characteristic features of any three.

7.0 References and Further readings

Adi, M. A. (1994) *Sheep, Goat and Swine production in Nigeria*
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1.0 Introduction

The system of pig production is diverse there is the traditional method of rearing in large parts of the tropics which is the simplest and cheapest. The intensive system on the other

hand entails considerable capital and specialized management skills. The integrated systems involve the production of pigs with other enterprises like fish farming, production of algae, methane gas generation, ducks and vegetable production. Such types of operations enhance the efficiency of resource use and increase output for the overall operation. Regardless of the system of production, any one considering pig production on a large scale should investigate the marketing and processing facilities available and obtain expert advice.

2.0 Objectives

By the end of this unit you should be able to:

a) Be familiar with the different systems used in pig production and know the advantages and disadvantages of each production system.
b) Give explanation why there is a need for our pig farmers to practice intensive system of pig production.
c) Understand the guide lines on how to improve on our Pig production system in Nigeria.
d) To distinguish the different commercial breeds of pigs that are suitable for each production system based on their Characteristics.
e) Appreciate the general principles of housing pigs and in some cases the necessary adjustment needed in housing pigs in hot climates.
f) Know the common equipment used on pig farms.

3.0 Main Content

3.1 Small-scale systems

3.2 Pig kept as scavengers

Is a traditional method of rearing pigs in many areas of the tropics where pigs are kept as scavengers, with no housing or medical care. It is simple and cheap, usually few pigs are allowed to wander freely and pick up food where ever they can. Supplementary food will be given where available in the form of kitchen wastes, rice bran, by-products of beer-making, maize stalks etc. These supplementary foods generally consist of low nutritional value and indigenous breeds of pigs predominate on the scavenging system. They are well adapted to the local environment and their relatively small size and mobility render them best able to cope with the conditions.

3.2.1 Advantages of small-scale systems

1) It is cheap and simple involving small or no amount of capital.
2) The pig plays an important socio-economic role as a form of bank, and pigs are sold at times of cash shortages or unexpected needs in the family.

3.2.2 Disadvantages of small-scale systems

1) Pigs raised on this system are susceptible to infestation with parasites and carry heavy burden of intestinal round worms and tapeworms.
2) Productivity is normally low because of seasonal supply of food resulting in irregular breeding of sows.

3) There is high rates of piglet mortality and low growth rates.
4) There is hazard of the scavenging system to humans because pigs have access to sources of parasites, e.g. human excreta, which can then be transmitted back to man when he eats the meat.

3.3 Semi-intensive production

This system is also known as 'backyard' system, here pigs are confined to a house and are fed by the farmer. The house is in the form of pens made from simple construction using bamboo and elevated. Feeding is based on kitchen waste, vegetables and by-product foods and management is generally minimal.

3.3.1 Advantages of semi-intensive

1) More attention is giving to the pigs than in the scavenging system.
2) Generally, herd sizes and productivity tend to be higher in these systems than in the scavenging systems.

3.3.2 Disadvantages of semi-intensive

1) Productivity is relatively low compared to the intensive production.
2) Mortality can be high.

3.4 Intensive production

This is an improvement from the small-scale production to a commercial production of pigs. Units may comprise up to 50 head, and the producer will grow and /or purchases food specifically high pig enterprise. In this system the housing is more sophisticated made up of concrete hard floor, adequate shelter, shed and pen space and appropriate feed and watering facilities.

3.4.1 Advantages of intensive pig production

1) There is improvement in the management and protection against infectious diseases and parasites by the farmer through the use of veterinary drugs and vaccines.
2) The system is characterized by rising high performance breeds for example exotic or cross breeds with indigenous breeds.
3) Markets are well established through arrangements with local butchers on regular bases or into the large-scale commercial sector, to bring in a regular income for the enterprise.
4) No risks of trouble from predators and thieves.

3.4.2 Disadvantages

1) It is capital intensive
2) High level of management skills is needed.
3) Increase chances of nutrient deficiency especially when pigs are not well fed.

3.5 Large-scale systems

3.5.1 Intensive

This is an intensive system of rearing and is the most common method of large- scale production. It is capital intensive and involve sow herds from 40 up to 1000 head. High performance breeds of pigs are used and are provided with optimum conditions of housing, feeding and management in order to ensure maximum output. Housing is designed for different classes of the stock and environmental conditions. This system is usually incorporated with grain production and stock feed manufacturing operations on the one hand, and marketing on the other. The pigs will invariably be marketed through a processor in order t maximize returns on the carcass.

3.5.2 Advantages of large-scale systems

1) No risks of trouble from predators and thieves.
2) With proper condition, there is less risk of parasitic infection.
3) Generates revenue for nation and a source of employment for the people

3.5.3 Disadvantages

4) High level of managerial skill is needed.
5) Increase chances of nutrient deficiency especially when pigs are not well fed.
6) Difficulties of keeping the floor clean especially during the rainy season when humidity is very high.
7) It involves high capital investment.

3.6 Extensive systems

There is a trend in Europe and America towards less intensive system of pig production particularly for sows. This system is often known as ‘outdoor’ system. In this system sows are kept in paddocks and providing individual huts for farrowing and shelter. Weaner pigs are generally raised under more intensive conditions.
Production of these types exists in the tropics and there are greater potentials in the systems.

3.6.1 Advantages of the extensive system

1) Less capital is required for the establishment compared to the intensive systems.
2) Sows can gain access to foods such as pastures, crop residues, cassava roots and sweet potatoes.

3.6.2 Disadvantages of the extensive systems

1) In the tropics shade and wallows must be provided, there must be tight control of parasites and adequate fencing to prevent contact with endemic diseases e.g. African swine fever.

3.7 Integrated systems

This is the practice of integration of pig production with other enterprises and has been practiced in tropical countries. Various combinations are used for e.g. fish farming, production of algae, methane gas generation, ducks and vegetable production. This type of

combinations along with pig production enhances the efficiency of resource use and increase output for the overall enterprise.

3.7.1 **Advantages of integrated systems**

1) By fertilizing fish ponds with pig manure and effluent, algae are generated which can then be utilized by fish. If sufficient water is available for suitable fish ponds, pig sties can either be constructed above the ponds.
2) Manure from the pigs can be channeled into the ponds to supply nutrients to the fish ponds there by generating more revenue to the farmer.
3) Alternatively, the nutrient-rich water from the pigs can be used for irrigating vegetables
4) Ponds can also be dried in rotation and vegetables grown in dry pond beds for family and commercial purposes.
5) The pig effluent can be used to produce algae which is then harvested and dried and fed back to pigs or other livestock.
6) The anaerobic fermentation of pig effluent can be used in the production of methane gas. Relatively simple digesters can produce a steady source of methane which can be used as a means of energy for domestic and agricultural use

3.7.2 Disadvantages of the integrated systems

1) It is capital intensive.
2) It requires high level of managerial skills**.**

3.8 Housing

Pigs do better when housed, and their buildings should be of concrete or with stones due to their rooting nature. Pigs productivity are more when they are housed in a thermally neutral environment i.e. when the environmental temperature around the pig is consistently between the pigs lower critical temperature (LCT) and upper critical temperature (UCT). The pig's metabolic heat production is then at minimum, and it is neither using feed energy to keep warm, nor reducing feed intake to keep cool.

Other consideration for pig comfort include:

a) Protection from other climatic extremes such as direct sun, wind and rain,
b) Provision of dry conditions which are hygienic and do not predispose the pig to disease as they easily get pneumonia.
c) Allowance for natural behavioral pattern of the pig as far as possible and minimizing the effect f social dominance
d) Provision of accessible food and clean water;
e) Providing conditions such that good stockman ship can be practiced.
f) Effective disposal of waste matter.

