

# SHEEP AND GOAT PRODUCTION HANDBOOK FOR SOUTHEAST ASIA

Third Edition



Edited by  
Roger C. Merkel and Subandriyo



# **SHEEP AND GOAT PRODUCTION HANDBOOK FOR SOUTHEAST ASIA**

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Roger C. Merkel  
Subandriyo

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@ Small Ruminant-Collaborative  
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## ACKNOWLEDGEMENTS

This production handbook for small ruminant production is the third edition of a manual previously entitled "A Collection of Training Materials for On-Farm Research of Small Ruminants" edited by Patrick Ludgate, 1989. Originally, the manual was a collection of training materials used for on-farm research conducted as part of the Small Ruminant Collaborative Research Support Program (SR-CRSP) in Indonesia. The SR-CRSP was a USAID funded collaborative research program carried out between the Research Institute for Animal Production (RIAP) of the Agency for Agricultural Research and Development of Indonesia and US based institutions, the University of California-Davis, Winrock International, North Carolina State University and the University of Missouri-Columbia. The training materials were the result of research carried out through interdisciplinary work by the different disciplines involved: reproduction/breeding, economics, nutrition/forages, animal health and sociology.

In May 1996 an international conference on small ruminants entitled "Small Ruminant Production: Recommendations for Southeast Asia" was held in North Sumatra, Indonesia. Conference participants were divided into groups and reviewed the existing manual on on-farm research with the goal of revising and updating the manual so that it could be published as a production handbook. Recommendations and suggestions from participants of that conference have been used in formulating this third edition. A complete list of participants who helped review the existing manual can be found in the proceedings of the same name. Much of the original information and many of the original drawings were used in this edition, a testament to those authors and artists as well as to Patrick Ludgate for his editing and hard work in completing the second edition. Listed below are the original authors of each chapter along with those who were most responsible for revisions. The illustrations in this manual were drawn by Ruli Lubis who, along with Muchi Martawidjaja, was one of the illustrators of previous and this editions.

**Breeding Strategies and Record Keeping** - Bambang Setiadi, Muryanto, Subandriyo, Eric Bradford and Ruth M. Gatenby

**Nutrition and Feeding Strategies** - I. Wayan Mathius, Dwi Yuslianti, Agustinus Wilson, Roger C. Merkel, Ben Mullen and Pat Faylon

**Management and Housing** - Muchji Martawidjaja and Ruth M. Gatenby

**Health and Disease Treatment and Prevention** - Abdul Adjid and Alan Wilson

**Economics and Marketing** - Tjeppey D. Soedjana and Atien Priyanti

Information on forage species for grazing and cut and carry was contributed by Werner Stür and Peter Horne. Gratitude is expressed to Ruth M. Gatenby, Kevin Pond and Prema Arasu for editing.

This production handbook would not have been completed without the opportunity given to us through the leadership and support of Henk Knipscheer of Winrock International. Publication of this manual would not have been possible without financial support from the Management Entity of the Small Ruminant Collaborative Research Support Program located at the University of California-Davis, Davis, California; Winrock International, Morrilton, Arkansas and Heifer Project International, Little Rock, Arkansas. Also indispensable in the completion of this project was the Central Research Institute for Animal Sciences, Bogor, Indonesia and its staff.

This manual was designed for use by farmers, extensionists and researchers. While this manual does not claim to be a comprehensive book detailing all aspect of small ruminants and their production, it is hoped that it outlines the basic information needed to successfully raise small ruminants.

Roger C. Merkel  
Subandriyo



# INTRODUCTION

In order to increase family income and decrease financial risk many small farmers decide to raise small ruminants. Some farmers grew up raising sheep or goats and thus are experienced. Others may be raising small ruminants for the first time and have many questions. From 1980 through 1996, the Small Ruminant Collaborative Research Support Program (SR-CRSP), a USAID funded livestock development project, conducted joint research with the Agency for Agricultural Research and Development of Indonesia to improve the productivity of sheep and goats. Scientists from Indonesia and the SR-CRSP conducted research in both research station and on-farm settings. Researchers designed training materials for use in teaching farmers proper management and improved strategies of animal raising. A collection of those training materials was compiled in the second edition of this manual, "A Collection of Training Materials for On-Farm Research of Small Ruminants" published in 1989. That edition was translated into Indonesian as well as the Sundanese dialect.

This third edition of that manual contains the information provided in the second edition, revised and upgraded, as well as new information, recommendations and strategies that can help a farmer to increase productivity. This handbook can serve as an information source to answer some of the basic questions farmers may have on raising small ruminants such as the type of housing, feeding and breeding systems to use. For experienced farmers, extension personnel and scientists, more advanced information is included such as concentrate formulas, disease treatment and prevention and record keeping strategies that can aid in selecting replacement stock to increase flock value.

Recommendations made in this handbook, in general, apply to both sheep and goats regardless of which species is named. For example, the lambing process, positions of lambing and difficulties in lambing pertain to goats as well as sheep. When distinctions are required, such as in length of estrus, separate mention is made for both sheep and goats in the text and drawings. The English version of this manual uses scientific names to refer to forage species while describing some diseases with scientific terms. This was purposefully done to avoid any confusion on species or diseases. Translations of this manual should use local, area specific forage names, species and medical terms that the target audience can understand.

