VM11D:
RUMINANT PRODUCTION

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Modules 3 & 4:
Sheep and Goat Production

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AN INTRODUCTION TO SMALL RUMINANT [SHEEP AND GOAT] PRODUCTION

INTRODUCTION

Modules 3 & 4 Learning Objectives

In this unit, you will:
1. understand the basic components and operations of intensive sheep production for mutton and breeding stock;
2. understand the basic components and operations of intensive goat production for chevron and milk production;

The following Texts which are suitable for Module 3 [Sheep Production] should be available in the library:

1] Gatenby, R. (1991): Sheep: The Tropical Agriculturalist. CTA-MacMillan, London.

2] Charray, J.; Humbert, J. M.; and Levif, J. (1992): Manual of Sheep Production in Humid Tropics of Africa. CAB International, Oxon, UK.

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Module 3: Tropical Hair Sheep Production

3.1 Welcome!

Welcome to our discussion on Tropical Hair Sheep Production! In the Caribbean and Central America, where land is limited or easily eroded, and because of the ever present threat of thieves, Hair Sheep Production needs to be intensive. The planning of an intensive sheep enterprise requires a logical and systematic approach to decision making. The description of intensive and the consequences of intensification have already been explained to you in an earlier lecture. The major factors involved in a breeding and fattening enterprise are as follows:

⇒ Breeds and Breeding/Reproduction and Mating Systems
⇒ Nutrition and Feeding
⇒ Stock Management
⇒ Flock Health Care

The goal of this module is **to give you a working understanding of the management of sheep in the tropics.**

This is the first of the units which contains Ruminant Production Systems. In an earlier Module [2.0 and 2.1] you were exposed to the role and functions of ruminants and the role of ruminants to mankind. At the end of this section, you should be able to contribute towards the improved management of any Tropical Hair Sheep Production Enterprise, possibly your own. This session makes reference to two texts. They are both very informative and are both very useful references. Please consult them as often as you need to.

The sheep *(Ovis aries)*, in particular the Tropical Hair Sheep, industry in the Caribbean and the Central Latin American region is a fledgling one when compared to the rearing of other domestic livestock species. However, the rearing of sheep has the potential for significant contribution in agricultural production in terms of tropical hair sheep

- **increasing the output of much needed animal protein to meet the human needs of the region;**
- **production of hides as raw materials for craft and leather industries and**

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- **production of high quality purebred animals, particularly rams for sale within the region.**

This third point is of great importance as the major constraint to increased sheep production in the tropics is breeding animal numbers. There are several sheep production systems but two are of primary concern to the Caribbean and Latin American region. The system which you select should depend on whether the primary purpose of your enterprise is breeding stock production or lamb (mutton) production.

Purebred Sheep Production

The production of purebred animals for sale as breeding stock can be a viable concern. However, your initial investment will be greater and the returns may be lower than with market lamb production. A thorough understanding of breeding and selection systems and the keeping of accurate records are highly essential for your success.

Market Lamb or Mutton Production

Lamb growing for the meat market entails the use of crossbreeding programmes to produce fast growing lambs for the market. Some people believe that for *maximum commercial production a minimum of 3 breeds must be involved.* Thus capitalization is possible with the effects of hybrid vigour or *heterosis* on certain very important traits, such as reproductive efficiency and growth. But remember, even if you only use one bred, nothing could be substituted for good management.

Activity 3.1 Reading 3.1 (1)

Roach-Benn, C. (1999):

Sheep Production in Trinidada and Tobago

Agricultural Development Bank of Trinidad and Tobago, Youth Window Project, Enterprise Management Handbook.

This reading was designed for young persons wishing to get into Sheep Production as a business. Please stop now and read this document. When you have finished this reading you can continue reading this unit. Do not try to absorb the whole document all at once as it would contain some information which would follow.

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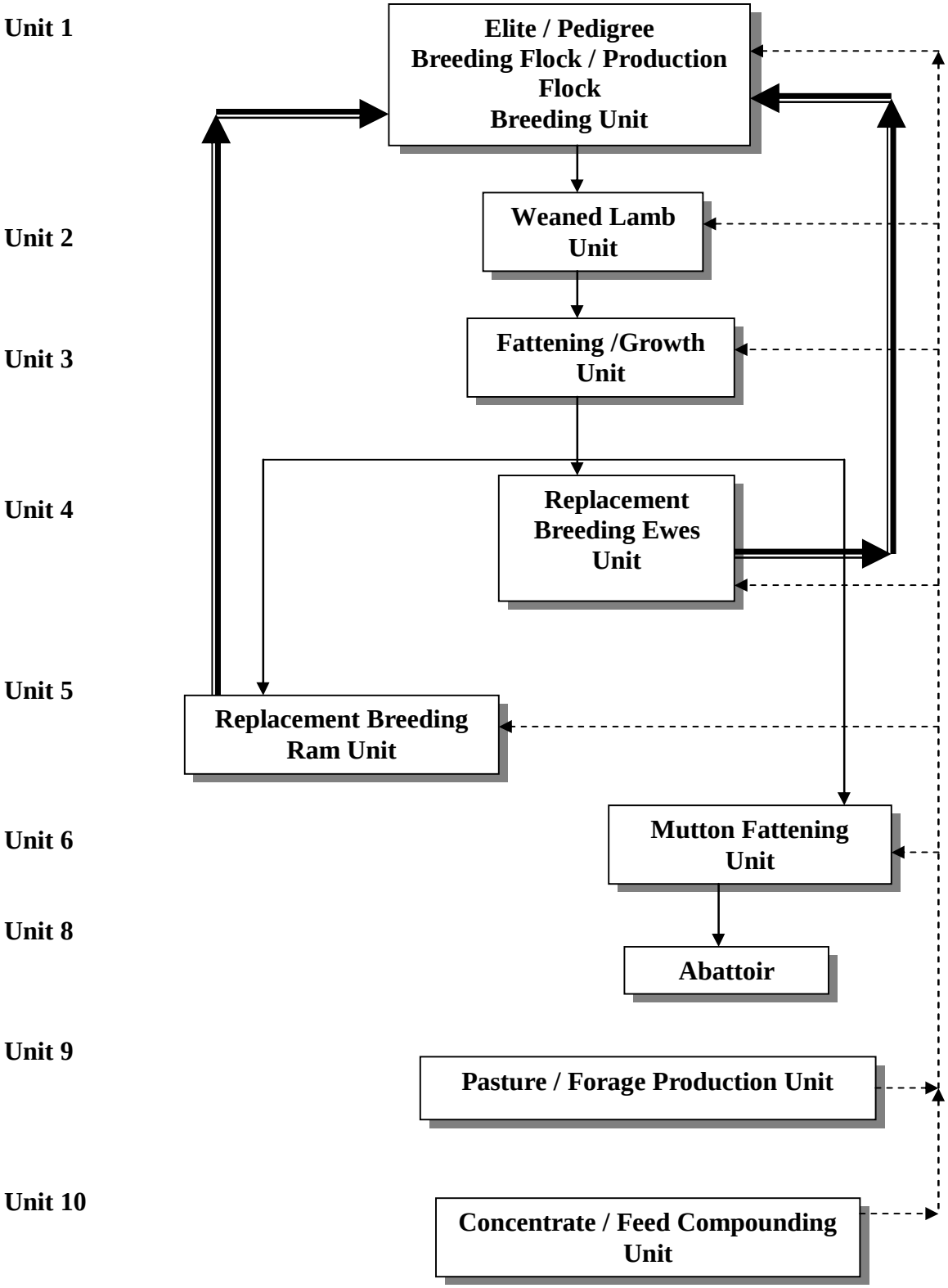
Figure 3.1 Sheep Production Units Industry Process Flow



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3.2 Breeds

We will now discuss the characteristics of breeds commonly used in the Caribbean.

3.2.1 What is a Breed?

When we enter into the arena of Breeds and Breeding, there are three (3) terms we need to clarify, and these will now be highlighted.

A Breed - a population of animals that are distinguishable from other populations with regard to some visible traits (phenotypic) which are genetically determined. These traits must be measurable and the Breed Society must possess a **"Herd Book"** with a description of these traits for a population of the registered animals. All breeds would have begun with a foundation stock. Based on the above, the only true Tropical Hair Sheep breed present in the Caribbean is the Barbados Black Belly (BBB) Sheep, as there is a formal association which possess a Herd Book at the BBB Breeders Association, The Grotto, Bridgetown, Barbados, WI.

A Type - a population of animals showing phenotypic characteristics of a breed, but without pedigree records, and no proof of breed genotype.

A Strain - a genetically distinct population within a breed.

If you wish to learn further about the breeds of sheep available in the rest of the Tropics you could consult Gatenby, R. (1991): Sheep: The Tropical Agriculturalist. CTA- MacMillan, London.

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The Breeds of Tropical Sheep available in the Caribbean and Latin America have been summarized by Gatenby (1991) and are presented in the table below.

Breed type/breed	**Location**
American Hair Type	
Barbados Black Belly	**West Indies**
Bahama	**West Indies**
Brazilian Woolless	**NE Brazil**
Morada Nova	**Ceara, Brazil**
Pelibuey	**Cuba & Brazil**
Virgin Island (White)	**West Indies**
West African	**West Indies, Central & South America**
Other Breeds	
Blackhead Persian	**West Indies, Central & South America**
Criollo	**Central & South America**

Gatenby (1991) further gave a list of recently developed tropical breeds of sheep.

Breed	Location	Use
Dorper	**South Africa**	**meat**
Vogar	**Togo**	**meat**
Avikalin	**Rajasthan, India**	**coarse wool, meat**
Israeli Improved Awassi	**Israel**	**milk, meat, coarse wool**
Assaf	**Israel**	**milk, meat, coarse wool**
Avivastra	**Rajasthan, India**	**fine wool, meat**
Blackhead Persian	**South Africa**	**meat**
Dormer	**South Africa**	**meat, wool**
Hissardale	**Haryana, India**	**wool**
Rabo Largo	**Bahia, Brazil**	**meat, coarse wool**
Santa Ines	**Brazil**	**meat**
Van Rooy	**Orange Free State, South Africa**	**meat**
Wiltpier	**Zimbabwe**	**meat**

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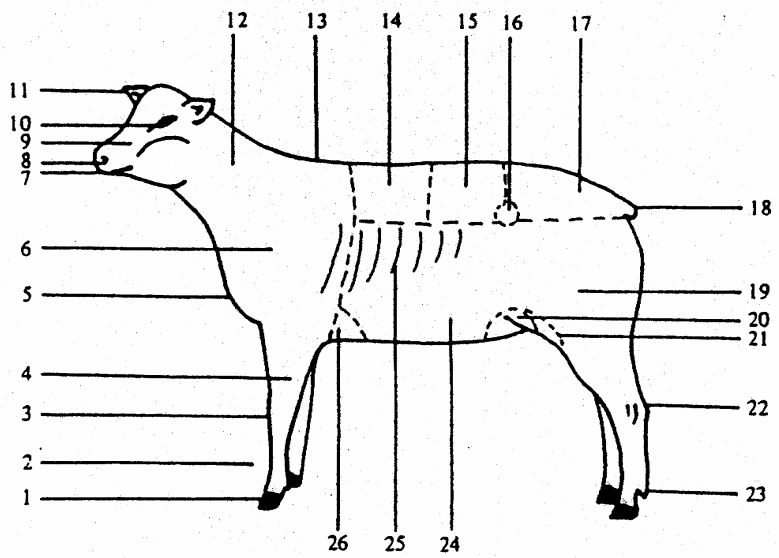
EXTERNAL BODY PARTS OF SHEEP



1. Hoof or foot
2. Pastern (front and rear)
3. Knee
4. Forearm
5. Brisket or breast
6. Shoulder
7. Mouth
8. Nostril
9. Face
10. Eye
11. Ear
12. Neck
13. Top of shoulder
14. Back or rack
15. Loin
16. Hip
17. Rump
18. Dock
19. Leg or thigh
20. Rear flank
21. Stifle
22. Hock
23. Dewclaw (front and rear)
24. Underline or belly
25. Ribs
26. Fore flank

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3.2.1.1 The Barbados Blackbelly

The Barbados Blackbelly has its origin in a combination of West African hair sheep and an unknown wool breed.

Characteristics

Some of the characteristics of the Barbados Blackbelly are as follows:

- Tropical hair sheep ranging in colour from light brown to dark reddish brown.
- Has a black belly with black points on the face and legs.
- "Leggy" but have deep bodies and well sprung ribs.
- Fair width of back and loin, but a very deficient hind quarter.
- Slight tendency to a Roman nose, especially in the ram.
- Well grown rams can attain a mature body weight of 150-200 lbs (but this is uncommon).
- Well grown ewes can attain a mature body weight of 90-130 lbs.
- Ewes are prolific giving 2-4 lambs per lambing (quite common).
- Out of season breeding possible (year round breeders).
- Hardy.
- Ewes can be rebred while nursing lambs as early as 3-4 weeks after lambing.

3.2.1.2. The Saint Elizabeth Sheep

This is the native sheep of Jamaica. It is thought to have developed during the slave trade from the introduction of various European wool breeds and African hair sheep.

Characteristics

Some of the characteristics of the Saint Elizabeth are as follows:

- This is a short-wool breed with the head, face, belly and legs uncovered.
- The colour of the face ranges from white to speckled to black.
- Compared to European breeds the St. Elizabeth is a small breed with rams weighing 140-200 lbs and ewes 100-140 lbs at mature body weight.
- They are hardy animals.
- They have a wide breeding season which typically stretches from May to October and is less pronounced from November to March.
- Litter size is small with single lambs being the norm.

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- Early maturing.

3.2.1.3. Virgin Island White

The Virgin Island White is found on the US and British Virgin Islands. It is thought to have its genes from West African Sheep, some Whildshire Horn and native criollo.

3.2.1.4. West African

See **Accompanying Reading** for information, Anon (1986).

3.2.1.5. Black Head Persian

See **Accompanying Reading** for information, Anon (1986).

3.2.1.6. Crosses

These would be animals of varying phenotypes and backgrounds.

3.2.1.7. Other breeds of Tropical Hair Sheep

There are many types of Tropical and Sub-Tropical Hair Sheep. However, there are very few "Beeds" with a " Herd Book" register. This is what makes the Barbados Black Belly (BBB) so important. The BBB Breeders Association is active and organized, and is continuously trying to improve the performance traits of that Breed.

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Reading Activity: Non Essential Readings

I am going to suggest some further readings. These are not essential readings, but for those of you who are interested and need to go further, it would be useful. Most of the following should be available at your Ministry of Agriculture, Livestock Section Library; as items (1) to (4) are all Food and Agricultural Organization Publications which are distributed to all Ministries of Agriculture. You could possibly contact your Livestock Production Office in your area in order to locate these. These are as follows:

Fitzhugh, H. (1987): Systems Approach to Small Ruminant Research and Development. In Small Ruminants in the Near East: Vol. I. FAO Animal Production and Health # 54

Food and Agriculture Organization (FAO) (1987): Small Ruminants in the Near East: Vol. II. FAO Animal Production and Health Paper # 55

Food and Agriculture Organization (FAO) (1989): Small Ruminants in the Near East: Vol. III North Africa. FAO Animal Production and Health Paper # 74

Food and Agriculture Organization (FAO) (1991): Small Ruminant Production and the Small Ruminant Genetic Reserve in Tropical Africa. FAO Animal Production and Health Paper # 88

The ongoing work of the Blenheim Livestock Station in Tobago, [Trinidad and Tobago, West Indies] with crosses of BBB, West African and Black Head Persian must be highlighted. This work has been reported on in Wildeus (1991). In essence, the findings that BBB, West African or crosses of BBB and West African were equally productive. The Blackhead Persians only give one (1) offspring per litter which is undesirable.

3.2.2. Breeding

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3.2.2.1. Selection of Sheep Breeding Stock

The purpose of selection is for you or the farmer to identify those animals which you will like to become parents of the future generations of your stock. In the selection process there are two (2) components the RAM and the EWE.