3.8.1 General consideration of designing pig house.

Right design of house is of paramount importance so that investment is justified by improved productivity. The land has to be well drained, non swampy and outskirts of the settlement away from public utilities like source of drinking water to prevent contamination. If the land is swampy drainage system should be constructed and the building foundation should be aid with stones and concrete and well elevated.

In very cold areas, beddings of dry grass or wood shavings could be provided in their sleeping sties to provide warmth and easy cleaning of the sties, this also helps the pigs look cleaner.
Adequate ventilation should be provided by having enough windows on the building to allow for cross ventilation. This windows may be open or close depending on the need and situation in the environmental temperature.
Most of the breeds of pigs in Nigeria are either exotic or cross breeds they are tolerant to cold. However, if they are taken to the southern humid or hot northern parts of Nigeria the paramount consideration is generally to ameliorate the effects of excess heat by provision of adequate shade and wallows as a means f coolant to prevent heat stress.
Alternatively pigs should be sprinkled with water when there is excessive heat.
Pigs buildings should be of concrete or with stones due to their rooting nature. They should be placed in their sites according to their ages and sexes to make for uniform feeding and prevent indiscriminate mating and high in-breeding.

Some examples of pigs housing include:
i) Danish swine house
ii) Traditional swine house
iii) field

i) Danish swine house:-

A fattening house with a central feeding passage along the walls.

ii) Traditional pig house

Swine house:-for a small farmer , a series of simple pens with an outside run attached, may be sufficient , swine require warm dry housing as they easily get pneumonia. The floor should be well concrete and the unit not too near the dwelling house of the farmer because of smell ad flies.

iii) Field housing;

This can be a simple shelter made of wood . The shelter is in a field and the swine have free range .Generally it is not advisable to keep swine outside in the tropics as they are then subject to African swine fever and kidney worm.

Table 2.1 Recommended space requirements for pigs

Class of swine	Area
Boars	9 m^2
Dry sows	2 m long x 0.64 m wide
Stalls	As for stalls put similar exercise

Cubicles	area
Yards	3-4 m^2 per sow
Farrowing accommodation	
Pen including crate	6.2m^2
Fattening/follow-on (including creep area)	10m^2
Weaners	
Cages (per pig)	0.2m^2 lying area + 0.2m^2 slatted area
Yards (per pig)	0.7-0.9m^2
Porkers	
(pen, including dunging area)	0.73m^2 per pig
Baconers	
(pen including dunging area)	0.93m^2 per pig
Heavy pigs	
Trough space (par pig)	
Fatteners	0.2-0.3m^2
Maiden gilts, sows	0.35m^2

3.9 Pig equipment

The following are tools to work with in a pig farm

1) Scalpel blades for incision and castration
2) Syringes and needles
3) Thermometer for taking temperature
4) Antiseptics and Disinfectants for cleaning wounds and disinfecting pen
5) Restraining ropes (snare) used in restraining pigs during farm operations.
6) Tail docking forceps
7) Cotton wool and bandages for dressing and bandaging of wounds
8) Protective clothing like boots, laboratory coats, head wear
9) Teeth clippers for cutting piglets, needle teeth.
10) Feeders and drinkers
11) Muzzle for handling mouth during farm operations
12) Ear notches and ear tags and tag applicator for individual identification.

Self assessment exercise 3.2

1a) Enumerate on the general consideration of designing a pig house and give examples of pig housing commonly found in the tropics.

b) Outline the tools to work with in a pig farm.

4.0 Conclusion

Regardless of the system of production, any one considering pig production on a large scale should investigate the marketing and processing facilities available and obtain expert advice before embarking on the operation.

5.0 Summary

- The system of pig production is diverse there is the traditional method of rearing in large parts of the tropics which is the simplest and cheapest. The intensive system on the other hand entails considerable capital and specialized management skills. The integrated systems involve the production of pigs with other enterprises like fish farming, production of algae, methane gas generation, ducks and vegetable production. Such types of operations enhance the efficiency of resource use and increase output for the overall operation.
- Pigs do better when housed, and their buildings should be of concrete or with stones due to their rooting nature. Pigs productivity are more when they are housed in a thermally neutral environment i.e. when the environmental temperature around the pig is consistently between the pigs lower critical temperature (LCT) and upper critical temperature (UCT). The pig's metabolic heat production is then at minimum, and it is neither using feed energy to keep warm, nor reducing feed intake to keep cool.
- Right design of house is of paramount importance so that investment is justified by improved productivity. The land has t be well drained, non swampy and outskirts of the settlement away from public utilities like source of drinking water to prevent contamination. If the land is swampy drainage system should be constructed and the building foundation should be aid with stones and concrete and well elevated.
- In very cold areas, beddings of dry grass or wood shavings could be provided in their sleeping sties to provide warmth and easy cleaning of the sties, this also helps the pigs look cleaner.
- Most of the breeds of pigs in Nigeria are either exotic or cross breeds they are tolerant to cold. However, if they are taken to the southern humid or hot northern parts of Nigeria the paramount consideration is generally to ameliorate the effects of excess heat by provision of adequate shade and wallows as a means f coolant to prevent heat stress. Alternatively pigs should be sprinkled with water when there is excessive heat.

6.0 Tutor Marked Assignments

1a) List all the production systems of pig farming and discuss the merits and demerits of each system.

7.0 References and Further readings

Adi, M. A. (1994) *Sheep, Goat and Swine production in Nigeria*
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Introduction to Non-Ruminant Animal Management: Pig Management

unit 3: Principles of Feeding pigs and Feed resources

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1.0 Introduction

Nutrition and feeding management are very important aspect of swine production. There fore it is extremely important that swine producers have a good understanding of the nutrient

requirement of swine during each phase of their life cycle, a knowledge of the feed stuff which can be used in swine feeding and an appreciation for the final point of feeding management in order to raise swine economically. Unfortunately, many swine farmers keep them in rather poor conditions and so are not able to make as much profit as they should. Swine are particularly affected by dirty, drafty housing and quickly becomes sick. They are also affected by poor feeding. The major groups of essential nutrients for pigs are energy, protein, minerals, vitamins and water.

2.0 Objectives

By the end of this unit you should be able to:

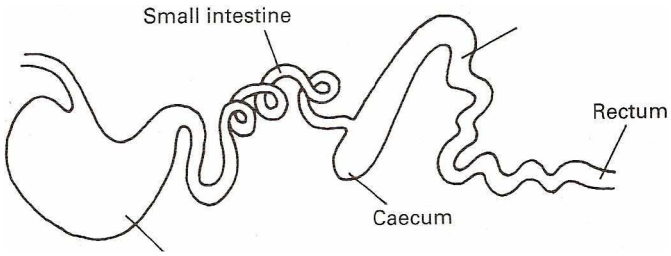
a) Understand the terms energy, protein, minerals, vitamins as they apply to nutrition in the pig.
b) Learned the nutritional requirement of pigs and daily food allowances of various classes of pigs.
c) Be acquainted with the essential and non essential amino acids and the amounts ideal for growing pigs.
d) Appreciate the recommended nutrient allowance for pigs under tropical condition
e) Be familiar with growth rate, feed intake and floor space required of different classes of pigs.
f) To know how the Gastro intestinal tract (G.I.T) of the pig accomplish nutrient utilization.