This manual does not represent all of the knowledge needed to raise small ruminants. Rather, this edition of the manual was developed to be used by farmers as an information source, extension personnel as a reference and storehouse of training materials and scientists as a starting point in their quest to improve village sheep and goat production. The greatest impact and benefit will occur when all three, farmers, extensionists and scientists, work together. Trainings can be tailored to meet the needs of particular groups and information presented as needed. As farmers progress in their knowledge and experience, so, too, can the materials presented to them. Trainers and scientists can learn what materials are beneficial and which need improvement or changing to fit their local conditions.

In any manual there will be information lacking that others feel is important. It is hoped that the material presented in this production handbook is pertinent to raising small ruminants in Southeast Asia and can aid farmers, extensionists and scientists in improving animal production practices.

Roger C. Merkel



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## **BREEDING STRATEGIES AND RECORD KEEPING**

- 1. Sheep and goat breeds found in Southeast Asia**
- 2. Sheep - goat breeding stock**
- 3. Body deformities**
- 4. Predicting the age of sheep - goats**
- 5. Puberty - heat**
- 6. Mating**
- 7. Pregnancy**
- 8. Preparation for lambing**
- 9. Birth positions of lambing**
- 10. Lambing process**
- 11. Difficulties in lambing**
- 12. Aids for lambing difficulties**
- 13. Care for newborn lamb/kid**
- 14. Preweaning care for lambs**
- 15. Increasing the productivity of sheep and goats**
- 16. Increasing the number of lambs/kids weaned per year**
- 17. Production record cards**
- 18. Production calendar for sheep and goats**
- 19. Identification of animals**

## 1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA

Knowledge of sheep and goat breeds aids in achieving success in raising these animals. Each breed has certain characteristics that can be used for their identification and selection for a particular production objective.

### Differences between sheep and goats

Characteristics	Sheep	Goats
Tail	Downward pointing	Erect
Body	Wool covered, except hair sheep	Hair covered, except for Angora breed, Cashmere goats have downy undercoat
Beard	None	Males, usually
Eating habit	Grazing in a mob Docile	Browsing singly May be more aggressive

### Important Southeast Asian breeds are:

#### Sheep

##### 1. *Thin-tailed sheep (Java Thin-tail, Sumatra Thin-tail, Malin)*

Found in Indonesia and Malaysia

Characteristics:

- body relatively small
- some coarse wool
- males often horned, females polled
- colors include white, brown, black, spotted, blackbelly pattern (brown body, black belly, striped face)
- size may vary among types (Java, Sumatra, Malin) but generally females 15-35 kg, males 30-50 kg

##### 2. *Fat-tailed sheep*

Largely found in Madura, Sulawesi, East Java and Lombok.

Characteristics:

- body slightly larger than indigenous sheep,
- males may have small horns, polled females
- long and wide tail which can accumulate fat deposits
- the tip of the tail is small

##### 3. *Priangan sheep (Garut sheep)*

A strain of indigenous sheep selected for large size and fighting ability. May have some exotic blood.

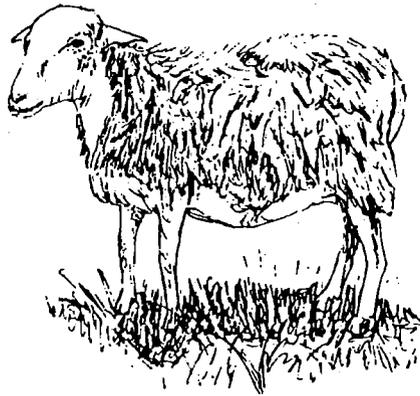
Characteristics:

- males with large horns, curving backward, shaped like spirals, base of left and right horns almost joined
- ears can be long, medium or short, behind the horns
- short tail with a rather large base
- adult body weight for male ranges 45-75 kg and for females 25-40 kg

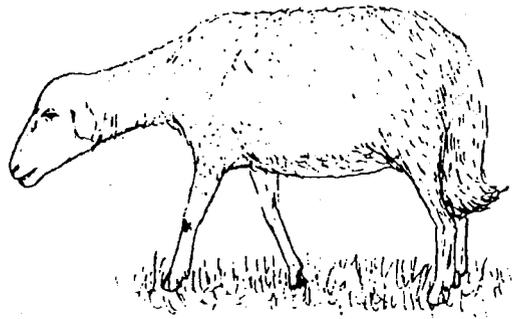
# 1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA

## SHEEP

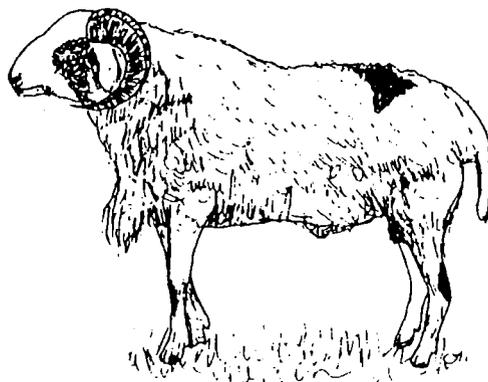
1. Indonesia Indigenous Sheep



2. Fat-tailed Sheep



3. Priangan (Garut) Sheep



## 1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA (continued)

### 4. *Thai Long-tail*

From Thailand, sometimes called Siamese Long-tail. Introduced into Malaysia.