3.2.2.1.1 Ram Selection

Characteristics

Generally a ram should have the following characteristics:

- Good size, deep body and well sprung ribs.
- Strong masculine head, wide between the eyes.
- Strong, wide muzzle.
- Alert eyes.
- Strong, powerful chest.
- Legs should be well spaced, strong and straight.
- Should be a good representative of the breed.
- Should have a straight top line.
- Should have well developed sexual organs with a prominent scrotum.
- Should be one of twins or triplets.

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Box: 3.2 (1): Amount of Improvement Made by Selection

The amount of improvement which you can make by selection will depend on the four (4) items enumerated below:

1) The relative **ease of efficiency of measuring a trait** and the use made of the record obtained.
2) The **selection pressure** that can be applied. This is limited by the reproductive rate, the number of flock replacements needed and the number of traits being selected for simultaneously. Since fewer rams are needed than ewes to continue a breeding programme greater pressure can be applied to the rams.
3) There should be phenotypic variation in the characteristics or traits within the animals being selected. **If there is no variability within the population then there can be no improvements**. If the variation is large then more rapid improvement can be made by selecting only the top-producing animals.
4) **Only that part of the variability of a trait which is influenced by heredity can bring about improvement by selection**. Improvement by selection can be made in such traits as prolificacy where the heritability is relatively low (average 15%) but the phenotypic variability is great. Improvement, can also be made where heritability is high but phenotypic variability small.

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3.2.2.1.2 Ewe Selection

Characteristics

A ewe should have the following characteristics:

- Well grown and healthy.
- Should stand firmly on her feet to avoid fallen pasterns.
- Should have deep, wide sprung ribs.
- Feminine head.
- Soft, pliable udder with two well developed teats.

The two main methods of selection are:

1) ***Tandem*** - where one characteristic is selected at a time.
2) ***Selection Index*** - where the information for two or more characteristics is combined and the characteristics are selected simultaneously.

Reading Activity
Charray, J.; Humbert, J. M. ; and Levif, J. (1992):
Manual of Sheep Production in Humid Tropics of Africa
CAB International,Oxon, UK, and CTA, Wageningen, Netherlands.

If you wish more information on Breed of Sheep please read the Chapters on " Reproduction and Genetic Improvement" pages 109-122 and
" Husbandry Systems and Productivity" pages 141-158

3.2.2.2. Reproduction

Sheep are naturally seasonal polyoestrus animals with the length of the breeding season varying between breeds. Some parameters which contribute to the normal breeding habits of ewes are as follows:

- Age at Puberty - 5-10 months. This is influenced by heredity, nutrition and date of birth.
- Oestrus Cycle - every 14-19 days.
- Length of Oestrus - 20-42 hours.
- Gestation Length - 143-152 days (5 months).

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Fertility in the ewe is affected by several factors that can be altered through management to produce the desired reproductive results. Some of these factors are:

- Heredity.
- Age at puberty.
- Age of the ewe.
- Light.
- Association with the ram.
- Level of nutrition.

Effect of Heredity on Reproductive Performance

Although the heritability for multiple births is low, lambing rates can be increased through selection for twinning ability. By selection of twin or triplet offspring from ewes and rams with high lamb reproduction records, the rate of genetic progress can be improved. This is why the BBB is a desirable breed because of its high twinning rate.

Effect of Nutrition on Reproduction Performance

Increasing the nutrient intake of ewes 2-3 weeks prior to breeding will influence ovulation rate and bring about an increase in lambing percentage. This strategy is called ***flushing*** and can be achieved by using fresh pasture or supplementary grain or fodder.

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3.2.2.3. Mating Systems

The mating system chosen will depend on the system of rearing, such as confinement or pasture.

3.2.2.3.1. Random Mating

In this system all individuals have equal opportunity to mate with all other individuals. No improvement is expected except through natural selection where small flocks are used and then a high degree of inbreeding is expected.

3.2.2.3.2 Controlled Mating Systems

These include:

a) Flock or Herd Mating - Large numbers of females mated to two or more sires which should be of the same breed. The ratio of rams to ewes should be 1:30.

b) Single Sire Groups - Here specific males are mated to specific females such as in line breeding.

c) Hand Mating - In this system the ewes in oestrus are identified and individually placed with a specific ram. Greater progress is expected with this system. The ram to ewe ratio can be much wider - such as 1:60. For this method to work efficiently:

   i) A keen herdsman is necessary for detecting oestrus in the ewe. The use of vasectomised or teaser rams may be considered as a means of early detection of heat (oestrous).

   ii) Proper and accurate record keeping is essential .

   iii) This mating system best suits the confinement system of rearing sheep.

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Table 3.1. Estimated lambing dates for given mating dates

Mating Date	Lambing Date	Mating Date	Laming Date
Jan 01	May 31 *	July 01	Nov. 28
15	June 14 *	15	Dec. 12
Feb 01	July 01 *	Aug. 01	Dec. 29
15	July 15 *	15	Jan. 12
Mar 01	July 29	Sept. 01	Jan. 29
15	Aug.12	15	Feb 12
April 01	Aug.29	Oct. 01	Feb 28
15	Sept.15	15	Mar 14 *
May 01	Sept 28	Nov. 01	Mar 31 *
15	Oct 12	15	Apr 14 *
June 01	Oct 29	Dec. 01	Apr 30 *
15	Nov 12	15	May14 *

[assumption 150 days pregnancy]
* - In a leap year the estimated lambing date is one day earlier than the tabulated date
Source: Gatenby (1991)

3.2.2.4. Preparation of the Ewe for Mating

Ewes should be bred when they are 8-9 months of age.
Ewes selected for breeding should be well grown and healthy. Before the onset of the breeding season ewes should have their feet trimmed. They should be dewormed and deloused and moved to clean rested pastures for two to three weeks prior to breeding.
Some improved feeding allows the ewe to gain a little extra weight and also increases the number of ovulations and her chances of producing twins or triplets. The extra feeding should continue throughout the breeding season.

3.2.2.5. Preparation of the Ram for Mating

Rams should be about 9-10 months old when first used for breeding.
The ram selected for breeding should bear all the qualities listed under *Selection of the Ram*.. The ram should be checked for any genital defects or injury.
In preparing him for the breeding season, like the ewe, he should be dewormed and deloused and his feet trimmed.

NOTE:

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During the breeding season the ram should be harnessed with a marking wax on his chest or used motor oil painted on his brisket. This aids in identifying ewes which have been served by the ram and is particularly useful in the flock and single sire mating systems.

3.2.2.6. Lambing and Dystocia

Lambing is probably the most important event in the Sheep Production System. All efforts before that were to get the ewes pregnant and successfully carry lambs to full term. Now both future generations as well as future products to market depend on live births. No matter what kind of a production system you have, it is important that you create a comfortable, clean and accessible environment where the ewes will give birth.

NOTE:

When an ewe is about to lamb, she becomes restless, lies down, and as contractions begin, tries to push out the lamb/s. The water bag begins to appear, which will eventually rupture, releasing fluids. The lambs generally come out about one hour after the contractions begin. In general, ewes will give birth lying down, and then will stand up to lick the lamb in order to remove the membranes covering it, and to stimulate the lamb to move. It is important to get the young lamb to suckle a few hours after birth so that it would receive the colostrum.

Difficulty in lambing is called **Dystocia**. It is caused when the lambs come out incorrectly i.e. in the wrong position. The correct positioning of the foetus is necessary as the vulva and its opening is limited in size, and therefore the passage of the foetus can only be accommodated if it is correctly aligned. See figures on Dystocia in Gatenby.

3.2.2.6.1. Assisting at Birth:

- two people are needed

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- the ewe is put on her right side for a right-handed person
- one person holds the head and front legs of the ewe on the side, the legs and the head must be properly restrained
- the right-handed person investigating the foetus
    - should wash their hands clean with a disinfecting solution
    - and should have their left hand over the side of the animal
    - lubricate the vulva with soap or a commercial lubricant
    - then use the right hand to investigate (**GENTLY !!**).

3.2.2.6.2. Assisting Multiple Births

- slowly push the lamb back into the uterus;
- feel the lambs to discover what position they are in and which parts are nearest the vulva;
- decide which lamb should come out first, [this will usually be the nearest lamb facing outwards];
- find its head and front legs and, if they are not in the right position for lambing, gently turn them round;
- when the first lamb has been eased into the correct position and the next has been pushed out of the way, give a slow even pull on the front legs to ease the lamb out;
- remove the membranes from the mouth of the newborn lamb and check that it is breathing; [if it is breathing, make sure that its mouth and nose are clear of any blockages and then massage its chest vigourously];
- put your hand back inside the ewe, position the second lamb correctly and help it to be born;
- repeat the process with third (and fourth) lambs, if they are present.

J *Assisting a breech birth:*

In most cases lambs should be delivered with the head and front legs first. Only for a breech presentation, i.e. rump near the vulva and back legs facing away, should the lamb be delivered back legs first. In this case each back foot should be brought round into the birth canal and then the lamb can be delivered back legs first.

NOTE:

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Before releasing an ewe which has had assistance with the birth of her lambs or lamb, the lambs should be put in front her head. Unless she is extremely exhausted their presence will revive her and she will lick them.

L *Dystocia in Sheep*

Figures 3.3 to 3.8 presents the different types of dystocias [breach birth or mal presentations of the foetus at parturition] in sheep.

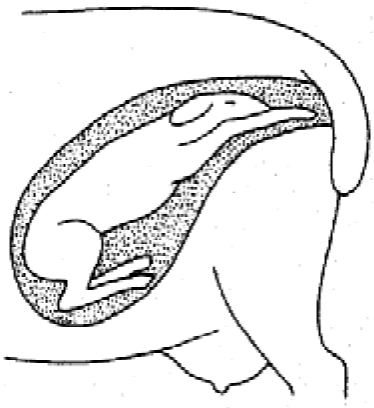

Figure 3.3: Position of an single lamb (normal birth)

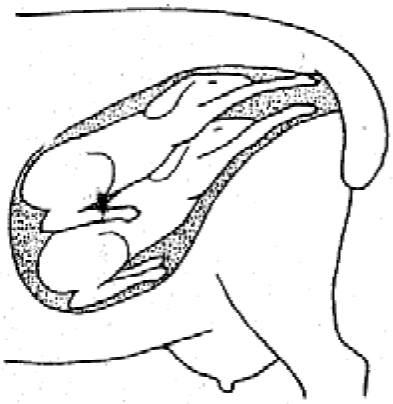

Figure 3.4: Position of twins (normal birth)

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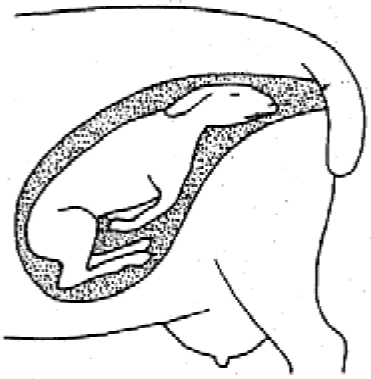

Figure 3.5: Abnormal Presentation lamb with front legs back

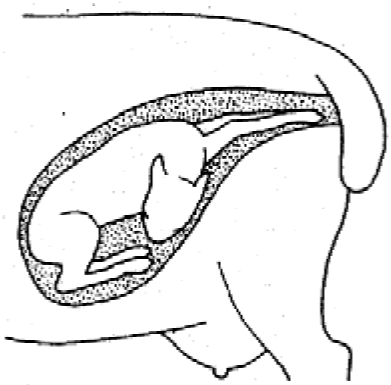

Figure 3.6: Abnormal Presentation lamb with head back

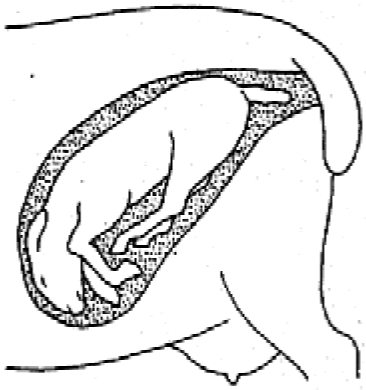

Figure 3.7: Abnormal Presentation Breech - rump first with Legs lambs

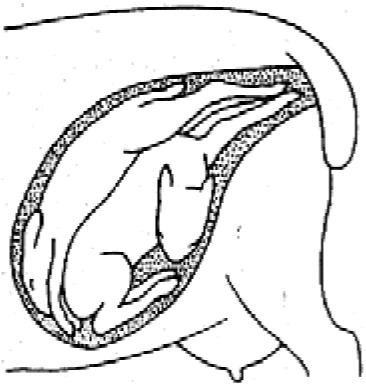

Figure 3.8: Abnormal Presentation Mal presentation of twin

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Reading Activity
Please turn for further reading to:

Extension Fact Sheet, *Breeding of Sheep,* Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/39/86.

Rastogi, Rajendra K., Fact Sheet, *How to Breed Better Sheep,* Regional Extension Communication Unit, Department of Agricultural Extension, Faculty of Agriculture, Department of Livestock Science, The University of the West Indies, St. Augustine, Trinidad, Occasional Publication No. 1, March, 1994.

Rastogi, Rajendra K., Fact Sheet, *How to Improve Sheep Reproductive Performance,* Regional Extension Communication Unit, Department of Agricultural Extension, Faculty of Agriculture, Department of Livestock Science, The University of the West Indies, St. Augustine, Trinidad, Occasional Publication No. 2, April, 1994.

Hogue, Doug. (1984), *Breeding Programme at the Cornell Mt. Pleasant Sheep Farm,* Mimeograph, Cornell University.

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Practical Activity
Practical Activity

FIELD TRIP: Ask your LST to suggest which sheep farm you should visit (if you are registered in a formal Distance Education Programme), contact your Ministry of Agriculture Local Office or your Agricultural Society to get a list of sheep farmers and do the following:

a) Observe and document the characteristics of the different kinds of breeds.

b) Restrain a sheep.

- ***i) catch it manually:***
- ***ii) learn how to use a shepherd's hook.***

Do's & Don'ts!

DO NOT keep long fingernails if you are working with sheep and have to provide assistance at lambing.

DO NOT have the lambing area far away from where there are always workers. The lambing area must always be visible.

Highlights

We highlighted for you the Breeds relevant to, and available within the Caribbean. A Breeding Calendar was presented to you, and you were advised on the different types of difficult lambings and how you could begin to address these problems.

Conclusion

The care and management of sheep breeding is not difficult and we have breeds of Tropical Hair Sheep suited to the Caribbean.

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3.3 : Nutrition and Feeding of Sheep

Quick Start h

If you are not at all familiar with the terms Nutrient, Nutrition, Nutrient Requirements or Feed Nutrients, I suggest that you go to Reading Activity 11.1 (5)

Reading Activity **Please turn for further reading to:**
Charrey, Humbert and Levi (1992): Feeding pg 60-108

In order for us to begin to talk about nutrition the very first thin we need to know is the listing of the physiological states of sheep.

3.3.1: Physiological States of Tropical Hair Sheep

- **Breeding Ram**
- **Breeding Ewe**
- **Replacement Rams ***
- **Replacement Ewes ***
- **Lactating Ewes**
  - **single lamb**
  - **double (twins)**
  - **triplets**
  - **tupping/mating**
    - **1-4 weeks *post partum***
    - **5-8 weeks *post partum***
    - **weaning at 8 weeks**
- **Weaned Lambs male and female**
  - **0-4 weeks post-weaning**
  - **4-8 weeks post-weaning**
- **Growing Lambs**
  - **8-16 weeks post-weaning** — **fattening rams**, **fattening ewes**
  - **Replacements ***
- **Pregnant Ewes**
  - **early (first third) pregnancy**
  - **middle (second third) pregnancy**
  - **late (last third) pregnancy**

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3.3.2. Nutrient Requirements for Varying Stages of Production

In order for us to do justice to your learning within this section we will have to give you a brief introduction to animal nutrition. The most important nutrients in the feeding of animals are water, energy, protein, minerals and vitamins.