3.0 Main Content

3.1 Gastro intestinal tract (G.I.T) and nutrient utilization

Swine has the ability to obtain nutrient from a wide variety of feed stuff. Historically the wild swine was omnivorous consuming both vegetative and animal feeds in the early days , domestic pigs were allowed to forage on grass , roots refuse and what ever else is available . swine is a simple stomach animal, so it must rely largely on feeds having readily digestible carbohydrate to meet its energy needs. The gastro intestinal tract (GIT) is important to the animal because it is made up of a number of organs that are responsible for utilization of food and nutrient. Further more, some knowledge of its anatomy and function is helpful in evaluating feed stuff and formulation of diet. Some knowledge in how the GIT digest feed and factors that affect feed utilization is important because loses in digestibility have a marked effect on efficiency of feed utilization. In addition, many feed related factors may alter or change normal functioning of the GIT. Consequently some degree of familiarity with its anatomy and function are important for a reasonable understanding of practices and problems in feeding livestock. The more complex carbohydrate, cellulose hemicellulose found in roughage and other fibrous feeds are broken down by microbial fermentation only. Swine dose not have a rumen. The fibrous component of the diet are not utilize as efficiently as in ruminant animals. Also simple stomach animal like swine are dependent upon certain essential amino acids present in dietary protein from which they build their own body protein unlike the ruminant animal, swine cannot synthesis the essential amino acids from poor quality protein or from non-protein nitrogen sources. The relative amounts of the essential amino acids in the protein are extremely important to swine.The alimentary tract of the pig (fig ww) is designed to digest and absorb concentrated foods. The GIT of simple stomach mammalian specie like the pig include the mouth and associated structures: a. mouth . b.

salivary glands c. oesophagus d. stomach e. small and large intestines e. pancrease f. liver



Stomach

fig 3.1 The digestive tact of pigs

Source: (Pigs) The Tropical Agriculturalist by D. H. Holness, A. J. Smith, and R. Coste page 7

These various organs and other structures are concern with procuring, chewing and swallowing food and with the digestion and absorption of nutrient as well as with some excretory function

Food taken in the mouth is ground in to a pulp by mastication. At the same time it is moistened and mixed with saliva. Saliva contains the enzyme ptyalin which initiates the break down of starch to simpler carbohydrates. The food then passes on into the stomach, which provides an acid environment due to the presence of hydrochloric acid. The gastric juice contains enzyme pepsin which begins the break down of protein.

The small intestine is the major site where food absorption occurs, and digestive juice from the pancrease, liver and the small intestine complete the process of digestion. Digestion has been defied simply as the preparation of food for absorption. It may include mechanical forces such as chewing or mastication, muscular contraction of the GIT. The overall function of the various digestive processes is to reduce food particles to a size of solubility that will allow for absorption. For instance, starch is hydrolysed to maltose by amylase from the pancreatic juice. Maltose and other disaccharides sugars are broken down by specific enzymes in the intestinal juice, eg. Maltase, lactase and sucrase in to monosaccharides such as glucose and fructose these are then absorbed through the gut wall.

Trypsin in the pancreatic juice acts on protein to produce polypeptides, which are then broken down to amino acids by various peptidases in the intestinal juice and subsequently absorbed.

Bile which is secreted by the liver, serves to emulsify fats into smaller globules, which are then broken down by enzyme lipase into fatty acids and glycerol ready for absorption. Lipase is present in both the pancreatic and intestinal juices.

Absorption includes various processes that allow small molecules of digestible food to pass through the membrane of the GIT into the blood or lymph systems. The shape of the stomach of different animal species vary as thus the relative size within species as well as among species. In swine, the stomach is relatively large with a capacity in the adult on the order of 6-8 litres. The weight of the stomach and its content is about 4% of body weight as compare to 1% in human. Most of the stomach is lined with mucosan cells which produce mucus that serves to protect the stomach lining from gastric secretions. In the central part of the stomach there are gastric glands which produce mixed secretion of enzymes and mucus. These gastric juices are effective in initiating digestion in the stomach. In swine the small intestine is

relatively long 15-20meters. The first portion of secretion is the duodenum which is the side for production of various digestive juices. Other juices enter the duodenum from the bile duct, while Other juices are derived from the liver and the pancrease. The small intestine is lined with small finger like projections the villi, which serves to increase surface area for absorption. The large intestine is made up of the caecum, colon and rectum. The relative length diameter differ considerably in different species of animal.
Pigs are omnivores and will consume a wide range of foods from both pant and animal sources. The natural inclination of the pig is to eat on a 'little and often' basis, and this is likely to maximize both total food intake and the efficiency of food utilization.

3.2 Nutrient requirement of pigs

3.2.1 Water

Water is one of the most important nutrient classes. Swine of all ages should have free access to fresh and clean water at all times. Limiting water intake will result in reduce growth rate and efficiency of gain in pigs and reduce milk production in lactating sows. A severe limitation of drinking water can cause death in pigs. The requirement of water is influenced by many factors including environmental temperature and humidity, composition of the feed and weight of the pig.

Table 3.1 water requirement of pigs

Type of pig:	**Water requirement for each kilo of feed/litre**
Fattening pigs	2.5
Lactating sows	5.0
Dry sows	3.0
Piglets'	ad libertum (freely as needed)

3.2.2 Energy

Apart from water, sources of energy are the most important food requirements of the pig and will most rapidly influence its survival if withdrawn. Energy can be defined as the capacity to do work and occurs in various inter-convertible forms such as chemical, thermal or radiant energy. It is normally measured in heat units, traditionally the calorie, but now the megajoule (MJ) is the most commonly-used unit (where 1 MJ = 0239 MCals).

Nursing pigs derived most of their energy from fat and sugar lactose in milk. Most of the energy for growing pigs is derived from metabolism of starch because of insufficient amylase

starch digestive enzyme in the small intestine. Protein I excess of the requirement can be use as an energy source but it is too expensive or costly to use protein as a source of energy. But in older animal sow and finishing fee, a limited amount of energy can be derived from volatile fatty acid product produce by bacteria fermentation of fibre. In the large intestine, energy requirement of pigs are expressed as digestible energy (D.E.) and metabolisable energy (M.E.). For all weight classes of pigs, the metabolisable energy (M.E.)is approximately 96% of the digestible energy requirement. Energy requirement of pigs are influenced by their weight which influences the maintenance requirement by their genetic capacity for growth or milk synthesis and by the environmental temperature in which they are housed. The energy requirement for maintenance is directly related to metabolic body weight and is approximately 110kcal of digestible energy (D.E.) per kilogram body weight. Energy food is mixed with maize, rice, sorghum, cassava, sweet potato and cereal grain.

3.2.3 Protein

Protein consists of some 20 basic units known as amino acids. When protein is eaten by the pig, it is broken down to the amino-acids, which are then used for the building up of the essential organs of the body and the skeletal muscle (lean tissue). Nine of the amino acids required by the pig cannot be synthesized by its body, and they must be supplied in the diet. If they are present in insufficient quantities, the pig will not grow and may not even survive.

Swine require ten (10) essential amino acid in it's diet for normal body function. A good quality protein is one that provides the amino acids in the amount and proportion necessary for the particular need of the pig (growth, reproduction and lactation). Protein food are oil seed e.g. cotton seed, soybean groundnuts coconut bean, peas, blood meal, fishmeal, e.t.c. amino acid requirement are influenced mostly by age and weight of the pig. In a daily basis the requirement increase as the pig increases weight.