Characteristics:

- low prolificacy
- fairly large wool sheep
- mature ewe weight approximately 30 kg

## Hair Sheep Breeds

### 1. *Barbados Blackbelly*

Originated from Barbados Island, Caribbean Sea

Characteristics:

- medium prolificacy
- brown with black belly
- males have a mane (long hair on chest and neck)
- both sexes polled
- mature body weights for females 35 - 50 kg and males 50 - 80 kg

### 2. *St. Croix*

Originated in Virgin Islands, Caribbean Sea

Characteristics:

- white
- males have a mane (long hair on chest and neck)
- medium prolificacy
- both sexes polled
- mature body weights for females 30 - 50 kg and males 45 - 80 kg

### 3. *Sei Putih Hair Sheep (Domba Sei Putih)*

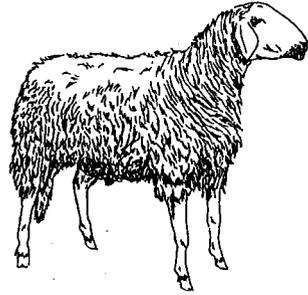
This is a new strain of sheep produced by crossing St. Croix, Barbados Blackbelly and Sumatra Thin-tail breeds (25% St. Croix, 25% Barbados Blackbelly and 50% Sumatra).

Characteristics

- larger than Sumatra Thin-tail
- are undergoing selection for color, growth and other productive traits
- mature weights for females 30 - 40 kg and males 35 - 50 kg
- colors vary from white, brown, spotted to blackbelly pattern

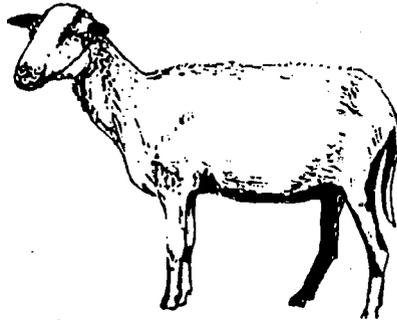
**1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA (continued)**

4. Thai Long-tail

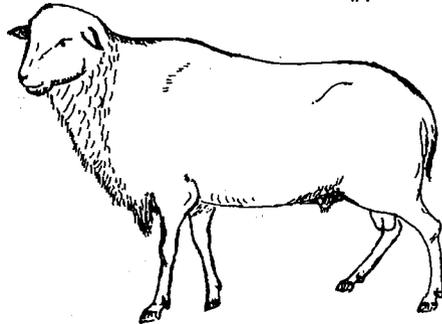


**Hair Sheep Breeds**

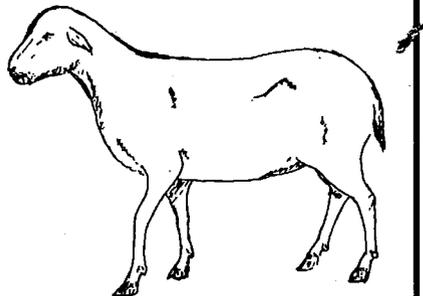
1. Bardados Blackbelly



2. St. Croix



3. Sei Putih Sheep (Domba Sei Putih).



## 1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA (continued)

### Goats

#### 1. *Kacang goat*

Found in Indonesia, Malaysia and southern Thailand, origin not clear.

Characteristics:

- body small and short
- ears small
- short neck, elevated back,
- males and females are horned
- average height for adult males ranges from 60 - 65 cm and females 56 cm
- adult body weight for males  $\pm$  25 kg, for females 20 kg

#### 2. *Etawah goat (Jamnapari)*

Originated from Jamnapari area, India

Characteristics:

- curved nose
- males and females are horned
- long ears (30 cm), drooping
- long legs with long hair on the back legs
- spotted colored coat with black, white or red or brown and white
- good milk producer (up to 3 liters/day/animal under good conditions)
- large and long teats (shaped like bottles)
- adult body height for males ranges from 80 - 100 cm, for females 70 - 90 cm
- adult body weight for males ranges from 40 - 70 kg, for females 30 - 50 kg

#### 3. *Etawah crossbreds*

Crossbreds between Kacang and Etawah goats from many years ago. This breed is well adapted to Indonesian conditions. Body shape is between Etawah and Kacang goat

Characteristics:

- ear length ranging between 18-30 cm
- adult body weight  $\pm$  40 kg for males and  $\pm$  35 kg for females
- shoulder height between 76-100 cm
- for males, the fur around the neck and shoulders is thicker and slightly longer
- for females, long fur only on thigh areas
- coat color varies from light brown to black