3.3.2.1 Water

It is essential that all animals be provided with an adequate supply of clean water. If the water is stagnant or of an offensive odour and the animals are forced to drink this, production will fall. There are several factors which affect the amount of water consumed voluntarily by sheep.

In general, however, water intake is roughly two or three times the dry matter intake. For every 2 kg of dry matter consumed, sheep require 4 - 6 litres of water. Two (2) kg of dry matter is equivalent to about 2.2 kg of concentrate or about 10 kg of freshly cut grass. The amount of water required increases greatly with late gestation **and during lactation**.

If the water requirement is not met during late gestation then the dry matter intake will be depressed and the ewe becomes predisposed to pregnancy toxaemia. Low water intake during pregnancy also results in lowered birth weight of lambs.

3.3.2.2 Energy

This is probably the most limiting nutrient in sheep nutrition. Energy deficiency is often the result of inadequate amounts of feed or poor quality feed. The main source of energy for sheep is hay, silage and pasture(grasses and legumes) and crop residues (corn stover etc.).

Symptoms of Insufficient Energy in the Diet:

- Slowing or cessation of growth.
- Loss of weight.
- Reproductive failure.
- Lowered milk production and shortened lactation.
- Increased mortality.
- Lowered resistance to disease and parasitism.

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Energy is measured as:

- Metabolisable Energy (ME)
- Net Energy (NE) or
- Total Digestible Nutrients (TDN)

Grains and protein supplements are high in TDN (70-80%), hay is intermediate (30-55%) and silage low (10-30%).

Some of the factors which affect energy requirement in ruminants and animals in general are size, age, pregnancy, lactation and growth i.e. the physiological state of the animal will affect its energy requirement. For details on energy requirement for varying stages of production, reference is drawn to the National Research Council (NRC) Publication on Nutritional Requirements for Sheep (NRC 1985), published in the U.S.A. Section 2.3.2, Table 2-1 presents this information for your perusal. The nutrient requirements are expressed on a percentage Dry Matter Basis (%DMB). Anyone wishing to rear sheep commercially should purchase a copy of the NRC (1985).

3.3.2.3 Protein

In sheep the *quality* of protein is more important than the *quantity*. The rumen bacteria breakdown the nitrogen portion of the protein and convert it to bacterial and protozoal protein. The dead bacteria and protozoa are further broken down by the digestive juices in the digestive tract into amino acids. These amino acids are then absorbed and utilised by the sheep. However, this process does not fully occur in suckling lambs since the rumen function is still undeveloped.

In the tropics, the total intake of protein and energy is usually the problem in the dry season. At this time, both energy and protein supplementation may be needed. Good sources are soya bean meal, cotton-seed meal and peanut meal (34-45% protein). Sheep may also be fed non-protein nitrogen (NPN), such as urea or sulphate of ammonia, but it is important that sheep be given adequate energy to facilitate efficient utilisation and performance.

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Symptoms of Protein Deficiency:

- Reduced appetite.
- Lowered feed intake or lowered efficiency of feed utilisation.
- Poor growth, poor muscular development and loss of weight.
- Reduced reproductive efficiency.

In diets protein is measured as %Nitrogen x 6.25, and this is referred to as % Crude Protein [%CP].

3.3.2.4. Minerals

Of the several mineral elements contained in the body, only 15 have been proven to be essential for sheep. These include 7 major mineral elements and 8 trace minerals:

- The ***major mineral elements*** include calcium (Ca), phosphorous (P), sodium (Na), chlorine (Cl), magnesium (Mg), sulphur (S) and potassium (K).

- The ***trace or micro minerals*** are iodine (I), iron (Fe), copper (Cu), molybdenum (Mo), cobalt (Co), manganese (Mn), zinc (Zn) and selenium (Se).

In developing countries, including the Caribbean, sheep rely mainly on forage to supply their required mineral needs. In most cases this is an inadequate source and supplementation becomes necessary based on the mineral limitations of the available forages, which is usually a reflection of the mineral status of the soils.

A suitable mineral mixture should contain the 15 elements listed above with a Ca:P ratio of 2:1; and a N:S ratio of 10: 1.

- **Calcium and Phosphorous**

These two minerals depend on vitamin D and Mg for proper utilisation. Over 50% of the minerals in the sheep's body are made up of Ca and P. Bone is made up of 36% Ca and 17% P. This underlines the importance of Ca and P in proper bone formation. A good source of Ca is legumes, while grains are a fairly good source of P. Steamed

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bone meal is an excellent and palatable source of Ca and P. Finely ground limestone is a good source of Ca. The requirements for Ca and P increase in the ewe during the last 6 weeks of gestation and peaks in the first 6 weeks of lactation.

Deficiency Symptoms for Ca and P

- Abnormal bone development.
- Reduced milk production is a consequence of inadequate calcium. If the deficiency is severe tetany may result.
- Phosphorous deficiency results in poor growth and depraved appetite (Pica), unthriftiness, listlessness and decreased milk production.

- ***Sodium and Chlorine***

Salt (Sodium) is necessary as a nutrient as well as for stimulating salivary secretions. The enzymes present in saliva are important in the digestion of feed. Sodium and chlorine are necessary for regulating the acid-base balance in the blood. Salt may be provided as licks or in pulverised form. If added to mixed feed it should form about 1% of the concentrate portion of the diet.

Deficiency symptoms for Na and Cl

- Chewing of wood, dirt, rocks etc.
- Decreased feed consumption.
- Decreased efficiency of feed utilisation.

- ***Iodine***

This is probably the most commonly deficient mineral in developing countries.

Iodine is needed by the thyroid gland, and for the production of thyroxine which is involved in some aspects of the hormona; control of reproduction and photoperiod response.

Deficiency symptoms of I

- An enlarged thyroid gland in lambs.
- Stillborn lambs.

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- Weak lambs born without wool.
- Low conception rates in mature ewes.

- ***Copper and Molybdenum***

Copper is an important catalyst needed by the body to utilise iron in the formation of haemoglobin. How do you avoid a copper deficiency in your sheep? First, you have to understand the symptoms.

Symptoms of a Cu Deficiency

- Lambs weak at birth.
- Lack of muscular co-ordination and partial paralysis of the hind quarters in young suckling lambs (neonatal atoxia or swayback).

There is a dietary interrelationship between copper and molybdenum. Excess molybdenum complexes with copper in the intestine and makes the copper unavailable to the animal. This can lead to molybdenum toxicity which causes a scouring (**diarrhoea)** in sheep. Molybdenum toxicity can be controlled by increasing the copper level in the diet by 5ppm **(parts per million).**

Brachiaria grass on alkaline soils (*e.g.*, bauxite soils) often leads to scours in sheep when grazed. The alkaline soils tend to increase the molybdenum uptake by the plant at a higher rate than copper. A high molybdenum intake can induce a copper deficiency leading to the symptoms shown above.
The NRC (1985) have indicated that concentrations of sulfur and molybdenum are the major dietary factors influencing copper requirements in sheep. Tropical Hair Sheep seem to require higher levels of Cu in the diet. Copper can be provided conveniently in deficient diets or in areas where forage is deficient in copper by adding copper sulfate to salt at the rate of approximately 0.5 %. In areas where this is a known problem, gestating ewes should be given access to this salt mix.

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3.3.2.5. Vitamins

Vitamins are necessary in the sheep's diet for proper growth, reproduction and lactation. The main vitamins required by sheep are the fat soluble vitamins A, D, E and K. Mature sheep do not require supplements of B vitamins since they are synthesized in the rumen by microorganisms. Vitamin C is also synthesized by the tissues and therefore is not required in the sheep diet.

- ***Vitamin A***

Vitamin A is found in the roughages of sheep as its precursor carotene. The carotene is converted in the walls of the intestine to vitamin A. It is necessary for maintaining normal epithelial tissue.

Deficiency symptoms of Vitamin A

- Keratinization of the respiratory, alimentary, reproductive, urinary and ocular epithelia.
- Poor bone development.
- Production of weak, malformed dead lambs.
- Night blindness.
- Low semen level in rams.

Prevention

- Injectable vitamin A should be given to ewes and rams prior to breeding to avoid reproductive problems.

Intensively reared or feedlotted animals must have access to green forgae. Even if the green forage is not an important part of the feedlot ration, he animals should hasve access to it at least once per week.

- ***Vitamin D***

This vitamin is usually commercially prepared in injectable form with vitamin A. It works along with calcium and phosphorous to prevent rickets (malformation of bones). Sheep fed outdoors and exposed to sunlight for long hours seldom need vitamin D supplementation as they obtain it from irradiation. Pregnant ewes however, have a greater demand for the vitamin and may need to be supplied.

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Deficiency symptoms of Vitamin D

- Congenital malformations in newborn lambs.
- Poor growth in lambs.
- Malformation of bones (rickets).

Prevention

- Animals must have access to periodic sunlight.

- ***Vitamin E***

Vitamin E has an important interrelationship with selenium. They can each substitute for the other to a certain extent in the diet.

Deficiency symptoms of Vitamin E

- In lambs results in nutritional muscular dystrophy or white muscle disease.

Prevention

Ensure the selenium content of the diet is about 0.1 ppm
Administer injectible forms of vitamins A, D, and E every three (3) months.

- ***Vitamin K***

This vitamin is necessary for the clotting of blood, and is prevalent in green leaves. It is also synthesized in the rumen of sheep. Therefore, supplement of Vitamin K is unnecessary.

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Table: 3.3 (2) Nutrient Requirement Tables for Sheep

Table 3-1. Nutrient Concentration in Diets for Sheep (expressed on 100 Percent Dry Matter Basis)

Body Weight		Weight Change/Day		Energy			Example Diet Proportions		Crude	Calcium	Phosphorus	Vitamin A	Vitamin E
(kg)	(lb)	(g)	(lb)	TDN[c] (%)	DE (Mcal/kg)	ME (Mcal/kg)	Concentrate %	Forage	Protein (%)	(%)	(%)	Activity (IU/kg)	Activity (IU/kg)
Ewes Maintenance													
70	154	10	0.02	55	2.4	2	0	100	9.4	0.2	0.2	2,742	15
Flushing - 2 weeks prebreeding and first 3 weeks of breeding													
70	154	100	0.22	59	2.6	2.1	15	85	9.1	0.32	0.18	1,828	15
Nonlactating - First 15 weeks gestation													
70	154	30	0.07	55	2.4	2	0	100	9.3	0.25	0.2	2,350	15
Last 4 weeks gestation (130 - 150% lambing rate expected) or last 4-6 weeks lactation suckling singles													
70	154	180 (0.45)	0.40 (0.10)	59	2.6	2.1	15	85	10.7	0.35	0.23	3,306	15
Last 4 weeks gestation (180 - 225% lambing rate expected)													
70	154	225	0.5	65	2.9	2.3	35	65	11.3	0.4	0.24	3,132	15
First 6-8 weeks lactation suckling singles or last 4-6 weeks lactation suckling twins													
70	154	-25 (90)	-0.06 (0.20)	65	2.9	2.4	35	65	13.4	0.32	0.26	2,380	15
First 6-8 weeks lactation suckling twins													
70	154	-60	-0.13	65	2.9	2.4	35	65	15	0.39	0.29	2,500	15

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Ewe Lambs													
Nonlactating - First 15 weeks gestation													
55	121	135	0.3	59	2.6	2.1	15	85	10.6	0.35	0.22	1,688	15
Last 4 weeks gestation (100-120% lambing rate expected)													
55	121	160	0.35	63	2.8	2.3	30	70	11.8	0.39	0.22	2,833	15
Last 4 weeks gestation (130-175% lambing rate expected)													
55	121	225	0.5	66	2.9	2.4	40	60	12.8	0.48	0.25	2,833	15
First 6-8 weeks lactation suckling singles (wean by 8 weeks)													
55	121	-50	0.22	69	3	2.5	40	60	13.14	0.3	0.22	2,125	15
First 6-8 weeks lactation suckling twins (wean by 8 weeks)													
55	121	-100	-0.22	69	3	2.5	50	50	13.7	0.37	0.26	2,292	15
Replacement Ewe Lambs													
30	66	227	0.5	65	2.9	2.4	35	65	12.8	0.53	0.22	1,175	15
40	88	182	0.4	65	2.9	2.4	35	65	10.2	0.42	0.18	1,343	15
50-70	110-154	115	0.25	59	2.6	2.1	15	85	9.1	0.31	0.17	1,567	15
Replacement Ram Lambs													
40	88	330	0.73	63	2.8	2.3	30	70	13.5	0.43	0.21	1,175	15
30	132	320	0.7	63	2.8	2.3	30	70	11	0.35	0.18	1,659	15
80-100	176-220	270	0.6	63	2.8	2.3	30	70	9.6	0.3	0.16	1,979	15

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Lambs Finishing - 4 to 7 months old													
30	66	295	0.65	72	3.2	2.5	60	40	14.7	0.51	0.24	1,085	15
40	88	275	0.6	76	3.3	2.7	75	25	11.6	0.42	0.21	1,175	15
50	110	205	0.45	77	3.4	2.8	80	20	10	0.35	0.19	1,469	15
Early Weaned Lambs - Moderate and rapid growth potential													
10	22	250	0.55	80	3.5	2.9	90	10	26.2	0.82	0.38	940	20
20	44	300	0.66	78	3.4	2.8	85	15	16.9	0.54	0.24	940	20
30	66	325	0.72	78	303	2.7	85	15	15.1	0.51	0.24	1,085	15
40-60	88-132	400	0.88	78	3.3	2.7	85	15	14.5	0.55	0.28	1,253	15

Source: NRC (1985). Nutrient Requirements of Sheep, National Academy Press, Washington, DC`.

Note: **These tables have been developed in the main, from experiences in the USA and from temperate data using mainly Wool Sheep. The guidelines have been found useful for Tropical Hair Sheep as well.**

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3.3.3. Ration Formulation

One method of formulating rations is the substitution method that follows the following procedure:

1. List the nutrient requirement of the sheep according to body size and the physiological function to be satisfied [consult Table 3-1].
2. List feed ingredients and their nutritive value.
3. Check how well the roughage portion of the ration will satisfy the sheep's requirement for TDN and CP.
4. Substitute some of the energy ingredient to meet the energy deficiency.
5. After balancing the diet, calculate the ratio of the feed needed to be included on an "as fed" basis.

Follow Steps 1 to 5 as outlined in Table 3.3.

Table 3.3: Sample Ration Requirement for 20 kg Lamb (DM Basis)

Step 1	DM% as fed	DM%	TDN%	CP%
Requirement		**100**	**73.0**	**16.0**
Pangola grass hay	**88**	**100**	**45.0**	**8.4**
Citrus pulp	**90**	**100**	**77.0**	**7.3**
Coconut meal	**93**	**100**	**83.0**	**21.9**

Step 2	DM% of diet	TDN% of diet	CP% of diet
Requirement	**100**	**73.0**	**16.0**
Pangola Hay	**100**	**45.0**	**8.4**
Difference	**0.0**	**-28.0**	**-7.6**
Substitute citrus pulp for pangola grass hay. First check the difference in TDN between the citrus pulp and the pangola grass hay (77 - 45 = 32) and the amount of TDN deficient in the all hay diet (28%). To supply the 28% TDN substitute 28/32 = 87.5% from citrus pulp.			