Table3.2 The essential amino-acids for pigs, and the amount of essential amino-acids in the 'ideal' protein for growing pigs

Essential amino-acids	**Amounts of ideal requirement for growing pigs (g/kg protein)**
Lysine	70
Methionine and cystine	35
Threonine	42

Tryptophan	10
Isoleucine	38
Leucine	70
Histidine	23
Phenylalanine and tyrosine	67
Valine	49

(Source: ARC, 1981)

3.2.4 Minerals

Compared with energy and protein, minerals are required in very small amount. Thirteen minerals are required in the diet. Major minerals includes calcium, phosphorus, sodium, magnesium, choline and the trace minerals includes iron, iodine and selenium. The two minerals required in the greatest amount by swine are calcium and phosphorus. Adequate levels of both calcium and phosphorus must be included in the diet for strong skeletal structure.

3.2.5 Vitamins

Vitamins can be defined as organic compounds which function in small amounts (mg or µg) and are essential to the normal functioning of the animal body. They cannot be synthesized in adequate amounts by body tissues and when lacking, provoke deficiency diseases.

Fourteen vitamins are required by swine, all in very small amounts. Fat soluble vitamins are A D E and K. while water soluble vitamins are vitamin C and B complex, Riboflavin, Pantotheic acid, Niacin, Vitamin B_{12}, Choline, Pyridoxine, Thiamin, Folic acid and Biotin. Cereal, grains and plant protein supplements are very poor sources of many of the vitamins. From a practical stand point, vitamin premix should be added to swine feed.

3.3 Feeding

The three swine feed usually available commercially are:

a) Creep feed-16% protein

b) Sow and Weaner meal 14% and

c) Swine finishing meal 12% for fattening of swine for pork and bacon.

Minerals are very important and ratio must contain some limestone, bone meal and common salt. A sudden change in feed stuff upset swine and prevent them from gaining weight. Changes in feed stuff should be made as gradually as possible over a period of a week or more.

Table 3.4: Approximate daily food allowances for different classes of pigs

Boars	3 kg sow and weaner meal (less if getting too fat)
Dry sows	2.0-2.5 kg
Farrowed sow:	1 kg plus 0.5 kg for each piglet.
Fattening pigs	
8 weeks	1.0 kg
10 weeks	1.25 kg
12 weeks	1.50 kg

14 weeks	1.75 kg
16 weeks	2.0 kg
18 weeks	2.50 kg
20 weeks	2.50 kg
22 weeks	275 kg
24 weeks	3.0 kg
26 weeks	3.0 kg
28 weeks	3.0 kg

3.4 Anti-nutritional factors

In the tropics, plant proteins are by far the most common source of protein for pigs and a number of these are associated with anti-nutritional factors. These can be in the form of toxins or other substances which interfere with digestion and utilization, and it is essential that these factors are taken into account when formulating rations. Example is soybean which contain a trypsin inhibitor. This inhibits the action of trypsin in the pig's gut and can reduce the digestibility of protein so that only 30 percent of it will be digested.

Self assessment exercise 3.3

1a) What are anti-nutritional factors?

b) Explain their effects using suitable examples.

c) Using suitable examples discuss essential amino acids in the pig

4.0 Conclusion

Nutrition and feeding management are very important aspect of swine production. Knowledge of the nutrient requirement of swine during each phase of their life cycle is extremely important and swine are affected by poor feeding. The major groups of essential nutrients for pigs are energy, protein, minerals, vitamins and water.

5.0 Summary

- Swine dose not have a rumen. The fibrous component of the diet are not utilize as efficiently as in ruminant animals. pigs are also dependent upon certain essential amino acids present in dietary protein from which they build their own body protein unlike the ruminant animal, swine cannot synthesis the essential amino acids from poor quality protein or from non-protein nitrogen sources.

- Digestion has been defined simply as the preparation of food for absorption. It may include mechanical forces such as chewing or mastication, muscular contraction of the GIT.

- The three swine feed usually available commercially are: Creep feed-16% protein, Sow and Weaner meal 14% and Swine finishing meal 12% for fattening of swine for pork and bacon.

6.0 Tutor marked assignment

1a) With the aid of a diagram discuss the anatomy and physiology of the gastrointestinal tract (G.I.T) of the pig and explain how nutrient utilization is accomplished.

b) Briefly describe the requirement of different classes of pigs for the following nutrients,
i) Water
ii) Energy
iii) Protein
iv) minerals
v) Vitamins

7.0 References and Further reading

Adi, M. A. (1994) *Sheep, Goat and Swine production in Nigeria*
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Introduction to Non-Ruminant Animal Management:

Pig Management

Unit 4: Management of Breeding stock, Piglets, Weaners, Growing and Finishing pigs

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1.0 Introduction

Good management of pigs on the farm is essential towards the profitability of the herd. The farmer must work hard to ensure that the well-being and productivity of his animals are realized. Considering the huge investment involve high degree of attention to all aspect of management must be followed to ensure success.

2.0 Objectives

By the end of this unit you should be able to:

a) Acquire knowledge and understanding of the management practices of different age groups of pigs (Breeding stock, Piglets, Weaners, Growing and finishing pigs).
b) Take part in the supervision of health status of a flock, with a view of Preventing and controlling most diseases.
c) Raise birds from day old to table weight (Broilers) and or point of lay (Layers) as the case may be.
d) Better understand the nutritional requirement and approximate daily feed intake of different classes of pigs (Day-old, Growers, Layers, Broilers etc)

3.0 Main Content

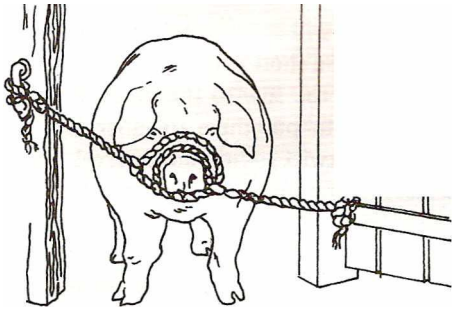
3.1 Management considerations

3.1.1 Stockman ship

This refers to the relationship between the farmer and his pigs. The farmer should be friendly to his pigs and vigilant for any irregularities arising from them. He should be able to pick any abnormality and act promptly to intervene as appropriately as possible. Where there is need for veterinary assistance he should consult a veterinarian for help or advice.

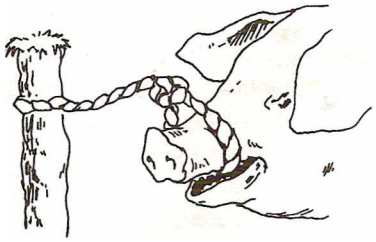
3.1.2 Handling and restraint

The necessity of restraint arises because, unfortunately, all the animals do not reciprocate your love for them. Handling of animals is a major concern to the livestock industry, especially handling of domesticated animals like pigs for routine management activities. Large domesticated animals have to be handled with respect to their size, and this applies particularly when they are sick. Such animals may attack from a sense of frustration. Pigs should be handled by the ears or by the hind legs above the hock. A twitch may be applied over the upper jaw behind the tusk and twist for the purpose of restraint. A pig-catcher which has a loop, the size of which can be altered by means of a ratchet on the made wide and slipped over the snout, large pigs can also be handle by use f a pignet. Small pigs can be caught by the hind leg seized above the neck or by the ears.