#### 4. *Marica goat*

Largely found in Sulawesi

Characteristics:

- body smaller than kacang goat
- possibly related to kacang goat

#### 5. *Gembrong goat*

Largely found in Bali

Characteristics:

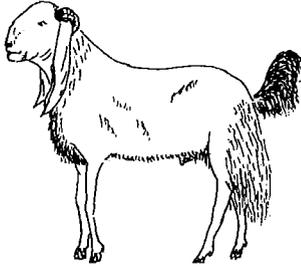
- larger body than kacang goat
- rather long hair, especially on males

1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA (continued)

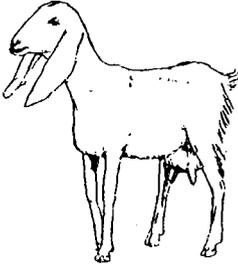
GOATS



1. Kacang Goat

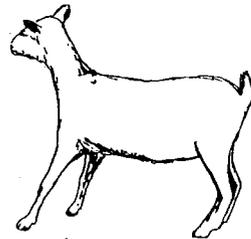


2. Etawah Goat



4. Marica Goat

3. Etawah Crossbred Goat



5. Gembrong Goat



## 1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA (continued)

### 6. *Saanen goat*

Originated from Saanen valley, Switzerland

Characteristics:

- males and females are hornless
- coat color white or light cream, with black spots on the nose, ears and teats
- wide forehead, medium and erect ears
- dairy type

### 7. *Alpine goat*

Characteristics:

- some with horns some without
- the same size and height as Saanen goat
- coat color varies from white to black
- white line above the nose
- dairy type

### 8. *Anglo-Nubian goat*

Characteristics:

- short hair
- long legged and well adapted to hot weather
- prolific animals
- some with horns and some without
- dual purpose, meat and milk
- yearling body weight for males  $\pm$  24.6 kg, for females  $\pm$  18.2 kg

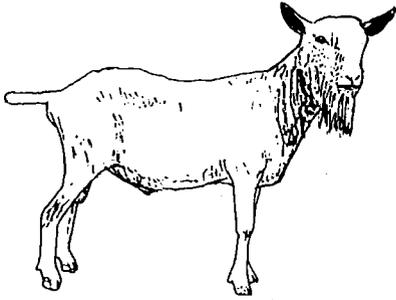
### 9. *Boer goat*

Originated from Hottentot, the semi arid country of Cape Peninsula

- short to medium hair
- horns are prominent
- coat color pattern of brown head and neck, with white body and legs
- broad ears and drooping
- markedly convex noses
- meat type
- mature body weight for females ranges from 60-75 kg

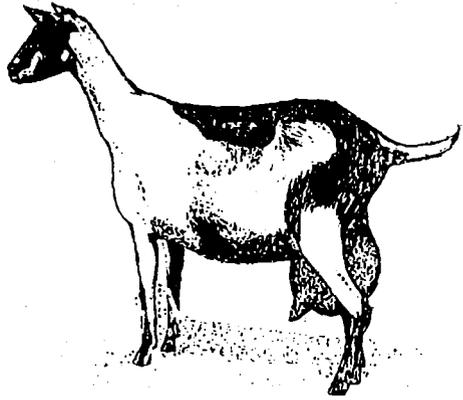
1. SHEEP AND GOAT BREEDS FOUND IN SOUTHEAST ASIA (continued)

GOATS

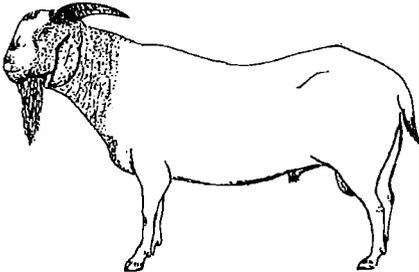
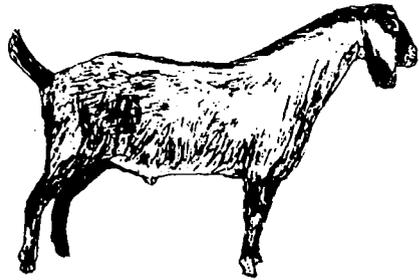