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Steps 3 & 4	DM% of diet	TDN% of diet	CP% of diet
Pangola hay	**12.50**	**5.60**	**2.0**
Citrus pulp	**87.50**	**67.37**	**6.39**
Total	100.00	72.97	8.39
Difference	**0.00**	**-0.03**	**-7.61**
Substitute coconut meal (mechanically extracted) for citrus pulp. Difference CP (21.9 -7.3 = 12.6). Amt. CP deficient in ration (7.61). To supply 7.61% CP, substitute 7.61/12.6 = 60.40% of coconut meal diet.			
Pangola hay	**12.5**	**5.63**	**2.00**
Citrus pulp	**27.1**	**20.87**	**1.98**
Coconut meal	**60.4**	**50.13**	**13.23**
Total	100.0	76.63	17.21
Difference		**+3.63**	**+1.26**

Step 5						
Determine the ratio of the feeds to include on an as fed basis.						
	AIR DRY BASIS (AS FED)			**DRY MATTER BASIS**		
	DM%	**Parts of Diet**	**%**	**DM%**	**TDN%**	**CP%**
Requirement				**100**	**73**	**16**
Pangola hay	**88.0**	**14.2**	**13.0**	**12.5**	**5.63**	**2.0**
Citrus pulp	**90.0**	**30.1**	**27.6**	**27.1**	**20.87**	**1.98**
Coconut meal	**93.0**	**64.9**	**59.4**	**60.4**	**50.13**	**13.23**
Total		109.2	100.0	100.0	76.63	17.21
N.B. To calculate parts divide DM% (DM basis) by DM% of feed (air dry) (*e.g.*, for angola hay divide 12.5/88.0) according to NRC tables a 20 Kg lamb could consume 1.0 Kg of DM from the diet or 1.0/0.90 (approx. DM percent) = 1.11 Kg of this diet per day.						

It is important that minerals and salt be provided free choice [available at all times].

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3.3.3.4. The Use of Molasses in Feeding Sheep and Ruminants

Let us first begin by having a good understanding of Molasses. What is it?

- it is liquid energy,
- is a good source of S and Ca for feeding to animals,
- it has very little or almost no protein,
- it is very difficult and messy and easily attracts flies, and is difficult to handle and transport,
- it has no fibre, and
- it is about 80% Dry Matter (i.e. it is a solid liquid).

Molasses can be fed to sheep and other ruminants in the following ways:

1. as a liquid supplement mixed with water;
2. as raw molasses top dresses and mixed in with the chopped forage (especially chopped forage of low acceptance to the animal);
3. mixed in with the concentrates and by-product feeds as a binder or to reduce dustiness; and
4. as molasses blocks offered *ad lib* with chopped forage or low quality hays.

Reading Activity

Please read:

Asiedu, F.H.; Fearon, A.L.; Hosein, A.A. and Barnes, R. (1994): Directions for Making and Feeding Molasses-Urea Feed Blocks. CARDI Fact Sheet # AP-F/37.94

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3.3.3.5. The Feeding of Bagasse Based Broiler Litter to Sheep

NOTE: The success of any livestock enterprise or feeding system depends on matching the animals requirements to the cultivated feed supply. The systems are based on the utilisation of cultivated forages and multipurpose trees as the roughage source.

Other feed ingredients would include as far as feasible by-products of the sugar industry and other locally available feedstuffs, *e.g.*, urea treated bagasse and bagasse based poultry litter. Diets are to be fortified with vitamins and minerals where necessary.
To enhance feed security a system of feed conservation must be established and the cultivation of sugarcane planted for strategic dry season feeding is a useful strategy.

Reading Activity

Please turn for further reading to:

Asiedu, F.; Fearon, A.L.; Hosein, A.A. and Barnes, R. (1994): Directions for Making and Feeding Molasses-Urea Feed Blocks. CARDI Fact Sheet # AP-F/37.94.

Extension Fact Sheet, *Nutrition and Feeding of Sheep*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/54/86.

Lallo, C.H.O., Benn, A. and Garcia, G.W. (1993): *Feeding and Nutritional Models for Intensive Fattening of Hair Sheep Lambs*. In Opportunities and Constraints for the Development of a Sustainable Small Ruminant Sub-Sector in the Caribbean Region, Caribbean Agricultural Research and Development Institute (CARDI), University Campus, St. Augustine, Trinidad & Tobago.

Lallo, C.H.O., Neckles, F.A. and Harper, W.A. (1988): *Intensive Mutton Production Based on the Feeding of Bagasse Based Broiler Litter and By-Product Feedstuffs*, Volume 2, 2nd. Annual Seminar on Agricultural Research, NIHERST, The University of the West Indies, The Ministry of Food Production and Marine Exploitation.

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Do's & Don'ts!

DO NOT attempt to use urea in your feeding program unless you are properly informed, as improper user of urea would lead to the death of your sheep.

Highlights

The physiological states of sheep and the Nutrient Requirement Tables were highlighted for you.

You were given an opportunity to appreciate the steps involved in formulating diets for sheep.

Conclusion

The proper feeding of sheep is not as easy as it looks.

You would need to give careful consideration to your feeding program if your sheep operation is to produce healthy, productive and rapidly growing animals.

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3.4. Stock Management

As a new enterprise lower flock size and stocking density should be maintained until problems are sorted out. If you are inexperienced, initially flock size should not exceed 25 breeding ewes with a maximum of 5 ewes per pen. This suggestion is for someone now setting out in sheep production on a part time basis. A farmer should decide on the area(s) of production to be undertaken *i.e.*, breeding stock and/or mutton production, as this would influence the type and breed(s) of animal selected for the flock.
A viable production system requires an accelerated lambing programme. Ewes should be exposed to the rams during the entire year, the aim being to achieve a minimum of 1.5 lambings/year or three (3) lambings every two (2) years. This is possible under a continuous breeding programme in the tropics.

Chapter 7 : Routine Husbandry, Housing and Equipment in Gatenby (1991) could be consulted as support readings to this section.

Please also refer to Hogue (1994) as this demonstrates a continuous breeding system with three (3) breeding and lambing periods per year are obtained.

3.4.1 Features of Intensive and Extensive Management Systems

· **The Extensive System**

The extensive system of management involves the rearing of sheep under range conditions. It is characterised by the following:

1. Usually large or small acreages of unimproved pastures with frequently little or no subdivision.
2. The use of sheep-proof perimeter fencing such as four foot hog wire reinforced with barbed wire.
   - Ü The barbed wire is strategically placed with one strand running first just above the ground to prevent entry by dogs.
   - Ü A second strand running along the middle of the hog wire acts as a rubbing deterrent and protects the fence from sagging.

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- Ü The placing of another strand of barbed wire just about four inches above the hog wire will deter any rogue sheep from jumping.

3. Low stocking rate with usually 4 or less sheep per acre (or 10 sheep /ha).
4. Low labour input.
5. Little or no supplementary feeding; the sheep must rely on the natural vegetation to satisfy their nutritional needs.
6. Proper pasture maintenance, involving the periodical removal of herbage not eaten by sheep.
7. Usually, no housing provided and ewes are allowed to lamb outside.

Advantages of the Extensive System:

- J **Low labour cost.**
- J **Low capital cost.**

Disadvantages of the Extensive System:

- L **High lamb mortality due to predators, such as dogs.**
- L **Lambs born in the bush often go unnoticed.**
- L **Sheep are not seen individually on a regular basis.**
- L **Matings are not identified easily, especially with large flocks.**
- L **High level of worm infestation.**

· The Intensive System

This system is characterised by its high level of inputs. Animals are typically housed and zero-grazed. A large number of animals can be reared on a small acreage of land using this system. The intensive system is best suited for feedlot operations (*i.e.*, fat lamb production).

The establishment and production of high quality fodder crops is essential if feed costs are to be kept at a minimum.

The following management practices usually apply here:

Housing

Housing may be simply constructed using locally available materials (*viz.*, round wood for fence posts and rafters). The *floor* need not be paved but should be well drained. The *fencing* may be of hog wire or wood laths. *Gates* should be wide enough to allow for the passage of a tractor and front end loader for easy removal of accumulated manure.

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The roof can be of galvanised sheeting and should cover the feeding area. Overcrowding should be avoided and a space requirement of 4 sq. ft. (0.4 m^2) per lamb of covered space (including feeding area) and 8 sq. ft. (0.8 m^2) of uncovered space should be provided. Housing should be secure and well ventilated.

Feeding systems

Fresh grass, hay or silage is carried to the animals and a supplementary feeding of a grain mixture done. An adequate supply of fresh water should be provided daily. A mineral mix and salt lick should be made available.

Advantages of the Intensive System:

- The growth of lambs can be closely monitored
- The cost per pound of gain can be measured.
- Several animals can be kept in a relatively small area - a high stocking rate is permitted.
- Internal parasites are more easily controlled.
- Reduced loss from predators.
- Ewes can be grouped in pens on stage of production, and fed accordingly.
- Labour cost can be reduced with mechanised harvesting and feeding programmes.

Disadvantages of the Intensive System:

- High level of managerial ability required.
- High initial construction costs and operating costs.

· The Semi-Intensive System

The semi-intensive system combines the pasture system

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with the confinement system. Animals are usually housed at night for security reasons and allowed to graze during the day. This system is suitable for improved pastures where grazing is done on a rotational basis and is supplemented with grain feeding at night.
The rotational grazing of pastures allows more animals to be carried per acre than on the range or extensive system. Because of the high stocking rate, however, there is need for a more systematic programme of internal parasite control. Over-grazing is prevented by allowing a stocking rate of not more than 6 ewes and lambs per acre and a grazing cycle per paddock of 35-40 days. The worm burden should be checked periodically by faecal analysis. The sheep should change pasture the day after being dewormed, to ensure that infestation of the new pasture is minimised.

Advantages of the Semi-Intensive System:

- J Better utilisation of pasture.
- J Breeding and lambing groups can be separated.

Disadvantages of the Semi-Intensive System:

- L High cost of fencing since there is much subdivision.

Whatever production system you choose, your labour requirements will be related to your flock size and the system for operation. A confinement system would have a higher labour requirement than a full grazing system. A full-time shepherd should be able to handle 200-500 heads. This assumes that all the necessary equipment and additional casual help are available at lambing, treatments, dipping and hoof clipping, etc.

Equipment

Proper equipment and handling facilities increase efficiency. Equipment should include:

1. Feed mixer - optional at start - old cement mixers can be utilised;
2. Forage chopper - optional at start - but will be required to chop sugarcane or elephant grass for feeding;
3. Tagging and hoof clipping equipment;
4. Sheep weighing scale;
5. Feed scale;
6. Knapsack sprayer;
7. Restraining equipment - a shepherd's hook;

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8. Ram harness and markers.

- **The Landless Farmer**

This is the group of "Farmers" who own small ruminants but do not own or cultivate land. They comprise a significant group of livestock owners in the Caribbean, and their output is significant.

3.4.2. Care of the Pregnant Ewe

· *Feeding*

Ewes should not be overfed during the early months of pregnancy. Ewes that become too fat in early pregnancy can develop problems at lambing.

In the last month (4th month) of gestation, ewes should be separated from the flock and put on a higher plane of nutrition. Increasing the feed at this time is called *"steaming up."*

It is also important to ensure that the ewe has adequate amounts of clean, fresh, drinking water, a mineral supplement and salt lick. Ewes can be fed molasses, free choice, regularly, along with their grain and hay to avoid the risk of pregnancy toxaemia.

· ***Crotching***

This is the practice of trimming wool from the crotch and udder. The advantages of doing this prior to lambing are:

- The lamb is prevented from sucking dirty wool.
- It is easier for the lamb to find the teats.
- It is easier for the sheep handler to assist the ewe at lambing if necessary.
- The lamb has a cleaner passage at birth.

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3.4.3. Care of the Freshing Ewe

The pregnant ewe should be observed at least 2-3 times a day by the shepherd two weeks prior to lambing. This is easier if accurate breeding records are kept.

A short time before lambing the ewe will:

- **Appear restless.**
- **Usually will have a developed udder.**
- **There will be a sunken area in front of the hip bones.**
- **Sometimes paws the ground and**
- **Lies down several times before going into labour.**

In the majority of cases the ewe will give birth normally and easily without assistance. However, if the lamb does not appear 30 minutes after the emergence of the water bag, then the stockman should assist her.

After the ewe has given birth, she should be offered a large amount of water and some molasses.

3.4.4. Care of the Lamb

Care of the lamb actually starts at birth. The mucus should be wiped off the lamb's nose and the lamb placed by the ewe's head for her to clean it off and identify it as her own. *This is particularly important if it is her first lamb.* The lamb's navel cord should be dipped in tincture of iodine as soon as possible after birth.

The lamb should be allowed to nurse by itself. However, if weak, it should be assisted. In any case, the lamb should get the colostrum ("first milk") within 30 minutes of birth. If no colostrum is available the following formula can be fed for two days:

Box 3.1 (3)
A Homemade Artificial Colostrum for Sheep:

26 ounces	**milk**
1 tablespoon	**castor oil**
1 table spoon	**cod liver oil**
1 tablespoon	**glucose or sugar**
1 beaten	**egg yolk**

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Mix well and feed at the rate of 1.5 to 2 ounces per feeding allowing 2 hours between feedings.
On the second day the feed should be increased to 3 ounces every 2 hours for 6 feedings. At 2 days old, gradually substitute lamb milk replacer.
Orphan reared lambs can be fed by bottle or by lamb bar (*i.e.*, bucket fitted with several teats for group suckling).
Other management practices associated with lamb care are:

· ***Docking***

This is the practice of removing the lamb‘s tail. It is done when the lamb is 2 or 3 days old. A burdizzo and a sharp knife are used for this operation. The tail is removed to prevent the accumulation of manure and the incidence of fly infestation. Removal of the tail also facilitates breeding, lambing and shearing. However, humid tropical conditions with tropical hair sheep this is not necessary. But may be only necessary when wool type sheep blood lines are being introduced under special conditions.

· ***Identification of sheep***

Sheep may be marked for identification by tattooing, ear-notching or ear tagging.

· ***Vaccination***

Lambs should be vaccinated against blackleg and tetanus at 6 weeks of age and again at 12 weeks.

· ***Deworming***

Lambs should be dewormed at weaning (12 weeks) with a broad spectrum antihelmintic.

· ***Coccidiosis control***

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Lambs raised in confinement should be treated with a Coccidiostat 1 week prior to weaning, in addition, the best form of coccidiosis control is to keep the area dry, well ventilated and have sunlight penetrate. The deep litter system is useful, but the litter must be kept dry.

3.4.5. Feeding Programme for Orphan-reared Lambs

Table 11.1(4) Orphan Lamb Feeding Programme

Age	*Amount*
3-14 days	**4-6 ozs. of milk replacer fed 4 times per day**
15-21 days	**6-8 ozs. milk replacer, 4 times a day plus good quality hay and grain (16% CP).**
22-35 days	**1 pint milk replacer given 3 times a day.**
36-56 days	**2 pints milk replacer given 2 times a day.**
57-90 days	**1 1/2 pints milk replacer given 2 times a day.**

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3.4.6 Housing Under Intensive and Semi-Intensive Systems

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Reading Activity
Roach-Benn, C. (1999):
Sheep Production in Trinidad and Tobago
Agricultural Development Bank of Trinidad and Tobago, Youth Window Project, Enterprise Management Handbook.

This reading was designed for young persons wishing to get into Sheep Production as a business. Please stop now and read this document. Please take a look at the section on housing. When you have finished this reading you can continue reading this unit.

The monetary values quoted in the financial analyses are in TT$. The current rate of exchange is US $1 = TT $6.3

3.4.7 Record Keeping

This an area which is often neglected in the farm operation. However, without proper records the farmer cannot know whether his business is losing or making money. He cannot know if there is any improvement in the productivity of his animals. The keeping of accurate records is therefore a very important aspect of the sheep enterprise, irrespective of its size.

3.4.7.1 Breeding Records

The first important thing for the farmer, is to be able to identify individual animals in the flock. This can be done using a tattoo or ear-notching system. Lambs should be marked shortly after birth and entered in a register. The register should accommodate such information as the pedigree, date of birth, sex, ear-mark, and disposal.

Individual performance data should be kept for each ewe. This should include her pedigree and date of birth as well as size of her

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offspring, lambing date, number and sex of lambs, birth weight. and weaning weight of lambs.