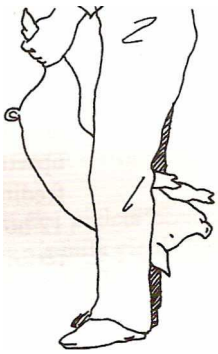


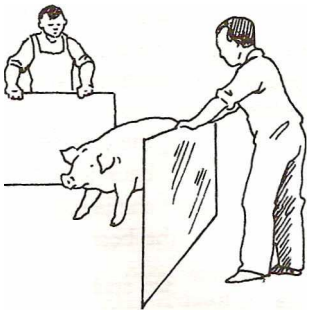
Tethering

Securing for veterinary treatment



Guiding pig forward with solid boarders





holding for c castration

Fig4.1 Handling pigs

Source: Livestock rearing in the tropics by I. McDonald and J. Low page 83

3.1.3 Hygiene

This is one of the important aspect of pig farming to prevent infection and ensure success and profitability.

Animals should be fed properly and adequate amount of clean water given. Prevent food and water from contamination by animal faeces. Isolate sick animals to prevent spread of infection. Maintain safe environment by preventing pollution, keep animals in dry clean places through periodic emptying and resting of each house. For the farrowing house, this should consist of a week's rest in between each batch of farrowing sows. For fattening pens, a five-day break after each group of fatteners is adequate. Immediately after it is empty, each pen should be thoroughly scrubbed and cleaned, washed and soaked in disinfectant and allowed to remain dry for the remainder of the period that is empty. Avoid stressing pigs through unnecessary handling and movements. Animals get infection and suffer more from diseases when they are stressed.

3.2 Management of breeding stock

3.2.1 Selecting boar for service

Boars are selected following performance testing to ensure efficient performance of their offspring. This include

1) Faster growth rate than average
2) Has less back fat than average
3) Has eaten less food than average
4) It has utilized its feed more efficiently as a result of producing less fat.
5) Must have two equally sized and firmly suspended testicles and with good sexual libido
6) Has good conformation, strong straight feet and good temperament.

Young boars that are newly brought to the herd must be given care to be able to adapt to their new environment. They should be dewormed, sprayed/dipped against ecto- parasites and exercised daily to allow him get used to his stock man as well as the sights and smells of the piggery. The boar should be fed t provide for continued growth, but should not be allowed to become fat and sluggish.

3.2.2 Mating conditions

Recent studies has indicated that where boars mating on their own pens displayed lower levels of sexual behaviour than boars mating in the service pen. This resulted in a lower percentage of gilts being mated in the boar pen. This has necessitated the used of a specifically designed service pen.

3.2.3 Frequency of use and boar-to-sow ratio

A boar should not start serving until he is over eight months of age; and during the first two months of service, only twice per week. Subsequently, he can be used for up to six services per week. Overworking a boar will reduce the quality f the sperm produced, leading to small litters and increased number of sows returning to service. The standard recommendation is one boar to 20 sows and gilts. The first service after a rest period should not be counted as the

semen may not be fertile. Considerable exercise is necessary to prevent the development of leg weakness. It may be necessary to trim the boars feet regularly.

3.3 Management of Gilts/ Sows

The major objective of gilt- management should be to induce all replacement gilts to reach puberty as soon as possible after selection. This will allow the following objectives to be achieved:

1. Disposing of gilts which are not showing any breeding activity at an early stage.
2. Access to a pool of young, sexually-active gilts;
3. Gilts will be in their second heat or more at first mating there by increasing the first litter –size.

Gilts and sows will tend to get too fat if they are not allowed enough exercise. A fat sow takes longer to come on heat and is more likely to crush her young piglets. Sexual maturity occurs as early as 4 or 5 months, but the first service should not be until 8 months, when the weight should be 10-130 kg. A sow has a productive life of four to five years.

3.3.1 Pigs breeding cycle

Pigs like other animals will mate only when the female is on heat or during oestrus period. This are physiological changes that takes place in the female which allow ovulation or shading of the egg for fertilization to take place in the presence of the
males sperms.

The normal heat period lasts for three to five days; signs of heat are:

First stage

- General restlessness
- Vulva turns red and swollen
- White mucus discharge

Second stage

- Real heat lasts for 40-60 hours
- Vulva less red and swollen, slimy mucous discharge
- Tendency to mount and be mounted
- Sow or gilt will stand still when pressure is applied to her back
- She is ready for service, this is the right stage to send her to the boar

Third stage

- After the heat, the sow will stand still when pressure is applied to her back,
- The swelling of the vulva disappears

3.3.2 Recommended practices

It is important to note that few of the signs above will be seen therefore it is best to put the sow with the boar for a short period every day when the heat is expected.

Always take the sow to the boar not the reverse, this is less upsetting for him. It is best to put them together just before feeding. Let the boar serve her twice, with an interval of about 12 hours between services. If the sow does not conceive, she will return on heat in about 3 weeks time. The gestation period is 114 days (3 months,

3 weeks, 3 days). Pregnant sows should not be too crowded in their pens as this can cause abortion.
A week before service, give the sow/gilt 1 kg of feed extra per day (standard is 2.5 kg/day). Continue this for one week after service. During the last month of pregnancy give 0.5-1 kg extra feed per day, but decrease this gradually one week before farrowing, and provide plenty of water to help prevent congested gut during farrowing.

3.3.3 Preparation for farrowing

1. The farrowing pen should be dry clean and free form draughts.
2. Clean and disinfect the farrowing pen thoroughly and scrub into the crevices with insecticides to control mange and lice ten days before the commencement of farrowing .
3. Deworm the sow with dewormers that are not contraindicated during pregnancy two weeks before the expected farrowing.
4. The sow should be moved to the farrowing pen 4-7 days before farrowing ad her body should be wash with soapy water and weak disinfectant to remove dirt and parasite eggs.
5. Provide plenty of straw, chopped into short lengths of say 10 cm to prevent the piglets being trapped in longer straw and being crushed by their mother. The first 3 days of life are the most critical for the piglets.
6. One day before farrowing the sow becomes restless and later milk can be squeezed out of the teats. She will begin to make a nest with straw.
7. Use a well designed farrowing pen for example farrowing crate to prevent the sow from accidentally crushing the piglets.

Self assessment exercise 3.4

Your tutor should organize a visit to a nearby pig farm where you will have the opportunity to enrich yourself with the practical knowledge of pig management and you will be able to:

1a) Describe the stages in the signs of heat in a sow/gilt and comment on the recommended practices during heat period.
b) Enumerate on the common preparations before farrowing

During farrowing the sow/gilt will lie down and grunt. It will be lifting her hind legs as labour pains increases. Generally pigs have little difficulty farrowing and will farrow with little interference from the attendant. Farrowing normally takes 4 to 6 hours but some sows will take up to 18 hours or more.
When a piglet is born it will severe the naval cord and then walks round the sows hind legs to find the teats and within 45 minutes start suckling it's first colostrum.
The after birth (placenta) will either come out as the last piglet is born or immediately after that. The placenta need t be buried as soon as possible to prevent the sow/gilt from eating it, as this may open her appetite for her own piglets.

3.4 Management of piglets

The piglet is born with very limited supplies of energy. This is further complicated by the stresses of the birth process. The piglet is born with thin skin and short hair. Thus it is less protected against extremes of temperature and humidity. In cold weather a small area can be heated with 50 watt electric light bulb hung 30-40 cm above the piglets, kerosene lamp, or stove. They should also be provided with warmth in the form of beddings made up of wood shavings or hay. In humid areas they should be put in a well ventilated pen. Farmers should

make sure their piglets has taken colostrums 'the first milk' which is rich in various nutrients and antibodies except iron and copper.

3.4.1 Creep feeding

Young piglets from 10 days onwards should have a high protein diet available to them. They has to be fed in small creep r area where the mother cannot eat the feed. The feed conversion rate of young piglets is very high thus creep feeding is particularly economic.
Creep feeding is very important as the piglets become used to feeding on meal at an early age; the sows milk also begin to decrease just as the piglets require more feed.