6. Saanen Goat

7. Alpine Goat



8. (Anglo) Nubian Goat



9. Boer Goat

## **2. SHEEP - GOAT BREEDING STOCK**

### **Characteristics for male breeding stock**

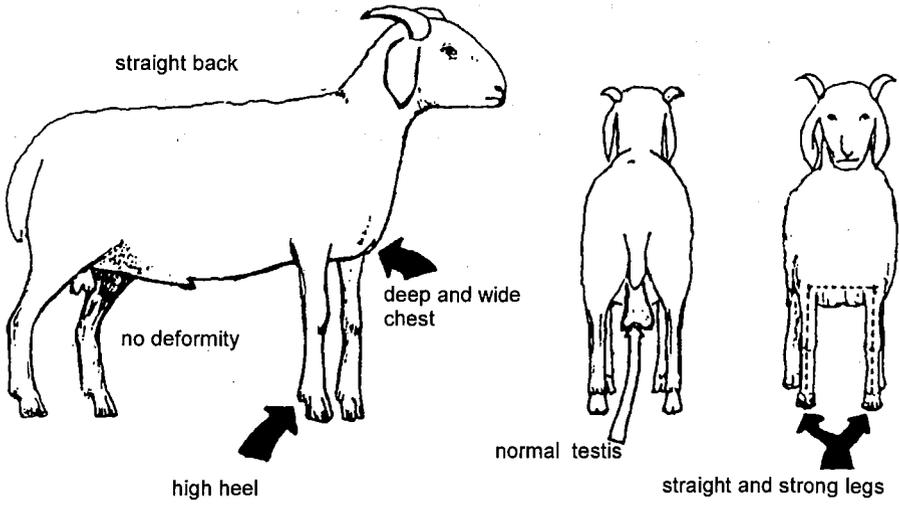
- healthy with large, relatively long body and no deformities
- deep and wide chest
- straight and strong legs
- high heels
- good appearance
- active and with high libido
- normal testicles (two of similar size)
- penis firm and can produce an erection
- preferably coming from twins
- clean and shiny, healthy looking coat
- no permanent teeth, indicating young animal
- should not be closely related to females in the flock
- had high growth rate when young

### **Characteristics for female breeding stock**

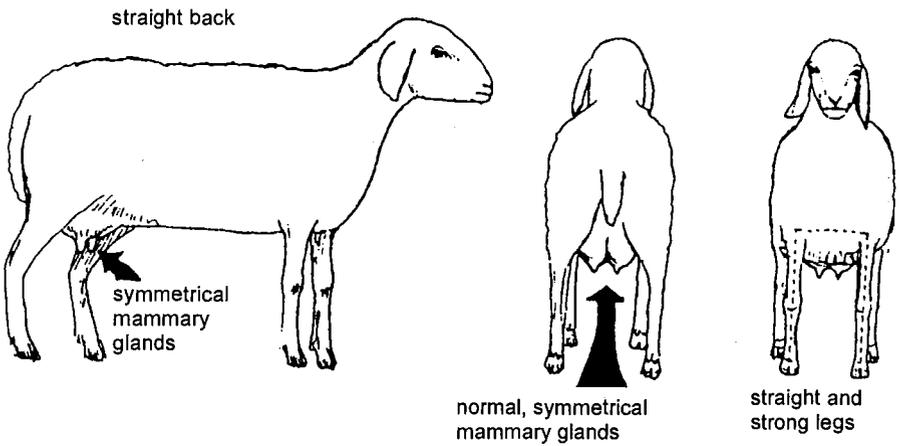
- healthy, not too fat with no deformities
- straight and strong legs
- normal genitals
- good mothering ability
- normal teats (smooth, firm, no infection or swelling)
- preferably from twins
- clean and shiny, healthy looking coat
- no permanent teeth, indicating young animal

## 2. SHEEP - GOAT BREEDING STOCK

### 1. Male breeding stock



### 2. Female breeding stock



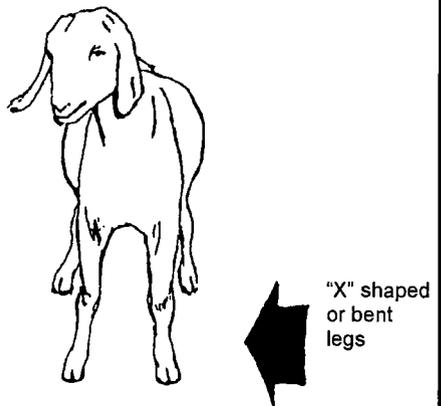
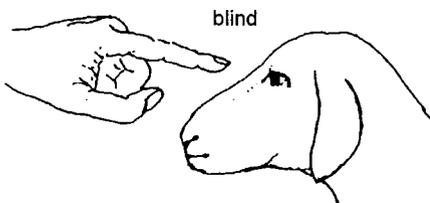
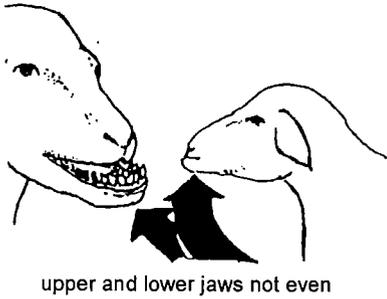
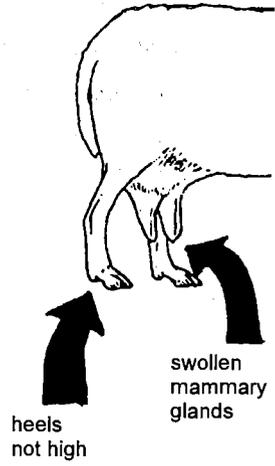
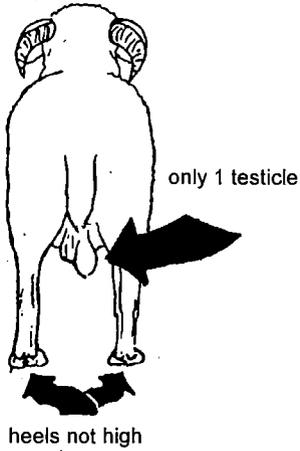
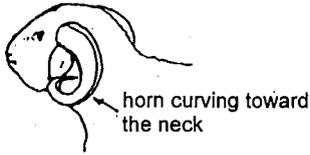
### 3. BODY DEFORMITIES