Service date of ewes should be recorded where possible as well as date when lambs are due and date for steaming up.

3.4.7.2Accounting Records

These records tell the farmer what the sheep operation is costing him. These include:

1. **Grazing costs**
   - **Rent or lease of land**
   - **Cost of fertiliser**
   - **Maintenance of pastures**
   - **Maintenance of fencing**
2. **Concentrate and hay cost**
3. **Cost of drugs and medicines**
4. **Labour cost**
5. **Overheads - telephone, electricity, water, farm transport, maintenance of compound, buildings etc.**

Do's & Don'ts!

If sheep are intensively housed, try to ensure that the area is kept dry, as wet floor conditions would lead to foot rot, and would also easily predispose lambs to coccidiosis which would lead to increased lamb mortality.

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3.5. Flock Health Care

A major problem under intensive rearing of small ruminants is endoparasites [internal parasites] though ectoparasites [external parasites such as mites and lice] may occur. Micro-minerals and vitamins deficiencies are also of importance with housed sheep and special attention must be given to this area as the system becomes more intensive. In addition, sheep succumb very easily to **coccidosis** and **foot rot** problems when kept in a humid environment and when the ground is wet and damp. This is why all sheep housing should provide for the ground to be dry or for areas where the feet of the animals will be kept dry. A disease prevention programme suitable for the farm should be drawn up in conjunction with the veterinarian and implemented at the start of the project.

In this section we would try to teach you how to troubleshoot by knowing how to identify, treat and prevent the most common sheep diseases. The single most heartbreaking event for the stockman is to loose his stock through disease. Without being armed with the proper knowledge, you can find yourself (and your sheep) in a helpless situation at the mercy of the unknown. At the end of this unit you will have the general understanding of how these diseases work and will learn the most important lesson of all: prevention. However, we caution you to please consult with your veterinarian on any questionable animal behaviour or animal disease.

Some of the most common diseases which can affect your sheep will be discussed under the following headings:

- **Metabolic and Nutritional diseases**
- **Clostridial disease**
- **Internal parasites**
- **External parasites**
- **Lamb diseases**
- **Foot rot**
- **Pneumonia - Respiratory tract infections.**

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3.5.1 Metabolic and Nutritional diseases

Metabolic diseases are diseases that affect the physical and chemical processes in the animal relating to the use and release of energy.

- ***Pregnancy toxaemia***

Causes

Pregnancy toxaemia is brought about by inadequate feeding, particularly during the last two months of pregnancy.
The hungry ewe (Note: hungry is used as the ewe in this condition is most likely very underfed) carrying twins or even triplets in the last eight weeks of pregnancy, uses up her energy reserves which are stored in the liver and muscles as glycogen, and throughout the body as fat. As the blood sugar level falls, body fat is then broken down to obtain energy and ketones (one of the end products of fat breakdown) which accumulate in the blood stream.

Symptoms

- Disinclination to move.
- Unnatural positioning of the neck -- the neck is carried to one side.
- Staggering gait.
- Impaired vision.

By the time these symptoms are observed, the animals must be attended to. If not, the animal may recover in a day or so, and we may believe that it is OK, then the animal will suddenly collapse and die.

Treatment

The treatment approach depends upon how close the ewe is to lambing. If within a week or so of lambing, treat as follows:

- Administer injections of cortisone and vitamin B plus.
- Oral administration of molasses and propylene glycol (glycerol).
- If pregnancy is not so advanced, it is best to have the ewe slaughtered.

Prevention

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- Provision of good quality hay and pasture during pregnancy, particularly the last eight (8) weeks.
- Feeding of supplementary concentrates may be necessary. [Based on the body condition of the pregnant animal: an animal in late pregnancy should not be showing ribs].
- Access to free choice molasses.
- Plenty of fresh water.

· *Cu Deficiency*

Causes

Low levels of copper intake by the animal

Symptoms

- Good healthy looking, fast growing lambs suddenly demonstrate lack of coordination and weakness in the hind quarters. Quite soon they become immobilized and a hind quarter paralysis is observed.

Treatment

- Early detection and drenching of the lambs with a Copper Sulphate Solution ( ) is important to prevent complete paralysis.

Prevention

- Drench ewes in the last Trimester (last third) of pregnancy with a copper sulphate solution as earlier described.

NOTE: Temperate Wool Sheep show signs of copper toxicity, with Tropical Hair Sheep, the problem appears to be a copper deficiency.

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3.5.2. Clostridial Diseases

The source of Clostridial diseases are any of a genus (Clostridium) of rod-shaped, spore-bearing, anaerobic bacteria (including pathogenic forms causing botulism).

- ***Blackleg***

Causes

Causative agent, *Clostridium chauvoei* invade the animal. The ideal setting in which the bateria can strike and cause an infection occurs whenever wounds are inflicted (*i.e.*, during or after lambing, castration, docking, shearing, etc.).

Symptoms

- The affected area appears swollen, soft and hot, later becoming tense and hard.
- There is crepitation on palpitation.

Treatment

- Daily injections of penicillin may save the sheep if done early. Mortality is usually high.

Prevention

- Routine vaccination using a multivalent Clostridial vaccine.
- Two doses of the vaccine should be given during the first year.
- A booster of the vaccine should be given one month prior to lambing.
- Another booster of the vaccine should be given in subsequent years just before lambing.

- ***Tetanus***

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Tetanus is an acute infectious disease and is characterised by rigid spasmodic contractions of various voluntary muscles specially that form affecting muscles of the jaw, called *lockjaw*.

Causes

Tetanus is caused by toxins produced by *Clostridium tetani*, commonly present in animal dung and in soil.

The bacteria gains access to the animal's body via a wound, usually a puncture wound. Wounds such as those caused by docking, castration or shearing, if untended, may lead to tetanus.

The symptoms may be *mild* or *acute*.

Mild Symptoms

- **Stiff or stilted gait.**

These mild cases may recover completely without treatment.

Acute Symptoms

- **Widespread stiffness of muscles.**
- **Muscles hard and rigid.**
- **Head and neck extended and tail cocked.**
- **Hypersensitivity.**
- **The jaws become locked.**

Treatment

- Treatment is recommended only for animals suffering with *mild* symptoms.
- Daily treatments of penicillin. [Consult your veterinarian]
- An animal suffering with acute symptoms should be destroyed.

Prevention

- Prevention measures should be taken concurrently.
- Routine vaccination similar to blackleg .
- Strict aseptic conditions and hygiene during operations that will be likely to produce wounds.

Reading Activity Please turn for further reading to:
Extension Fact Sheet, *Diseases of Sheep*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St.

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3.5.3. Internal Parasites

Internal parasites are organisms that live *in* another organism at whose expense they obtain nourishment and shelter. In sheep, these include roundworms (found in the lungs, stomach or intestines) and flatworms (found in the liver or intestines). [See Extension Fact Sheets on Parasites of Sheep]

Symptoms

- Symptoms depend on:
  The species of worm present
  The age of the sheep
  The state of the sheep's nutrition.

- ***Trichostrongyles***

Indication of the presence of intestinal worms, such as *trichostrongyles*.

Symptoms

- Diarrhoea
  - Listlessness and unthriftiness (not growing vigorously)

- ***Haemonchus Contortus***

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Indicates stomach worms, such as *Haemonchus contortus.*

Symptoms

- Anaemia [gums, tongue and eyes look very pale]
- Bottle jaw - the presence of a watery swelling under the jaw

· ***Tapeworms***

Tapeworms (another intestinal worm) are more of a problem in lambs than in adult sheep due to the adult sheep's developed immunity.

Symptoms

- Loss of weight and unthriftiness
- Presence of rice-like segments in the dung
- Sudden death of lambs -- heavy intestinal infestation will be noted upon post mortem.

Internal parasite infestation may result from a *combination* of the three types of worms discussed and will present the following symptoms:

- Unthrifty appearance
- Stringy and dirty fleece
- Anaemia and diarrhoea

Treatment

- Use of antihelmintics [worm dispelling drugs?] combined with
- Pasture rotation program will give good results.

Prevention

- Cross grazing pastures with cattle or horses. The sheep internal parasite larvae cannot develop in these species and are therefore destroyed.

3.5.4. External Parasites

External parasites are organisms that live *on* another organism at whose expense it obtains nourishment and shelter. On sheep, they include mites, lice and ticks.

· ***Lice***

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Lice are small, flat-bodied, wingless insects living on birds or mammals.

Symptoms

- Constant scratching or rubbing on fence, walls, etc.

Treatment & Prevention

- Regular dipping or spraying [with chemicals which will kill ticks, lice and fleas] will control the spread of infestation.

· *Mites*

Mites are any of various small arachnids parasitic on animals, man, plants, and stored grain.

Symptoms

- Formation of scabs in wooled or clean areas. If formed in the wooled area then wool loss occurs.
- Constant rubbing.

Treatment & Prevention

- Regular dipping or spraying will control the spread of infestation.

Dematophilosis

- [see section on Dairy Cattle Diseases in Module 5: Unit 7]

Reading Activity

Please turn for further reading to:

Extension Fact Sheet, *Parasites of Sheep*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/52/86.

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3. 5.5 Lamb Diseases

Various diseases will strike your most defenseless stock, your lambs.

- *Scours*

Cause

Escherichia coli, a bacterium with several different strains.

Symptoms

Symptoms are usually present in the *first week of life.* The infected lamb will:

- Abstain from suckling
- Stand with head arched.
- Have bright yellow diarrhoea.
- Death comes in a few days if untreated.

Treatment

- Antibiotic treatment that is specific to the strain of *Escherichia coli* , analysed by a sensitivity test.

Prevention

- Change lambing area regularly to prevent build-up of infection (bacteria).
- Avoid overfeeding of high protein diets to ewes.
- Avoid feeding cheap feeds to lambs.

- ***Coccidiosis***

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A group of specific infectious diseases caused by protozoan parasites which attack the epithelial tissue of animals.

Causes
Certain species of *coccidia* that usually affect lambs 1 to 4 months old.

Symptoms
- **Dark blood-stained diarrhoea**
- **Pot belly and unthrifty appearance**

Treatment
- 5 day course of Sulphamezathine orally, followed by
- A change of pasture

Prevention
- Move lambs to fresh pastures as soon as possible.

· *Joint-Ill*

This is a disease affecting the joints of young lambs.

Cause
Germs such as *streptococci, Corynebacterium ovis* and *bacterium coli* which gain entrance to the lamb's bloodstream via the umbilicus shortly after birth.

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Symptoms

- Fever of 105-106° Fahrenheit
- Tucked up appearance
- Lameness in one or more joints which become swollen and painful

Treatment

- If caught early, daily injections for five days of penicillin

Prevention

- With prevention, the accent should be on hygiene and cleanliness.
- Dip lamb's navel in iodine solution immediately after birth
- Use clean straw to bed down lambs in pens

3.5.6 Foot Rot

See Goat Health Care.

Reading Activity Please tu**rn for further reading to:**

Extension Fact Sheet, *Trimming Sheep's Hooves,* Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/103/88.

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3.5.7 Respiratory Tract Infections

- **Pneumonia**

Sheep are susceptible to 2 types of pneumonia:
- **Bacterial Pneumonia**
- **Mechanical Pneumonia**

Ü *Bacterial Pneumonia*

Cause

Bacterial Pneumonia is caused by *asteurella haemolytica*.
Predisposing conditions are poorly ventilated buildings, stress, changes in environment, etc.

Symptoms

- **Sudden death may be the only sign**
- **High temperature (106-107° Fahrenheit)**
- **Rapid breathing**
- **Dry cough**

Treatment

- Use of broad spectrum antibiotics e.g. oxytetracycline
- Improve ventilation
- Reduce stocking rate

Prevention

- Keep area particularly where the animals are intensively managed, dry, well drained, and free of moisture. Allow sunlight and good airflows to keep the area dry.

Ü *Mechanical Pneumonia*

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Cause

Mechanical Pneumonia usually occurs through misuse of the drenching gun or the nipple bottle. When this is done improperly, the fluids enter the animal's lungs.

Symptoms

- As soon as animals are improperly drenched or bottle fed, they show signs of coughing, choking and nasal discharge. Frequent and obvious nasal discharge.

Treatment

- Slaughtering

Prevention

- Gentle and careful drenching.
- Make sure the nipple hole for bottle fed lambs is not too wide.

Train all personnel in proper use of the drench gun and bottle feeding of lambs. The veterinarian should assist in this area.

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3.5.8 Target Performance Coefficients

Table 3.5(1) Sheep Target Performance Coefficients

Sheep	
Age at First Mating	**8-9 months**
Weight at First Mating	**29.5 - 34.1kg (65-75 lbs)**
Age at First Lambing	**12-14 months**
Lambing Interval	**3 Lambings per 2 years**
Lambing Rate	**1.8-2**
Flock Mating – Ram : Ewe	**1 : 30**
Hand Mating – Ram : Ewe	**1 : 50-60**
Mortality Rate:	
Lambs	**10%-15%**
Replacement	**3%-5%**
Adults	**3%**
Culling Rate:	
Mature Ewes	**20%-25%**
Age at Slaughter	**6-8 months**
Weight at Slaughter	**32 - 36 kg (70-80 lbs)**

The target performance coefficients for tropical hair sheep are presented in Table 3.5(1)

Dos and Donts!

Highlights

Conclusions

References on Sheep

Accompanying Readings

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Module 4: Tropical Goat Production

Welcome to our discussion of Tropical Goat Production! This Session contains 4 sections:

⇒ Breeds and Breeding/Reproduction and Mating Systems
⇒ Nutrition and Feeding
⇒ Stock Management
⇒ Flock Health Care

The goal of this session is to give you an understanding of the management of goats in the tropics. You will be able to identify the various breeds of goats suitable for rearing in the tropics and you will know how to care for them.

Learning Objectives

The Learning Objectives of this session are for you to be able to identify the various breeds of Goats suitable for rearing in the tropics. You will learn how to rear them for a farm/business enterprise, applying the knowledge you gain from this module.
At the end of this session , you should be able to have a good appreciation of the management needs of the dairy goat in the Tropics.

4.1. : Breeds and Breeding

Quick Start h

Goats *(Capra hircus)* were introduced into the New World (the Caribbean and Latin America) with the coming of Columbus. Goats are now widespread in the Caribbean and Latin America. Unfortunately, as of this date, the productivity of goats is low throughout the Caribbean, Latin America and the wider Tropics, whether they are reared for meat or milk. This is due to a number of factors but particularly due to poor management practices. Goats are usually treated as “second class” livestock. Not enough attention has been paid to various aspects of their husbandry, such as nutrition and disease control.

The goat has the potential to contribute significantly to the Tropical Regions’ output of livestock production through both small and large scale production units. This contribution could best be made through

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dual purpose systems producing both meat and milk. Regardless of the system of production, unless the basic areas (*i.e.*, breeding, animal selection, nutrition and feeding, housing and animal husbandry, health and disease prevention) are given the necessary attention this potential will never be realised. Before proceeding, think of this section as being complementary to the earlier session on Breeds and Breeding of Sheep [Module 3]. This is why in the Distance Mode we recommend that you study these two units together.

Reading Activity 4.1(1): Reading 4.1(1)
Please turn for further reading to:
R 4.1 (1) Knights, M. and Garcia, G.W. (1997): The Status and Potential of the Goat (*Capra hircus*) for milk production in the Tropics.
This paper sets the stage for you to be able to fully appreciate the role which the goat could play in the tropics, particularly with regard to milk production.