3.4.2 Provision of iron

It is necessary for piglets to be given iron this can be in the form of an injection of 2ml iron dextran, or as pills or in their creep feed or swab the sow's teats with an appropriate solution that contains iron or copper, like ferrous sulphate, or administer in water daily, for the first five days of life.
Piglet needle teeth should be clipped off with a pair of clippers to prevent them from wounding their sows teat which might make her refuse them suckling. If piglets are reared on a concrete floor, provide clean soil or earth (sod) which is of up-rooted grass with both roots and earth intact at a corner of the pen as a source of iron and copper.
By observing good management and sanitary practices as mentioned above the piglets will double their birth weights within 5-8 days. At weaning i.e. between 4-6 weeks of age they should weigh 10-12 times more than their birth weight. Growth rates in large litters are usually less uniform than smaller ones. Bigger piglets usually prefer the better front teats and so gain more weight and faster than the rest. Piglets usually stick to teats they started with.

3.5 Management of Weaners

Weaning is the separation of young piglet from it's mother with the aim of stopping them from suckling milk. This could take place between 4 to 6 weeks of their life. At this age, the piglets will eat feeds and fend for themselves.
When changing to weaners ration, for the first few days, some quantity of creep feed is to be mixed in the ration, and then gradually reduced until only the weaners ration is now fed. Early weaning at 3 weeks is possible but requires intensive management and extra care and expensive equipment.
To minimize stress to the piglets, do the following:

- Remove the sow but leave the piglets in the pen as this lessens the stress to the young piglets.
- If the litter is more than 10 piglets, those that are relatively bigger and heavier should be removed a little earlier, not more than 4 to 5 of them removed while the rest should be

allowed on the sow for about 6 days more. This will increase the weight of the smaller piglets

- Stocking density at weaning should be high to promote warmth but should not be over crowded as they will struggle and fight for feed causing reduction in growth rate and reduction in weight gain of the weaker ones.
- After one week, deworm the piglets and move them to the fattening pen. The sow will come on heat again 2 to 7 days after weaning.

3.6 Management of Growing and finishing pigs

By the 8-9 weeks of age the growing pig is over the stress of weaning, and its digestive system will be competent to deal with a range of protein and energy sources, some 80% of the food used in a pig unit is consumed by the growing and finishing pigs, therefore the efficiency of food utilization during this phase is crucial factor affecting profitability.
The management system which is adapted must relate to the specific objectives of each unit and these may range from home consumption of a cheap a carcass as possible to the production of sophisticated bacon products. These considerations dictate the type of pig to be produced. Feeding and management must be geared to optimize performance. The small scale rural producer, for example, will attempt to maximized the use of cheaper, lower quality feedstuffs. It must be remembered however, that the growing pig has only a limited ability to digest and utilize fibre in the diet and too much bulky food may depress growth to such an extent as to render its inclusion uneconomic. Under commercial conditions different priorities may be given to factors such as food-conversion efficiency and food cost per pig growth rate, carcass leanness and grading according to the relative economic advantages they confer in the whole production unit.

3.7 Culling of Sows

To maintain overall productivity in the herd, it is important to have a culling policy so that sows removed at the correct time. The reasons for culling include;
Lameness, other injury, farrowing problems, poor litter-size, poor mothering ability, and low fertility. For a sow that regularly produces a good litter will eventually start to decline with age, probably around her tenth litter if she is producing well, a god guide is to allow her to remain in the herd until her performance falls below the average of the gilts in the herd. At the same time it is important to have a supply of pregnant gilts available t replace sows that need to be culled.

4.0 Conclusion

Proper management of each class of pigs on the farm is essential towards the profitability of the herd. The farmer must make every effort to ensure that the well-being and productivity of his animals are achieved.

5.0 Summary

- Consideration for management of pigs includes a) stockman ship this refers to the relationship between the farmer and his pigs. b) Handling and restraint: The necessity of restraint arises because, unfortunately, all the animals do not reciprocate your love for them. c) Hygiene:
- This is one of the important aspect of pig farming to prevent infection and ensure success and profitability.
- Boars are selected following performance testing to ensure efficient performance of their offspring. This include, faster growth rate than average with less back fat than average, It has utilized its feed more efficiently as a result of producing less fat, must have two equally sized and firmly suspended testicles and with good sexual libido also good conformation, strong straight feet and good temperament.
- A boar should not start serving until he is over eight months of age; and during the first two months of service, only twice per week. Subsequently, he can be used for up to six services per week. Overworking a boar will reduce the quality f the sperm produced, leading to small litters and increased number of sows returning to service. The standard recommendation is one boar to 20 sows and gilts.
- Piglets should be provided with warmth in the form of beddings made up of wood shavings or hay. In humid areas they should be put in a well ventilated pen. Farmers should make sure their piglets have taken colostrums 'the first milk' which is rich in various nutrients and antibodies except iron and copper. Young piglets from 10 days onwards should have a high protein diet available to them. This has to be fed in small creep (creep feeding) or area where the mother cannot eat the feed.
- Weaning is the separation of young piglet from its mother with the aim of stopping them from suckling milk. This could take place between 4 to 6 weeks of their life. At this age, the piglets will eat feeds and fend for themselves.
- By the 8-9 weeks of age the growing pig is over the stress of weaning, and its digestive system will be competent to deal with a range of protein and energy sources some 80% of the food used in a pig unit is consumed by the growing and finishing pigs, therefore the efficiency of food utilization during this phase is crucial factor affecting profitability.

6.0 Tutor marked assignment

1a) Discuss pig management considerations under the following:
i) Stockman ship
ii) Handling and restraint
iii) Hygiene
b) List the criteria used in selecting boar for breeding and explain the care needed for young boars before their first service.
c) What are the main objectives in sow/gilt management?
d) Explain in detail how to manage a piglet highlighting creep feeding, provision of iron etc.

7.0 References and Further reading

Adi, M. A. (1994) *Sheep, Goat and Swine production in Nigeria*

Holness, D.H., Smith, A.J. and Coste, R. (1991) Pigs *The Tropical Agriculturalist (CTA) Macmillan*
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Introduction to Non-Ruminant Animal Management: Pig Management

Unit 5: Swine Diseases and their prevention

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1.0 Introduction

Once disease affects a pig herd the impact on the economics of pig production in terms of the cost of control and decreased productivity can be enormous. The first priority must therefore always be to try to prevent the occurrence of disease. Thus many of the management procedures are aimed at disease prevention or at mitigating the effects of those diseases that cannot be prevented. With skilled management, combined with well-designed housing and sound nutrition, an overall strategy to minimize the possibility of disease attack can be formulated.

2.0 Objectives

By the end of this unit you will be able to:

a) Know the meaning of parasites their causative agents, mode of transmission, signs, and control measures of swine parasites.
b) Understand the common bacterial and viral diseases of swine, their causative agents, mode of transmission, signs, and control measures
c) Give examples of non specific diseases of swine.

3.0 Main Content

3.1 Parasites

Parasites are defined as organisms which live on and obtain food from the body of another, known as the host. They may live on the exterior of the pig, when they are known as external parasites, or within the internal tissues and organs when they are known as internal parasites. Parasites will seldom result in the death of the host except in the case of massive infestations or if the host is also stressed in other ways.

3.1.1 External parasites

These mainly cause irritation to the skin surface, often leading to wounds and an increased susceptibility to other infections. The most common external parasites are mange-mites, ticks, lice, fleas and flies.