When you choose sheep/goats, avoid those with body deformities such as:

- uneven upper and lower jaws
- horns curving toward the neck
- only one testicle, or two but which are very different in size
- sign of infections, swelling in teats
- legs shaped like an X
- blind, (check by pointing an index finger in front of the eyes, if there is no response such as blinking, then the animal is blind. Do not wave your hand to check for blindness. A blind animal may blink in response to the air movement.)
- sterile

### 3. BODY DEFORMITIES

1. Male    2. Female



#### 4. PREDICTING THE AGE OF SHEEP - GOATS

Predicting the age is based on the number of permanent incisors.

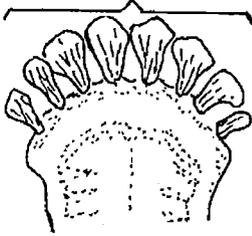
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Permanent incisors	Approximate age
1. None (only temporary teeth)	less than 1 year (1yr 3 mnths)
2. A pair of incisors (2 teeth)	1-2 years (1 yr 3 mnths - 1 yr 10 mnths)
3. Two pairs of incisors (4 teeth)	2-3 years (1 yr 10 mnths - 2 yrs 4 mnths)
4. Three pairs of incisors (6 teeth)	3-4 years (2yrs 4 mnths - 3 yrs 5 mnths)
5. Four pairs of incisors (8 teeth)	4-5 years (3 yrs +)
6. Permanent incisors starting to wear out or to fall out	5 years or more

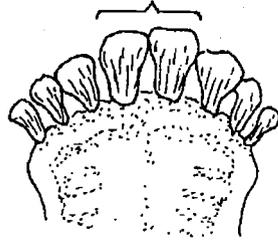
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#### 4. PREDICTING THE AGE OF SHEEP - GOATS

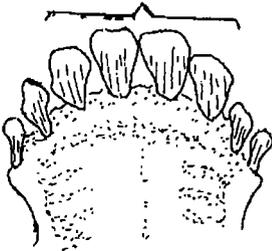
temporary incisors  
less than 1 year



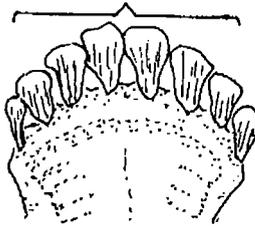
1 permanent pair  
1 - 2 years



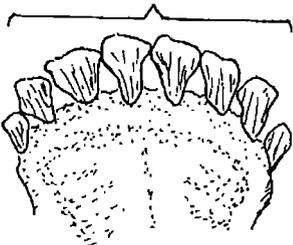
2 pairs of permanent incisors  
2 - 3 years



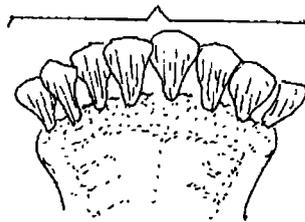
3 pairs of permanent incisors  
3 - 4 years



4 pairs of permanent incisors  
4 - 5 years



Permanent incisors starting to wear away  
5 years or more



## 5. PUBERTY - HEAT

- Puberty is the physiological stage in life when the female animal begins its estrus cycles. In this condition a female has the potential to produce offspring.
- Sheep/goats reach puberty at 6-8 months of age.
- Animals will begin mating at puberty and males and females should be separated to avoid unwanted matings and inbreeding. Females can be mated at nine months of age or around 18 kg body weight.
- Mating can only be successful if the female is in heat.
- The signs of heat are:
  1. The outer part of the genitals is swollen, wet, red and warm
  2. Wagging of the tail
  3. Remains quiet when mounted by a male or other animals
  4. Restless (noisy) at other times and reduced appetite
- A female will be in heat approximately every  $17 \pm 2$  days for sheep and every  $21 \pm 2$  days for goats.

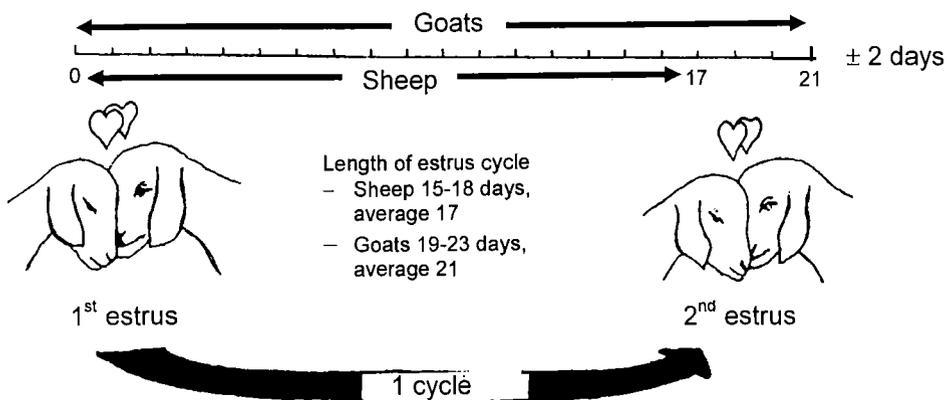
## 5. PUBERTY - HEAT



### Signs of estrus

- sex organ swelling reddish and damp
- restless and noisy
- wagging tail
- mounting another animal stationary when mounted