Figure 4.1: The Anatomical Parts of the Dairy Goat

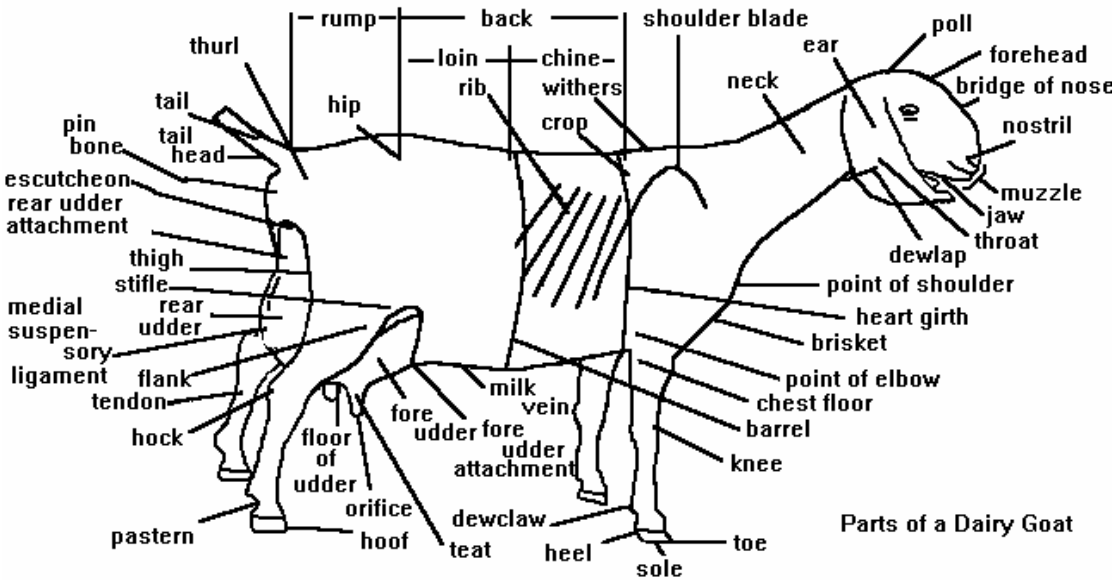

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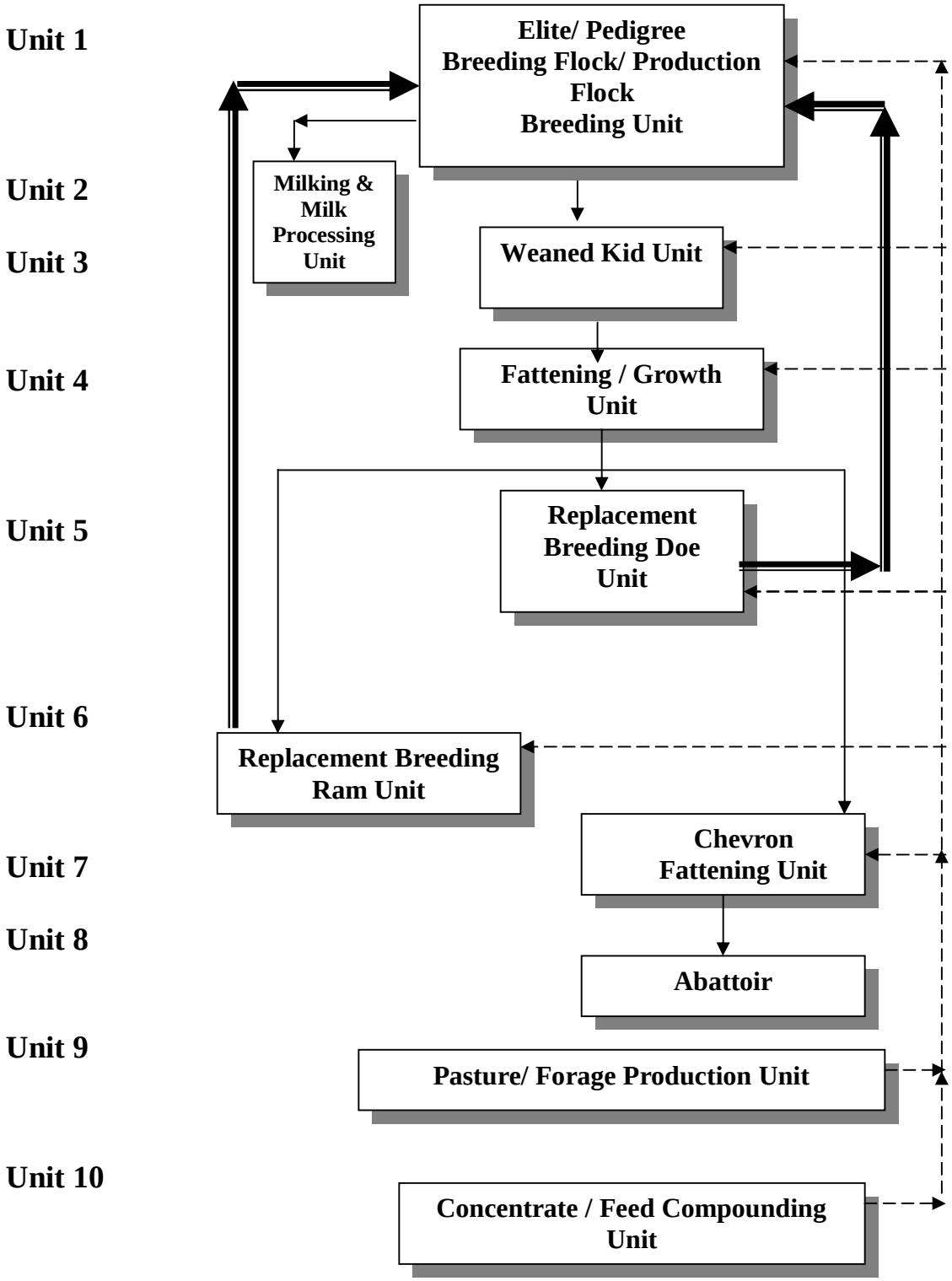
Figure 4.2: Dairy Goat Production Units Industry Process Flow



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4.1.1. Breeds and Breeding/Reproduction & Mating Systems

The use of exotic breeds of goat has been well established throughout the Caribbean, but the full impact of these introductions on the local population is difficult to determine. It is important to bear in mind that quantitative traits such as milk production and body type are controlled by several hundred genes and so are not just simply inherited. In many instances these traits, even if they are inherited are masked by environmental factors, nutrition and disease. Thus the process of genetic improvement must go hand in hand with improved management. The breeds imported into the Caribbean will now be described.

The reason why goats are good candidates for improvement, is the high degree of heritability of some of its traits. Luttmann (1986) complied the table (Table 4.1 (1)).

Table 4.1 Degree of heritability of some goat traits.

Trait	Heritability (%)
Milk	
Total Yield	**25-60**
Fat Yield	**30 - 47**
Fat (%)	**21 -62**
Protein Yield	**32 - 47**
Protein (%)	**59**
Casein (%)	**65**
Lactose (%)	**38**
Flavour	**27**
Milking Speed	**67**
Birth Weight	**1**
Live weight at 7 months	**49**
General Body Weight	**50**
Age at first kidding	**54**
Number of Kids	**10**

Source: Luttman, G. (1986):
Compiled from;
George, F.W. Haenlein (1984): Inheritance of Type and Milk Production in Goats. In Sheep and Goats Handbook, Vol. 4. Westview Press; and Maurice Shelton (1978): Reproduction and Breeding in Goats. J. of Dairy Science 61: 994-1010.

4.1.2 Breeds Used in the Caribbean Region

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There are mainly four (4) breeds of goat found in the Caribbean region.

Anglo-Nubian

The Anglo-Nubian is suited to semi-tropical environments. It was produced by crossing Indian and Sudanese Nubian goats with indigenous British goats at the turn of the century. The breed also contains some Swiss blood. Animals have a distinctive Roman nose and large pendulous ears. There are of a variety of colours including Black, Mahogany, White and Cream. The breed is big framed, females averaging over 70kg and males more than 100kg. Though not as high milk producers as several other breeds, the milk is of high quality in terms of fat and protein.

Alpine

The type most commonly found in the region, the Alpine is a mix of various European breeds, (the French Alpine is the most popular). Other types are the Swiss, Rock and British Alpine. The breed has colour combinations of black and white through shades of cream and fawn to reddish brown. Its ears are erect and the animal has a long slender neck. Milk production ranges between 675 and 900 kg over a lactation period of 250 - 305 days. Does should weigh upwards of 55 kg. and bucks 77 kg and upwards.

Toggenburg

This breed originated in the Toggenburg valley of Switzerland and is the oldest recognised breed of dairy goat. It has a light brown

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colour shading, off white on the belly, legs, inside of thighs and under the tail. There is also a white bar running along each side of the face from the ears to the muzzle. The breed has the potential to produce 700 - 900 kg of milk per lactation and mature weights of bucks and does are in excess of 75 and 55 kg respectively.

Saanen

As with the Toggenburg, the Saanen derives its name from a valley in Switzerland. It is the largest of dairy breeds. Mature does may weigh in excess of 64 kg and bucks 85 kg. Saanens can produce over 1000 kg of milk in a single lactation of between 275 to 300 days. The animals are pure white with erect ears and may or may not have dark spots on the skin and udder.

Other Breeds of Tropical Goats

Other breeds which may not be popular in the Caribbean exists. These are described in Steele (1996), but have not been presented here as they are of little immediate practical importance to us in the Caribbean and Latin America.

Please refer to Knights and Garcia (1997).

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Reading Activity 4.1 (2): Reading 4.1(2)
Please turn for further reading to:
R 4.1 (2) Extension Fact Sheet, *Breeds of Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/29/85.

4.1.3 Breeding

4.1.3.1. Selection of Breeding Stock

In selecting breeding stock the first step should be to determine the aims of the breeding programme and from these aims the most important traits would then identified.

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Next, data should be collected on individual animals and their close relatives in respect to these traits so as to determine the breeding value of these animals. They can then be ranked, and those with the highest breeding value selected as breeding stock. With respect to those traits of economic importance such as milk yield, body size and butterfat percentage there is usually some correlation.

Breeding Value**: Genetic worth of an animal in respect of a particular trait or combination of traits.**

Selecting for one trait may therefore affect another, either positively or negatively. For example, within breeds there is a positive correlation between milk yield and body size, therefore selecting for increased milk production will lead to an increase in body size.

Selection**: Choice of come animals in a population in preference to others. Usually the choice of animals as parents of the next generation.**

With respect to sexes, a higher selection intensity for males is possible since fewer males than females are required in a breeding programme. This higher selection intensity allows for more progress in genetic improvement over a shorter period. Therefore, it is very important to select only the best bucks to be used as herd sires.

Activity L

Based on the breeds discussed in the last section, which breed would be your breed of choice for the Caribbean? Why?
<u>Selection of this nature is totally dependent on the availability of suitable types of</u> <u>records which have been accurately maintained</u>. In cases where such records are not available, selection must be based on phenotypic expression (visible characteristics).

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Phenotype**: Visible or measurable traits which could be correlated to genotype.**
Genotype**: The entire array of genes carried by an individual.**

Phenotypic characters tend to be highly correlated with production.
Phenotypic selection takes into account the following:

- ***Age*** **- is determined by an examination of the teeth which are changed in pairs annually for the first four years after birth.**
- ***Legs*** **- should be strong, wide set and straight with the animal showing no signs of limping.**
- ***Skin*** **- should be smooth and pliable with no lumps or abscesses.**
- ***Size*** **- animal should have a large solid body with good barrel.**
- ***Udder*** **- should have only two teats (both males and females)**
- ***Conformation to breed type*** **- the animal should be a good representative of its breed.**

Activity L

Please turn for further reading to:

Extension Fact Sheet, *Breeding of Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/34/85.

4.1.3.2. Reproductive Performance

Puberty in does usually occurs between five (5) and six (6) months of age and slightly earlier in males. However, animals should not be bred at this time as it will have a negative effect on growth and future performance.

Does should be bred when they have achieved approximately 76% of their estimated mature weight.

Bucks may be used at six (6) months if they are well grown but should only be used very lightly.

In temperate regions goats are seasonally polyoestrus with the breeding season coinciding with the period of reduced daylight hours. In the tropics goats are believed to exhibit estrus throughout the year or to be seasonally polyoestrus but with an extended season. This makes it

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possible to achieve three kiddings in two years or even two kiddings in one year in some instances.

The length of the estrus period may vary between 24 and 48 hours but generally it lasts approximately 36 hours. The interval between estrus may vary from 18 to 24 days with an average of about 21 days. Ovulation is spontaneous and occurs just prior to the end of estrus.

Since survival time of the sperm (30-48 hours) is greater than that of the egg (16-24 hours) and the sperm requires a capacitation period, breeding should be carried out as soon as the animal exhibits standing heat.

The control of oestrus and ovulation through the use of hormones (oestrus synchronization) has now become common practice in some areas. It is generally used on dairy herds during the anoestrus period and can prove to be quite expensive. The cost-effectiveness of such a technique should be closely examined before it is attempted.
Goats usually have very few problems relating to fertility and any animal exhibiting such a problem should be immediately culled from the herd. One problem relating to fertility that may occur is hermaphroditism. This usually results from mating polled bucks to polled does and may cause as much as 20% hermaphroditism. This problem can be easily solved by the introduction of horned animals into the breeding programme.

Prolificacy: Ability to produce young.

Prolificacy in goats is a function of three factors: namely, genetic, nutrition and the time of breeding. The propensity for some animals to produce more than one kid at each kidding is inherited, although it may not always be exhibited. Thus, in selecting breeding flock this factor should be considered (see selection of breeding stock). The number of ova shed during oestrus may be influenced by body condition and the plane of nutrition during the breeding season. Therefore, a proper level of nutrition must be maintained during the breeding season (see section on feeding programmes). Optimum conception can be achieved by breeding at the correct time, which is at the onset of standing heat. Improved conception may also occur if does are re-bred 24 hours after the first service.

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4.1.3.3. Mating Systems

Let's examine the three systems of mating:

- **Pasture mating**
- **Hand mating**
- **Artificial insemination.**

The advantages and disadvantages of each are summarized in Table 4.2

Table 4.2 Mating Systems

System	Advantage	Disadvantage
Pasture Mating	Easier to use on large herds. Gives good conception rates. Requires little labour or capital input.	No record can be kept. Young does may be bred early. Buck may follow one doe and serve her several times. High risk of inbreeding.
Hand Mating	Proper records can be kept. Farmer does not have to own the buck. Reduces the risk of inbreeding. Gives good conception rate.	Difficult to monitor in large herds. Requires much time and labour. Dependent on farmer's ability to detect estrus in does.
Artificial Insemination	Allows widescale use of superior bucks. If easily available is more convenient for small herds than owning a buck.	Expensive to operate. Dependent on the farmer to detect oestrus. Reduced conception rates.

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Do's & Don'ts!

NEVER turn your back to a Buck, you may feel his presence on your BUTT!!
DO NOT breed poor quality animals if it could be avoided, as poor quality parents usually produce poor quality off-spring.

Highlights

The high heritability of Milk Traits, Live Weight at 7 months and Age at first kidding have been highlighted to you.

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4.2. : Nutrition and Feeding

Quick Start h

The Learning Objective of this unit is for you to understand the nutritional requirements of the goat under production. The single most expensive factor within any production is feed. The ration provided should satisfy the nutrient requirements necessary for maintenance, optimum production and the prevention of nutritionally related disorders. It should also be efficient and economical to feed. In the formulation of rations for goats it is important to know the nutrient composition of the available feed. One should also know how to combine these feeds in order to meet nutritional requirements.

The Lesson /

As with all other classes of livestock, in order to achieve efficient production you must meet the requisite quantities of dietary components. Unfortunately, nutrient requirements for goats are not completely known and the available data is based mainly on extrapolations from limited research and from what is known about the requirements of cattle and sheep. NRC (1981) Nutrient Requirements of Goats is the most comprehensive work on goat nutrition available.
Differences in aspects of milk composition, carcass composition, water requirements and physical activities make these data only partially applicable: thus, these requirements should only be used as guidelines only, and adjustments made where necessary.