Table 5.1 showing some ectoparastes of pigs

Name	**Means of Transmission**	**causative Organism**	**Signs**	**control**
1)Mange-mites	Direct contact	*Sarcoptes scabiei*	Crusty, dry looking skin around the eyes, ears & snout, skin is swollen & inflamed pig constantly rubbing itself & performance depressed.	Regular treatment either dipping or spraying with anti mange medication. Spraying of pens. Chronic cases to be culled.
2) Ticks	Tick bite require more than one host to complete life cycle	Tick spp	Transmit Babesiosis, and other tick borne diseases. (fever, emaciation depressed performance etc.	By spraying and dipping with suitable acaricides
3) Lice and fleas	Direct contact	Lice and fleas species	Irritation, anaemia	Spraying of pigs and pig quarters with suitable insecticides

3.1.2 Endo parasites of pigs

Table 5.2 shows some endoparasites of pigs

Name and features	**Means of transmission**	**Causative agent**	**Signs**	**Control**
1) Round worms Live in the small intestines can grow up to 300 mm long and 6 mm thick. Capable of laying thousands of eggs per day	Ingestion of Contaminated feed and water by infected eggs from dung of infected pig	*Ascaris lumbricides*	Larvae migrate through liver & lung. Irritation in lungs causes coughing & ill-thrift in young pigs. Liver damage can lead to condemnation at slaughter. Heavy infection can lead to obstruction of Small intestines, weakness, weight loss	By breaking the life cycle i.e. regularly moving range pigs on to fresh grounds. Frequent removal of faeces in housed pigs. Breeding pigs should be routinely dosed with broad spectrum anthelminthics and young stock dosed after weaning.

Name and features	**Means of transmission**	**Causative agent**	**Signs**	**Control**
2) Tapeworms Pig is the intermediate host and the adult worm live in man	Ingestion of Contaminated feed and water by infected eggs from dung of infected humans	*Taena solium*	Lavae encyst in the pig's muscle particularly the heart and tongue. Pork meat are condemned at slaughter	By preventing pigs access to human faeces. Regular deworming is helpful.

3.2 Infectious diseases

Table 5.3 infectious diseases of pig

Name	**Mode of trans mission**	**General character**	**Preventive measures**
1) Africa swine fever (ASF) is a viral infection There was an epidemic in Nigeria in 1999--2000	By direct and indirect contact, inhalation, ingestion ticks at as vectors. Feeding infected un boiled swill, carrier animals, contaminated vehicles e.t.c. are very important in transmission	Loss of appetite, pigs hurdling together, small purplish blotches on the skin, in coordination and laboured breathing.	Prevent direct contact between domestic and wild pigs. No vaccine, no treatment. Strict prevention of movement of pigs, personal and vehicles between pig farms. Do not feed pigs with uncooked garbage from hotel this may contain the virus. In case of outbreak of ASF , bury or burn the carcasses, disinfect house with strong disinfectants. Rest the house for three months.

Name	**Mode of trans mission**	**General character**	**Preventive measures**
2) Foot-and mouth disease Most contagious of all known viral diseases.	The virus is carried by buffalo. Infection can occur by feeding infected bones or cooked meat.	Causes blisters on the feet, snout, udder and the mouth. Is painful to the pig, which cannot eat and often has to be destroyed.	There is no cure. If outbreak occurs in nearby farms, pigs can be vaccinated. vaccinate with the right virus
3) Erysipelas Is caused by a bacterium that lies in the soil	By animal contact or is picked up from the soil.	Stages are acute, sub acute and chronic. Acute form sudden death is common, marked constipation, reddish/purplish discoloration of the ears, abdomen and legs. Chronic form can lead to chronic arthritis, swollen joints and stiffness and heart damage.	Treatment is effective with right antibiotics and should be timely. Excellent vaccines are available. Routine vaccination programme is recommended to prevent infection.

Name	**Mode of trans mission**	**General character**	**Preventive measures**
4) Anthrax Is an acute, and often fatal bacterial disease which often cause mortality in humans.	By contact with anthrax carcasses or by spores in contaminated food or pasture.	Two main types of signs exist. A swelling in the back region which causes difficulty in breathing or sudden death with blood oozing from the body orifices	There is effective vaccine against the disease If the disease is suspected carcass should not be open as this releases infective spores. Infected carcass should be buried at sufficient depth to prevent transmission of the spores.

3.3 Non -specific diseases

These include abscesses, gastric ulcers, intestinal haemorrhage syndrome

Self assessment exercise 3.5

1a) What are parasites?
b) Give 3 examples of ecto and endo parasites of pigs.

4.0 Conclusion

The impact of a disease in a pig herd, in terms of the cost of control and decreased productivity can be enormous, the first priority must therefore always be to try to prevent the occurrence of disease. Thus many of the management procedures are aimed at disease prevention or at mitigating the effects of those diseases that cannot be prevented.

5.0 Summary

- Parasites are defined as organisms which live on and obtain food from the body of another, known as the host. They may live on the exterior of the pig, when they are known as external parasites (ecto parasites) or within the internal tissues and organs when they are known as internal parasites (endo parasites). Parasites will seldom result in the death of the host except in the case of massive infestations or if the host is also stressed in other ways.
- Examples of ecto-parasites include mange-mites, ticks, lice, fleas and flies. While examples of endo parasites include round worms and tape worms. Examples of infectious diseases of viral origin include African swine fever and Foot-and mouth disease. Examples of infectious diseases of bacterial origin include Swine erysipelas and Anthrax disease. Examples of non infectious diseases include Abscesses and Gastric ulcers.

6.0 Tutor Marked Assignment

1) Discuss Mange-mites, Round worms, African swine fever, Swine erysipelas under the following headings:

i) Causative agent and Mode of transmission

ii) General character and signs

iii) Control and prevention

7.0 References and Further readings

Adi, M. A. (1994) *Sheep, Goat and Swine production in Nigeria*

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Introduction to Non-Ruminant Animal Management:
Pig Management
Unit 6: Swine Processing and Marketing

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1.0 Introduction

Pig processing start by transporting them to the slaughter house. The method, by which they are restrained, transported and the stress to which they are subjected becomes very important. The final phase of pig production is the sale and disposal of the end product. The pig is extremely versatile in terms of the number of product which can b derived from pig meat. The main categories are: Fresh meat, Cured products, Other processed products, Lard (pig fat), Pig skin, Bristles, Intestines, Offals, Blood, Slaughterhouse by-products and Hoofs.

2.0 Objectives

a) To know the most effective and reliable measures of transporting animals for Processing.
b) Be familiar with the needs to protect the animals in the lairage to ensure profits after slaughter.
c) To be aware of the different methods used in slaughtering pigs and other protocols including ; slaughter procedure**,** Bleeding , scalding and de-hairing, evisceration and meat hygiene.
d) Understand the systems of marketing pigs used by small scale and large scale producers
e) To know the different uses of pig meat employed by the consumer.

3.0 Main Content

3.1 Transport

The stress of transporting pigs to the slaughterhouse can result in pigs dying in transit, dying in lairage at the slaughterhouse, or reduced meat quality in the carcass. The stresses which confront the pig are the handling at loading and unloading, the new surroundings, mixing with strange pigs, the physical discomfort of the journey, and most importantly under tropical conditions, heat stress.
Measures taken to minimize these stress include:

1. Ensure that the loading ramp is properly designed with solid walls and is at the correct height for the cart, truck or trailer.
2. Handle the pigs quietly and gently at all times. Avoid the use of sticks and prodders.
3. Do not feed pigs for 12 hours before loading.
4. Avoid loading and traveling during the heat of the day.
5. Spray the pigs with cold water before loading and again in the truck.
6. Provide cover on the truck, good ventilation, adequate bedding and ensure the floors are not slippery. Make sure the sides of the truck are high enough to prevent the pigs jumping out. If possible, subdivide animals into groups of 10 or fewer, and never mix pigs of different weight.
7. Do not stop en route to the slaughterhouse.