### ESTRUS CYCLE

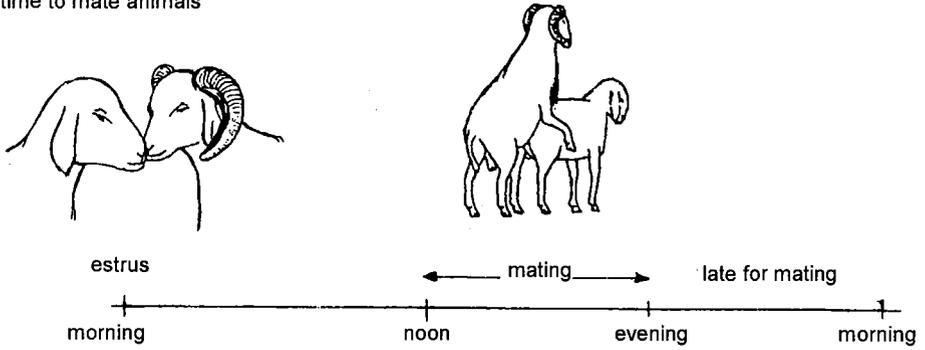


## 6. MATING

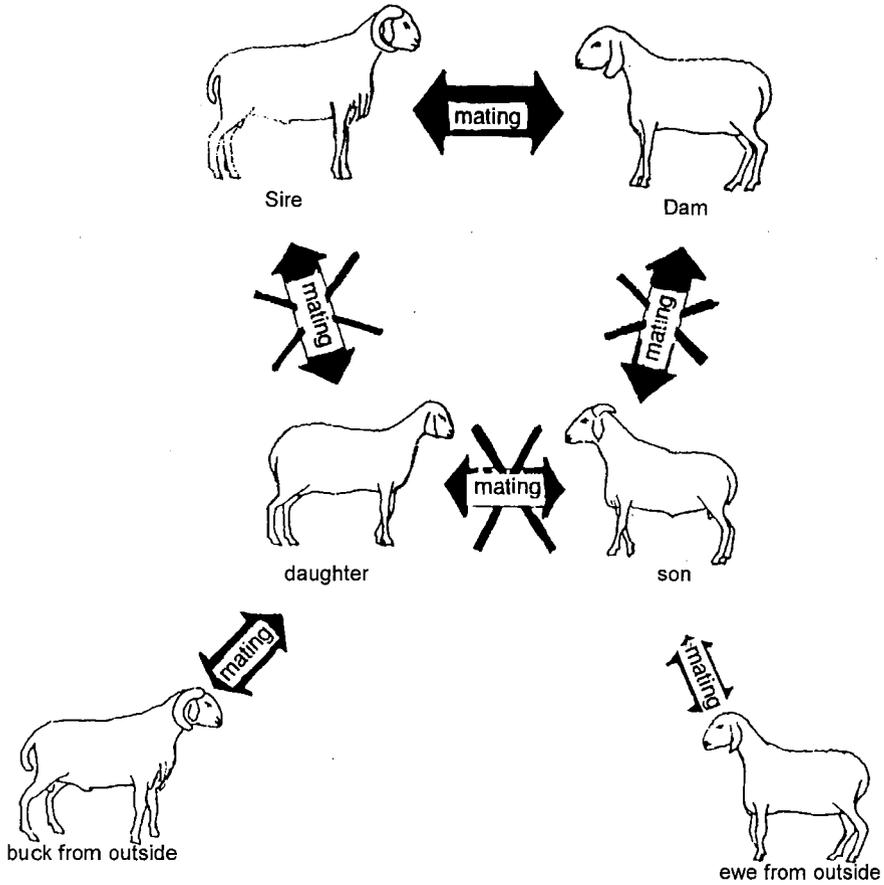
- The best time for mating sheep/goats is 12-18 hours after the first appearance of the signs of heat.
- To avoid unsuccessful matings, the animals (male and female) should be put in a small pen together. In grazing systems, the animals may mate while grazing and no pens are necessary. Males should never be left in pens with females who have offspring as the lambs/kids may become injured if the male is chasing a female who is unwilling to mate.
- Mating is unsuccessful (no pregnancy) if the female returns to estrus (after 17 days for sheep, or 21 days for goats).
- Do not mate animals that are closely related (father and daughter, mother and son, brothers and sisters), because it may result in lambs/kids with birth defects (small, unhealthy and deformed). Mating closely related animals is called *inbreeding* and must be avoided.
- Rotate the male breeders or borrow (or exchange) an unrelated male from another farmer every 12 months.
- Cull females after two unsuccessful matings with fertile males.
- Females will come into heat again beginning about 35 - 45 days after lambing/kidding and mating may begin if they are in good condition. Females in poor condition, such as those nursing twins or triplets, may take longer to be rebred and it may be best to wait until weaning to rebreed. Females with single offspring can be mated successfully before the lamb/kid is weaned.