4.2.1. Feeding Requirements for Goats

Let's discuss the requirements of dry matter. Dry matter intake is a major consideration because it indicates how much food the animal will be able to utilize. Some guidelines relating to this are as follows:

- 5-7 % of liveweight for average dairy goats.
- 5-8.5 % of liveweight for well bred high producing milking goats.
- 2.5-3 % of liveweight for the small goats of the tropics or for maintenance.

It is important that you note that dry matter intake is influenced by the type of feed and its acceptability to the animal.

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4.2.2. The Physiological States of Goats are now listed for you as follows:

- Breeding Ram
- Breeding Does [Lactating or Non Lactating]
- Replacement Rams
- Replacement Does
- Lactating [L] Does Suckling
  - single
  - double (twins)
  - triplets
  - mating
    - 1-4 weeks (Early Lactation)
    - 5-8 weeks (Middle Lactation)
    - 9-12 weeks (Late Lactation)
  - weaning at 12 weeks for meat goats
- Lactating [L] Does not suckling (see lactation curve) - 3.5 months dry so mating would occur after the 12th week. Lactation 6-8 months.
- Dry and Pregnant Does
- Dry and Open Does
- Weaned kids (male and female) - as (6) for sheep
- Growing and Replacement
- Pregnant Does - as (8) for sheep

4.2.3. Energy

The goat's requirement for energy (which is usually the most limiting factor in tropical feeds) is affected by the age, body size, pregnancy, lactation and physical activity of the animal. Good quality forages may be able to supply as much as two mega calories (Mcal) of metabolisable energy (ME) per kilogram of dry matter which is sufficient for mature, low-producing animals. For the rapidly growing or higher milk-producing animal this roughage will need to be supplemented with concentrates to increase the energy value of the diet to 2.5-3 Mcal of ME per kg of dry matter.

4.2.4. Protein

Protein is essential for the building and maintenance of tissues of the body and also for milk production, reproduction and disease resistance.

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The body does not maintain protein reserves as it does energy it reserves in the form of fat.

Excess protein is used to supply energy and the remainder broken down and excreted. This, coupled with the fact that protein is usually the most expensive component of the diet, means that you should not feed your animals more protein than they require. Protein levels of between 12 and 16 percent of the ration dry matter is sufficient for nearly all stages of production.

4.2.5. Vitamins

Refer to your Learning Activity.

4.2.6. Minerals

Refer to your Learning Activity.

Activity L

Please turn for further reading to:

Extension Fact Sheet, *Nutrition of Goats: Feeds and Feeding*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/35/86.

4.2.7. Feeding Programme: The Doe

The Non-Pregnant Doe

You can maintain non-pregnant does on pasture alone, but it is advisable that they be "flushed" prior to breeding. This involves increasing the *quality* of feed offered for about three to four weeks before mating. You can achieve this by feeding about 500 grams of concentrate per doe per day or by improving the quantity and quality of the forage offered. This practice may serve to improve litter size.

The Pregnant Doe

Approximately 70% of foetal development takes place during the last six (6) weeks of gestation (gestation is about 20 weeks). This means that there is little need for you to

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supplement their feed during the first 3-1/2 months of pregnancy. However, during that last six weeks an improved plane of nutrition is necessary to prevent the birth of weak or dead kids. The use of good quality grass combined with an ample supply of legumes is sufficient. If these are not available, then 500-750 grams of concentrate can be fed. It is advisable that you also provide mineral supplements.

The Lactating Doe

It is essential that the highest quality forage be provided *ad libitum* to the lactating doe. You can then supplement this with a 16% crude protein concentrate at the rate of 1 kg of feed for the first 1 kg of milk, and then an additional 250 grams per 0.5 kg of milk. Mineral supplement is essential.

Does which are suckling kids for meat production should receive about 1 kg per day of protein. This is sufficient for the first 10 weeks of lactation. After the first 10 weeks, you can reduce the protein and then it can be stopped at 12 weeks.

When you are feeding commercial concentrates at these levels, you need to consider the economic feasibility of using them.

4.2.8. Feeding Programme: Weaners and Yearlings

After weaning, the animal's requirements for maintenance and growth will only be met by the feeds that are offered. It is essential that you provide such feeds of sufficiently good quality to meet these needs. Good quality pasture or legume and grass hays are adequate.

If however, the quality of your pasture or legume and grass hays are poor, supplementing with 500-750 grams of 14% concentrate per animal per day will support the required rate of growth.

It is also important for you to avoid your young replacement animals getting fat, as this will impair their reproductive performance in later life.

4.2.9. Feeding Programme: The Doe The Buck

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A buck that is not in use can be maintained on forage alone and grain fed according to the general condition of the animal. You should never allow him to get fat.

During the breeding season, when his voluntary intake may be reduced, it may become necessary for you to supplement his diet with concentrates (about 1 kg per day). It is very important that the animal be allowed to exercise regularly in order to maintain good breeding condition.

4.2.10. Ration Formulation

One method of formulating rations is the substitution method that follows the following procedure:

1. List the nutrient requirement of the goat according to body size and the physiological function to be satisfied.
2. List feed ingredients and their nutritive value.
3. Check how well the roughage portion of the ration will satisfy the goat's requirement for TDN and CP.
4. Substitute some of the energy ingredient to meet the energy deficiency.
5. After balancing the diet, calculate the ratio of the feed needed to be included on an "as fed" basis.

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Table 4.3 …..Nutrient Requirements of Goats

Body Weight (kg)	TDN (g)	ME Mcal)	NE (Mcal)	Protein Total (g)	Protein Digestible (g)	Ca (g)	P (g)	Vitamin A (1000 IU)	Dry Matter per Animal: 1 kg = 2.0 Mcal ME Total (kg)	Dry Matter per Animal: 1 kg = 2.4 Mcal ME Total (kg)
Maintenance only includes stable feeding conditions, minimal activity, and early pregnancy.										
10	159	0.57	0.32	22	15	1	0.7	0.4	0.28	0.24
20	267	0.96	0.54	38	26	1	0.7	0.7	0.48	0.4
30	362	1.3	0.73	51	35	2	1.4	0.9	0.65	0.54
40	448	1.61	0.91	63	43	2	1.4	1.2	0.81	0.67
50	530	1.91	1.08	75	51	3	2.1	1.4	0.95	0.79
60	608	2.19	1.23	86	59	3	2.1	1.6	1.09	0.91
70	682	2.45	1.38	96	66	4	2.8	1.8	1.23	1.02
80	754	2.71	1.53	106	73	4	2.8	2	1.36	1.13
90	824	2.96	1.67	116	80	4	2.8	2.2	1.48	1.23
100	891	3.21	1.81	126	86	5	3.5	2.4	1.6	1.34
Maintenance plus low activity (= 25% increment, intensive management, tropical range and early pregnancy).										
10	199	0.71	0.4	27	19	1	0.7	0.5	0.36	0.3
20	334	1.2	0.68	46	32	2	1.4	0.9	0.6	0.5
30	452	1.62	0.92	62	43	2	1.4	1.2	0.81	0.67
40	560	2.02	1.14	77	54	3	2.1	1.5	1.01	0.84
50	662	2.38	1.34	91	63	4	2.8	1.8	1.19	0.99
60	760	2.73	1.54	105	73	4	2.8	2	1.36	1.14
70	852	3.07	1.73	118	82	5	3.5	2.3	1.54	1.28
80	942	3.39	1.91	130	90	5	3.5	2.6	1.7	1.14
90	1030	3.7	2.09	142	99	6	4.2	2.8	1.85	1.54
100	1114	4.01	2.26	153	107	6	4.2	3	2	1.67

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Maintenance plus medium activity (= 50% increment, semiarid, slightly hilly pastures and early pregnancy).										
10	239	0.86	0.48	33	23	1	0.7	0.6	0.43	0.36
20	400	1.44	0.81	55	38	2	1.4	1.1	0.72	0.6
30	543	1.95	1.1	74	52	3	2.1	1.5	0.98	0.81
40	672	2.42	1.36	93	64	4	2.8	1.8	1.21	1.01
50	795	2.86	1.62	110	76	4	2.8	2.1	1.43	1.19
60	912	3.28	1.84	1.26	87	5	3.5	2.5	1.64	1.37
70	1023	3.68	2.07	141	98	6	4.2	2.8	1.84	1.53
80	1131	4.06	2.3	156	108	6	4.2	3	2.03	1.69
90	1236	4.44	2.5	170	118	7	4.9	3.3	2.22	1.85
100	1336	4.82	2.72	184	128	7	4.9	3.6	2.41	2.01
Maintenance plus high activity (= 75% increment, arid rangeland, sparse vegetation, mountainous pastures, and early pregnancy).										
10	278	1	0.56	38	26	2	1.4	0.8	0.5	0.42
20	467	1.68	0.94	64	45	2	1.4	1.3	0.84	0.7
30	634	2.28	1.28	87	60	3	2.1	1.7	1.14	0.95
40	874	2.82	1.59	108	75	4	2.8	2.1	1.41	1.18
50	928	3.34	1.89	128	89	5	3.5	2.5	1.67	1.39
60	1064	3.83	2.15	146	102	6	4.2	2.9	1.92	1.6
70	1194	4.29	2.42	165	114	6	4.2	3.2	2014	1.79
80	1320	4.74	2.68	182	126	7	4.9	3.6	2.37	1.98
90	1442	5.18	2.92	198	138	8	5.6	3.9	2.59	2.16
100	1559	5.62	3.17	215	150	8	5.6	4.2	2.81	2.34
Additional requirements for late pregnancy (for all goat sizes)										
	397	1.42	0.8	82	57	2	1.4	1.1	0.71	0.59
Additional requirements for growth - weight gain at 50 g per day (for all goat sizes)										
	100	0.36	0.2	14	10	1	0.7	3	0.18	0.15
Additional requirements for growth - weight gain at 100 g per day (for all goat sizes)										
	200	0.72	0.4	28	20	1	0.7	0.5	0.36	0.3
Additional requirements for growth - weight gain at 150 g per day (for all goat sizes)										
	300	1.08	0.6	42	30	2	1.4	0.8	0.54	0.45

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Additional requirements for milk production per kg at different fat percentages (including requirements for nursing single, twin or triplet kids at respective milk production level).

(% Fat)								
2.5	333	1.2	0.68	59	42	2	1.4	3.8
3	337	1.21	0.68	64	45	2	1.4	3.8
3.5	342	1.23	0.69	68	48	2	1.4	3.8
4	346	1.25	0.7	72	51	3	2.1	3.8
4.5	351	1.26	0.71	77	54	3	2.1	3.8
5	356	1.28	0.72	82	57	3	2.1	3.8
5.5	360	1.29	0.73	86	60	3	2.1	3.8
6	365	1.31	0.74	90	63	3	2.1	3.8

Source: NRC (1981)

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4.2.11. Closing

Unit 3.2 presented you with information on the feeding of Goats. However, it should be noted, that while sheep graze very low down on the pasture, goats prefer to ”Browse” on hedges and shrubs. Goats could therefore prove useful in areas where the paddocks are bordered by shrubs and hedges.

Accompanying Reading

Extension Fact Sheet, *Nutrition of Goats: Feeds and Feeding*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/35/86.

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4.3. Stock Management

Quick Start h

The Learning Objective of this section is to show you the effects of the different methods of stock management on goat production. It also discusses the care of goat during key life passages (*e.g.*, as a lamb, during pregnancy, etc.) and emphasises the importance of recordkeeping for the goat enterprise. You will see the possibilities that exist for increased goat production in the Caribbean.

The Lesson /

By nature goats are browsers. So, if you give them a choice, they will consume less grass and more materials from herbaceous shrubs and trees. This habit adapts them well to an extensive system of management.

4.3.1. Extensive Systems

Under the extensive system, your animals are allowed to roam large acreages in search of food with no supplementation. This system has inherent disadvantages.

Disadvantages

- The major one being the tendency of goats toward over-grazing and debarking of trees, which eventually leads to soil erosion and destruction of the grazing area.
- Another problem with range rearing is the difficulty or inability for you to use management tools, such as controlled breeding and record keeping.

You can use proper range management, including deferred grazing, the use of proper stocking rates and establishment of browse plantations, to minimize some of the problems associated with this system.

4.3.2. Semi-intensive Systems

The semi-intensive system of management is between the extensive and intensive systems. Generally, animals are grazed during the day and housed at night with some amount of feed supplementation being offered. This system allows you more management control in the areas of nutrition, breeding and allows for milking. Where the extensive system required little

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or no capital inputs this system will require a minimum of expenditure on housing and feed depending on the scale of the operations.

4.3.3. Intensive Systems

Under an intensive system of management, goats are reared in complete confinement. This is the most suitable system for the temperate breeds found in the Caribbean region and also for areas where land is intensively cultivated. This allows you full control over nutrition and breeding. You must take great care in planning rations since the animals are not able to select their own food, but must eat whatever you offer them. The disadvantages of this system are:

Disadvantages

- High level of capital investment required.
- High level of managerial skill you must have to function efficiently on a large scale.

Your major concern in setting up an intensive management unit is the identification of a suitable source of forage which will be available all year round.

4.3.4. Housing and Equipment

Conditions in the tropics make is possible for you to construct relatively cheap housing for goats. If you locate an area that is not exposed to high winds or draughts, it is possible for you to build a shed, using only one or two solid walls. The rest would consist of wire or whatever cheap materials are available.

Pens for Does

Per doe, the floor spacing required is approximately 2 - 3 square meters depending on the size of the animal. You should use earth yards in conjunction with each shed in order to allow the goats some freedom of movement.

Feed Troughs

You should construct feed troughs in the pens to allow all the animals to feed at the same time. Each animal should be allowed approximately 40 cm of trough space.

Pens for Bucks

You should construct pens for bucks with an exercise yard so they are kept in good physical condition. The buck pens should be located as

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far as possible from the milking area as milk will absorb easily the odors given off by the buck.

Milking Area

The size of the area used for milking will depend on the size of your enterprise. Whatever the size, your milking area should always be smooth and made of concrete to allow for easy cleaning and proper sanitization.

See the following illustration of a raised platform milking system which is preferred for large scale operations. Note how you can milk animals from the rear or from the side, by machine or by hand.

If you have a small operation, you can us the simple milking stand where only a few animals are milked.

Figure 4-1. The Dairy Goat Milking Platform

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Activity L

Please turn for further reading to:

Extension Fact Sheet, *Housing Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/30/85.

4.3.5. Lactation Curve of the Dairy Goat

The Lactation curve of the Dairy Goat is presented in Figure 4.2.