3.2 Lairage

It is important to penned the pigs waiting to be slaughtered under shade and in small groups and sprayed with water, and feed only if there are long delays before slaughter. Pigs should be handled and driven quietly and gently at all times and supervised to prevent fighting. As far as possible, avoid fear, they should be penned away from the sights and smells of the slaughtering process. All the potential profits which have been achieved during the growing period can be nullified by deaths or damage at this stage.

3.3 Slaughter procedure

For reasons of animal welfare, pigs should always be stunned before they are bled. Effective stunning ensures prompt and more complete bleeding and also minimizes Intensive muscle contraction. The main methods of stunning are:

- Mechanical - A captive-bold pistol or other implement is used to stunned the animal.
- Electrical - A pair o tongs is used to apply an electrical charge to the pig's head.
  A current of 1.25 amps and 300 to 600 volts renders the pig unconscious within one second.
- Gas - pigs can be led into a tunnel containing 70 to 80 percent carbon dioxide, when they will lose consciousness within two seconds.

3.3.1 Bleeding

Immediately after stunning the animal should be suspended by it hind legs and the blood vessels of the neck completely severed to ensure thorough and complete bleeding. The blood should be collected in clean vessels.

3.3.2 Scalding and de-hairing

By immersing the carcass in water at 65 to 75°C, the hair is loose and can be removed by scraping. Any excess hair can be burn of by a flame.

For small scale farmers who are slaughtering on the farm, a drum of water over fire is adequate for scalding purposes. Or alternatively were water is scarce, and if the skins are not used, de-hairing can be achieved by covering the carcass with a 5cm deep layer of straw or dry grass and burning it. The skin can then be scraped to remove the carbonized surface and any remaining hair.

3.3.3 Evisceration

A long cut is made down the belly from the breast to the hams. To prevent the meat being contaminated, the entire length of the gut should be removed intact. Other internal organs can be separated, and the gut emptied and cleaned away from the rest of the meat.

3.3.4 Meat hygiene

The freshly killed carcass is an ideal breeding ground for bacteria and hygienic conditions are of paramount importance to prevent infections. Ideally carcass should be chilled immediately after slaughter, and the meat should remain chilled until it is cooked. Where refrigerator is not available, carcasses should be hung in a cool room, protected from flies by gauze, and then sold and eaten as soon as possible.
At any slaughterhouse, all carcasses should be examined by a qualified meat inspector. He examined the carcass and offal critically for signs of parasites infections (e.g. measly pork, 'milk-spot' livers, damaged lungs, e.t.c.). Meat that does not pass inspection is condemned and should be burnt. The carcass slaughtered from pigs on the farm should also be examined critically so that the transmission of disease and parasites from pigs to humans can be avoided.

3.4 Marketing

The main systems of marketing pigs are:
Private sales This is the most common method in the tropics among small scale producers. One, or a number of pigs are sold to local consumers, other producers , butchers or middlemen. The pigs are sold live and the price is generally subject to negotiation this system has the advantage of being the simplest, but in rural areas individuals who are not aware of current prices can be taken advantage of by speculators and dealers. Due to this problem, marketing co-operative have bee formed in some rural areas to ensure adequate prices for producer members.
Public sales This involve taking the pigs to a central market place, where they are sold by auction on a live basis to the highest bidder.
Direct sale to an abattoir or butcher This is more applicable to a larger- scale producer. The big disadvantage of direct sales is the effect of the 'pig cycle'. This is the notorious fluctuation in price which occurs in most countries. When pigs are in short supply, prices rise, but this in turn stimulates increased production among producers, and consequently prices fall. As it takes approximately a year for a producer to react to price changes, the cycle will occur every 12 to 18 months. This leads to lack of stability with producers going in and out of pig production.
Contact sales By entering into a contract with an abattoir to supply a certain number of pigs over a period at a set price, the producer is largely protected from the effects of the pig cycle. In turn, this allows him to plan his production output over a longer time.

3.5 Uses of pig meat

Pig meats are marketed in the form of:
Fresh meat - This is the most important product in the tropics in general, as processing facilities are limited. Pig destined for the fresh meat trade are usually slaughtered at younger ages and lower weights (porkers) than those used for processing. If sold in the commercial markets, the carcass can be butchered into a number of whole sale cuts which can be cooked and eaten in a number of different ways.
Cured products - These include the various bacons and hams which are curd in brine and can also be flavoured by hanging in smoke to increase the shelf life of the product compared with fresh meat. Bacon and ham are derived from the baconer category of pig, which is heavier than the porker.

Other processed products- Included in this category are all the various types of sausages, pies, luncheon, meats, hamburgers and mat pastes. These tend to be produced from the lower value of the porker and baconer carcasses, or mature sows and boars.
Lard (pig fat) – This is sold as a separate product for human feed, animal feed or soap production.
Pig skin – Pig skin can be made into valuable leather.
Bristles - These can be used for brushes and are in special demand for shaving and paint brushes.
Intestines – Is used for sausage casings.
Offals - These are all edible ad the liver in particular is delicacy.
Blood – This is collected separately and processed into sausages and other delicacies for those who consumed it.
Slaughterhouse by-products – Bones, blood and inedible meat tissue is converted into animal feeds.
Hoofs – These are used for gelatin and glue products.

Self assessment exercise 3.6

1a) Describe the uses of pig meat.
b) Explain the negative role played by speculators and dealers in marketing pigs.

4.0 Conclusion

The final phase of pig production is the sale and disposal of the end product. The pig is extremely versatile in terms of the number of product which can b derived from pig meat.

5.0 Summary

- The stress of transporting pigs to the slaughterhouse can result in pigs dying in transit, dying in lairage at the slaughterhouse, or reduced meat quality in the carcass.
- Measures taken to minimize stress transit include: Ensuring that the loading ramp is properly designed with solid walls and is at the correct height for the cart, truck or trailer, the pigs must be handled quietly and gently at all times.
- While inside the lairage, it is important to penned the pigs waiting to be slaughtered under shade and in small groups and sprayed with water, and feed only if there are long delays before slaughter.
- Immediately after stunning the animal should be suspended by it hind legs, and the blood vessels of the neck completely severed to ensure thorough and complete bleeding.
- By immersing the carcass in water at 65 to 75ºC, the hair is loose and can e removed by scraping. Any excess hair can be burnt of by a flame.
- The main systems of marketing pigs are: Private sales, Public sales, direct sale to an abattoir or butcher , Contact sales.
- Pig meat are marketed in the form of : Fresh meat, Cured products, Other processed products- Included in this category are all the various types of sausages, pies, luncheon, meats, hamburgers and mat pastes. These tend to be produced from the lower value of the porker and beckoner carcasses, or mature sows and boars. Lard (pig fat), Pig skin, Bristles, Intestines, Offal, Blood, Slaughterhouse by-products, Hoofs.

6.0 Tutor marked Assignment

1a) Explain the measures taken to minimize transport stress in pigs.
b) What is the acceptable practices in a lairage?
c) List the main method of stunning pigs before slaughter.
d) Discuss the main systems of marketing pigs.

7.0 References and Further reading

Adi, M. A. (1994) *Sheep, Goat and Swine production in Nigeria*
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