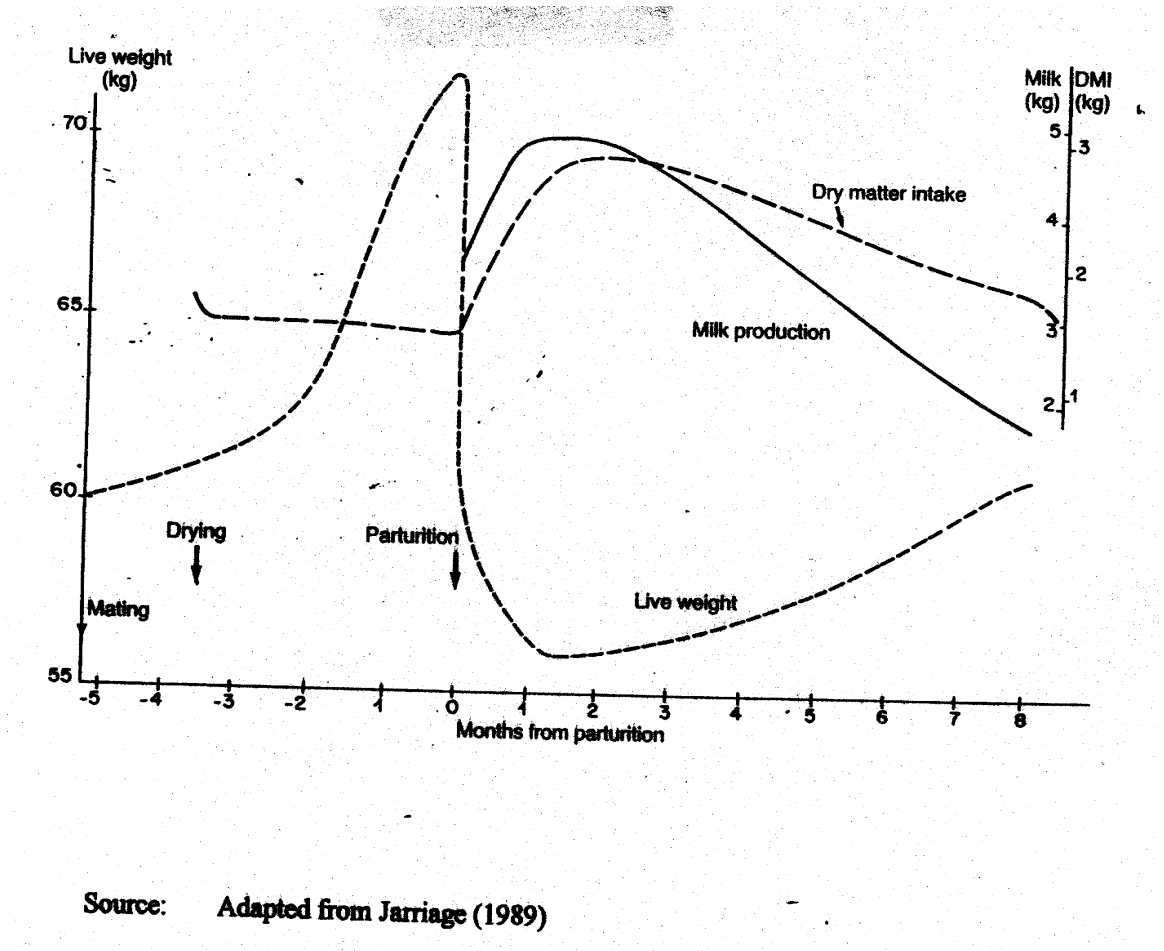

Figure 4.2 The Lactation Curve for Dairy Goats
Source: Adapted from Jarriage (1989)

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4.3.5.1. How to use the Lactation Curve.

Care of the Doe
Since pregnant does should be dried off about 6-8 weeks prior to kidding (remember we discussed this before?), it is necessary for you to maintain accurate breeding records. During this 8 week period the doe should be maintained on a high plane of nutrition (*see* section on feeding).

In drying off the doe you should take care to avoid mastitis. The best way to effect drying off is to simply stop milking. In the case of high producing animals it may be necessary for you to reduce the animal's production over several days, before she is dried off. This can be done by confining her and maintaining her on a very low plane of nutrition for 3-4 days.

Following parturition, excess hair, especially around the udder should be sheared in order to prevent contamination of the milk. It is also very important that you check animals hooves and remove excess growth.

Re-breeding the doe depends on two factors. One is whether or not breeding is seasonal. If it is seasonal, then animals must be bred during that season. The other factor is the expected length of lactation. For high yielding temperate breeds this is usually about 9 - 10 months in which case you would breed in the sixth or seventh month following parturition. For shorter lactation lengths breeding should be done at an earlier stage. You can try oestrus synchronization. It can prove useful but is expensive.

4.3.6. Management for Meat

In rearing animals for meat your primary consideration is the rate of the animal’s growth. To ensure proper growth, a nursing doe must be maintained in good condition (see section on feeding) throughout her lactation. In order to maximise her productivity, you should rebreed her as soon as possible after kidding.
Kids may be weaned at about fourteen weeks at which time the rumen (stomach, remember?) should be sufficiently developed so that they can maintain a constant rate of growth from a roughage-based diet. Animals whose growth is retarded during these early weeks of life seldom recover enough to express their true genetic potential.

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In fattening weaners for slaughter, you must first consider the cost effectiveness of using commercial or locally mixed concentrates. Wherever possible, fattening rations (see section on ration formulation) should be based on cheap, locally available materials. Sugarcane and its by-products along with poultry manure can form the basis of cheap feeds for fattening. How do you use chicken manure?

You may fatten goats under an intensive system of management as long as high quality feeds are available. If the feed is not of the best quality then a semi-intensive system is recommended. In this case, the animal will be able to select some of its own feed through grazing.

It is very important for you to remember that if male and female weaners are not going to be separated during the fattening period then the males should be castrated at weaning or before.

4.3.7. Kid Rearing

Kid rearing starts at conception with the proper management of the doe during gestation as we discussed in a previous section. Following parturition, normal kids should be standing and attempting to nurse within a matter of minutes. In the case of weak kids it may be necessary for you to help them start suckling.

This *first milk* (colostrum) is critical to the proper growth and development of the kid. It is a good practice to collect extra colostrum and store it by freezing so that this will be available at the next kidding if problems arise.

You should start disease control at birth by ensuring that animals are born in clean dry surroundings. You should then dip the newborn kid's navel stump in an iodine solution to prevent navel ill which can prove to be fatal in later life. It is essential that you do this as soon as possible after birth.

Where milk is not of commercial importance, you should allow kids to remain with their mothers until weaning. Where milk is harvested for sale or for home consumption then a number of different systems of rearing can be employed. These systems are as follows:

- Kids are removed from the dam at 3-4 days old and reared on milk replacers or whole milk while the mothers are milked.
- Kids are separated from the mother after varying lengths of time between 2-6 weeks and allowed to suckle only once or twice per day with the remaining milk being used for other purposes.
- Foster mothers are used to suckle 4-6 kids each, thus releasing the other does for milking.

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NOTE:	**The biggest problem in rearing goats in the Tropics is kid mortality. It is therefore important to make every effort to keep your mortality levels below 10%. Alexandre *et al.* (1997) have shown that in Guadeloupe, mortality levels over a twenty (20) year period between 0-75 days ranged between 8.1% in the dry season and 20.1% in the wet season. This means that in the wet season one in every five (5) kids die over a time span of 0-75 days.**

Regardless of the system of rearing that you adopt, it is important that the young animal be introduced to solid food as early as one week old. This will encourage proper rumen development and reduce stress at weaning. Grass and grain feeding should start when kids are one week old. At this time, consumption will be very low, but fresh feed should be offered daily.
You should perform other management practices (such as castration, dehorning and identification) within the first three weeks after birth.

4.3.8. Record Keeping

Record keeping, when properly done, can be a very useful management tool. It can you in monitoring production and help to maintain or increase your efficiency.
Among the data that you should maintain are those relating to reproductive performance. Records of date of mating, buck used, litter size, weaning weights and mortality, should be maintained. These records will assist in your proper management of the doe during gestation, assist in monitoring inbreeding and also in the culling and selection of replacement stock.
In operations where milk production is the primary objective then you should keep milk production records for individual does. These records will also assist you in the culling and selection of replacements.
Inventory records are also important and you should maintain them as detailed as possible. Your inventory records will provide information on your total herd size and also a breakdown of the herd into the various groupings. Regular physical checks should be carried out and compared with inventory figures to ensure that you can account for all your animals.

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Activity L

Please turn for further reading to:

Extension Fact Sheet, *Record-Keeping of Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/37/86.

4.3.9. Care of Doe and Young at Kidding

- **Dystocia.**
  Please refer to this section on sheep.
- **Prolapse**
- **Useful things to have when caring for dairy goats at kidding.**
  - Chlorine Bleach or Disinfecting Solution for washing hands
  - Antibacterial Soap
  - Iodine Solution (10%) or antiseptic spray for dipping navel
  - Lubricating Cream or Petroleum Jelly
  - Torch light for use at night
  - Dry Towels and box for moving kids
  - Scissors
  - Clean cords for use in dystocia corrections
  - 2 or 4 gallon bucket
  - Syringes
  - Spare colostrum (frozen from a previous birth)

Accompanying Reading

Extension Fact Sheet, *Housing Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/30/85.

Extension Fact Sheet, *Record-Keeping of Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/37/86.

Unit Summary

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4.4 Flock Health Care

Quick Start h

The Learning Objective of this unit is to teach you how to troubleshoot health problems with goats by knowing how to identify, treat and prevent the most common goat diseases. The single most heartbreaking event for the stockman is to loose his stock through disease. Without being armed with the proper knowledge, you can find yourself (and your goats) in a helpless situation at the mercy of the unknown. At the end of this unit you will have the general understanding of how these diseases work and you will learn that the most important lesson of all is prevention. However, we caution you to please consult with your veterinarian on any questionable animal behaviour or abnormal animal condition that you may observe.

The Lesson /

There are certain prerequisites for the maintenance of a healthy herd of animals and if these are adhered to, disease problems will be minimised. You should:

- Keep your animals in clean surroundings.
- Reduce factors that predispose your animals to disease by:
    - Careful selection of new animals brought in to the herd (make sure they are healthy)
    - Proper disposal of dead animals
    - Isolation of sick animals
    - Maintenance on a suitable plane of nutrition.
    - Repair or Removal of sharp objects which could injure the animals and create a portal of entry for infections.

It is important to note that the single most important tool that you have to ensure proper herd health is <u>your sight</u>. Your keen observation on a daily basis to detect changes in appearance and behaviour will lead to early treatment of animals. Your being observant will prevent death or the spread of disease throughout the herd.

Activity L

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Please turn for further reading to:

Extension Fact Sheet, *Why Animal Health*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/81/87.

4.4.1. Common Diseases of Goats in the Caribbean

The following table shows the major diseases of economic importance, their causes, prevention and treatment.

NOTE:Be sure to read the prevention of each disease carefully. It's better to practice prevention than to have to see and treat diseased animals.

Table 4-1. Common Diseases of Goats in the Caribbean

DISEASE	CAUSE	SYMPTOMS	TREATMENT	PREVENTION
TETANUS *Lock-Jaw*	An anaerobic bacterium, *Clostridium tetani*, enters through wounds (*e.g.*, at castration or puncture wounds)	Stiffening of joints and muscles. Animal lies on its side with limbs stretched out	Anti toxin <u>not always effective</u>	Ensure sanitary conditions during and after operations (such as castration) Keep debris (such as old nails and wire) away from animals
FOOT-ROT	Gram negative anaerobic bacterium, *Sherophorus neurophorus*	Lameness with foul smelling necrotic (gangrene-like) lesions on the hoof	Paring of the hoof. accompanied by topical treatment with 5% solution of copper sulphate or formalin In severe cases systemic antibitics are needed	Keep animals in clean, dry surroundings In an area where the disease is common, always use a footbath with copper sulphate
MASTITIS	A range of bacteria *i.e.*,	Hot swollen udder,	Intramammary infusions of	Ensure proper drying off of does, keep

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DISEASE	CAUSE	SYMPTOMS	TREATMENT	PREVENTION
	Streptococcus spp.	discoloured milk with solid flakes he udder becomes hard and fibrous if left untreated	antibiotic preparation In severe cases intra muscular injections of antibiotic	milking area clean Milk infected animals fast
NAVEL-ILL *Omphalophlebitis*		Fever, depression, refusal to nurse and swollen joints Infection may occur within the first days of life with the actual symptoms not showing up until several weeks later	Kids under 2 weeks old will respond to tetracycline or penicillin With older animals or in chronic cases, recovery will be unlikely	At birth, dip navel stump in 5-7% iodine solution
PNEUMONIA	Viral infection precipitated by stress	Fever, running nose, coughing	Keep animals in warm well-ventilated area and treat with antibiotic or sulfa drugs	Keep animals in well-ventilated, dry surroundings
CASEOUS LYMPHADENITIS	A gram positive bacterium, *Corinebacterium pseudotuberculosis*	Abscesses under the jaw in front of the shoulder, above the udder or scrotum and high on the flank	Surgical removal or opening and washing thoroughly with water and iodine	Do not introduce infected animals to the herd Isolate infected animal and all those with recurring abscesses
CAPRINE ARTHRITIS ENCEPHALITIS (C.A.E.)	Viral disease spread through colostrum and milk	In young kids, 2-4 weeks old, lameness develops in	No treatment Infected animals should be slaughtered	Do not allow kids to suckle infected does Serological testing of the herd and

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DISEASE	CAUSE	SYMPTOMS	TREATMENT	PREVENTION
		hind legs, leading to eventual parallysis In older goats symptoms show up after the animal reaches 2 years and older. There are swollen joints and eventual loss of use of the legs		slaughtering of all disease-positive animals
CONTAGIOUS ECTHYMA	Viral disease	Thick scabs and sores around the muzzle and udder	No treatment	Isolate infected animals The disease can be transferred to man
INTERNAL PARASITE INFESTATION	Caused mainly by stomach worms such as *Haemonchus contortus*	Loss of appetite, anaemia, rough hair coat, listlessness, and in severe cases, an accumulation of fluids under the jaw	Commercial preparation of antihelmintics such as thiabendazole and levamisole	Do not feed animals on the ground or in dirty feed boxes Rest grazing areas for at least 4 weeks to break the life cycle of the worms
COCCIDIOSIS	Protozoan parasites, *e.g., Eimeria spp.*	Anorexia, weakness and distended stomach	Isolate and treat with sulphadimidine nitrofurazone or amprolium	Keep housing area dry and clean and rotate pastures

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Activity L

Please turn for further reading to:

Extension Fact Sheet, *Diseases of Goats,* Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/31/85.

Extension Fact Sheet, *Internal Parasites in Goats,* Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/33/85.

4.4.2. External Parasites-ticks, lice and fleas

You know your goats have external parasites when they continuously scratch and rub against trees and fences. The insects may also be visible on the animals. The good thing is that they are easily controlled by regular spraying or dipping cycle. (See also Module 3: Unit 4)

Activity L

Please turn for further reading to:

Extension Fact Sheet, *External Parasites of Goats,* Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/32/85.

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4.5 Target Performance Coefficients

Table 4.4: Target Performance Coefficients in Dairy Goats in the Tropics

Age at First Mating	**8-9 months**
Weight at First Mating	**65-75 lbs (75% mature weight)**
Age at First Kidding	**17-20 months**
Kidding Interval	**8.5 months (3 kiddings per 2 years)**
Average Litter Size	**2.1 kids**
Kidding Rate	**1.6 - 2.0**
Buck : Doe Ratio	**1:12 (<12 months)**
1:30 (Mature)	
Mortality Rate:	
Kids [0 to 15 days]	6.5% - 20.2%
Kids [15 to 75 days]	5.1% - 7%
Kids [0 to 75 days]	9.8% - 25.3%
Weaners	2% - 3%
Adults	<5%
Lactation Length	**180-270 days (Higher value for high grades)**
Lactation Yield	**142 – 294 kg**
Milking Peak [Week 2] kg/day	**1.09kg**
Ave Daily Milk Prod (kg/day)	**0.79 +/- 0.21 kg/day**
Age at Slaughter	**6 - 8 months**
Ave Birth Weight (kg)	**1.73 +/- 0.34 kg**
Ave Weaning Weight (kg) @12 weeks	**7.75 +/- 1.76 kg**
Average Daily Gain (ADG) 10-30 days g/day	**84.3 +/- 25.9 g/day**
ADG 40-70 days g/day	**65.7 +/- 24 g/day**
Weight at Slaughter	**70-80 lbs (32 to 36 kg)**

Source of Part of the Information : Alexandre *et al* (1997)

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Reading Activity
Please turn for further reading to:
Extension Fact Sheet, *Trimming Goats' Hooves*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/102/88.

4.6 References on Goats

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Accompanying Reading Dairy Goats

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Extension Fact Sheet, *External Parasites of Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/32/85.

Extension Fact Sheet, *Internal Parasites in Goats*, Regional Extension Communication Unit of the Caribbean Agricultural Extension Project (RECU/CAEP), Faculty of Agriculture, The University of the West Indies, St. Augustine, Trinidad, CAEX - FS/33/85.

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Unit Summary

Questions for Study

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