## 6. MATING

- time to mate animals



- avoid mating animals closely related



## **7. PREGNANCY**

### **Pregnancy is shown by:**

1. No signs of heat after 17 or 21 days and no other estrus cycles.
2. Enlarged abdomen.
3. Udder and teats are larger near the end of pregnancy.

### **Prepare a separate pen for pregnant ewes/does by using partitions so that:**

1. They are not disturbed by the males or other animals.
2. Their feed is not disturbed by other animals.
3. They are calmer.

### **To maintain the health of the ewe/doe and to promote its pregnancy, it is necessary:**

1. To keep the barn clean including the floor and area under the barn.
2. To maintain the pen in good order so that the animals do not become caught between broken floor slats.

### **A pregnant female should gain weight (5 kg or more) during her pregnancy. For this to occur offer good quality feed. An important period is 2 months prior to and 3 months after lambing. Feed pregnant ewes:**

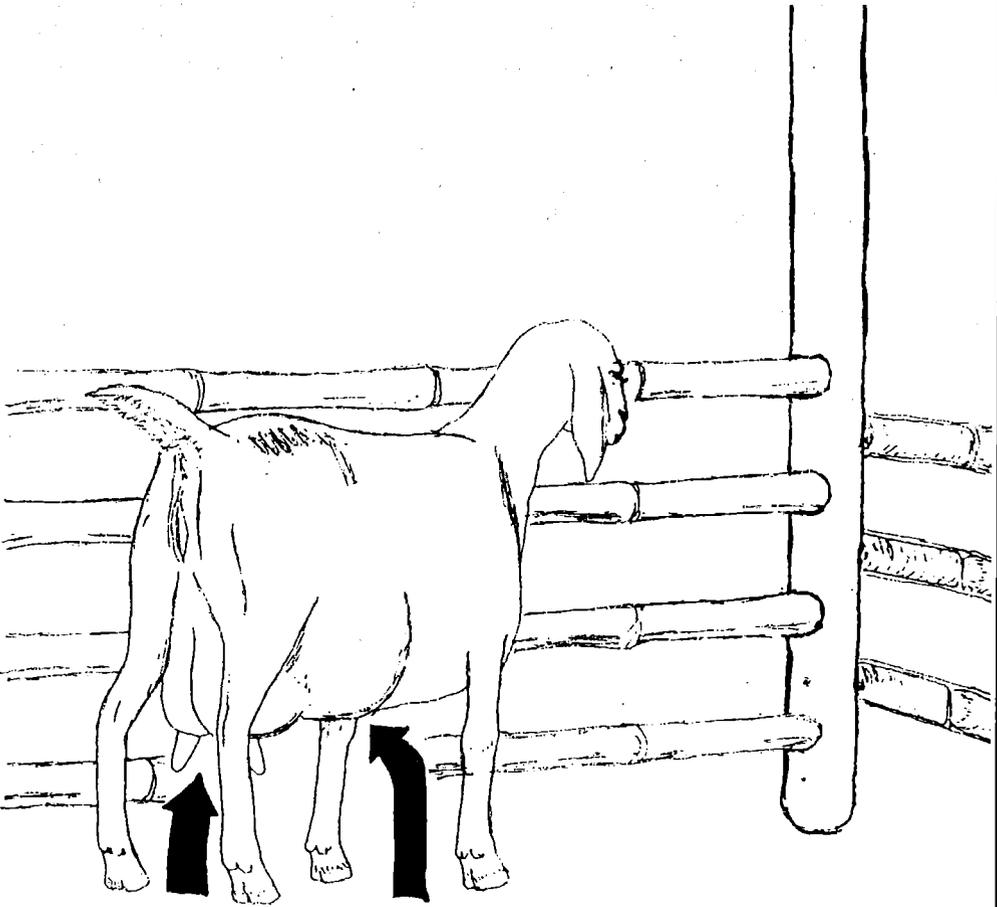
1. Grasses.
2. Legume forages (gliricidia, sesbania, leucaena, calliandra or other legume leaves).
3. Extra feed, rice bran or soybean waste products (such as that from tofu manufacture).
4. Plenty of clean water.

### **Gestation period (time to birth) is about 150 days or 5 months in both sheep and goats.**

## 7. PREGNANCY

Pregnancy can be detected by:

- no sign of estrus after 17 or 21 days
- enlarged abdomen
- mammary glands and teats are larger
- the animal does not get remated



larger mammary  
glands

enlarged  
abdomen

## **8. PREPARATION FOR LAMBING**

### **The signs prior to lambing:**

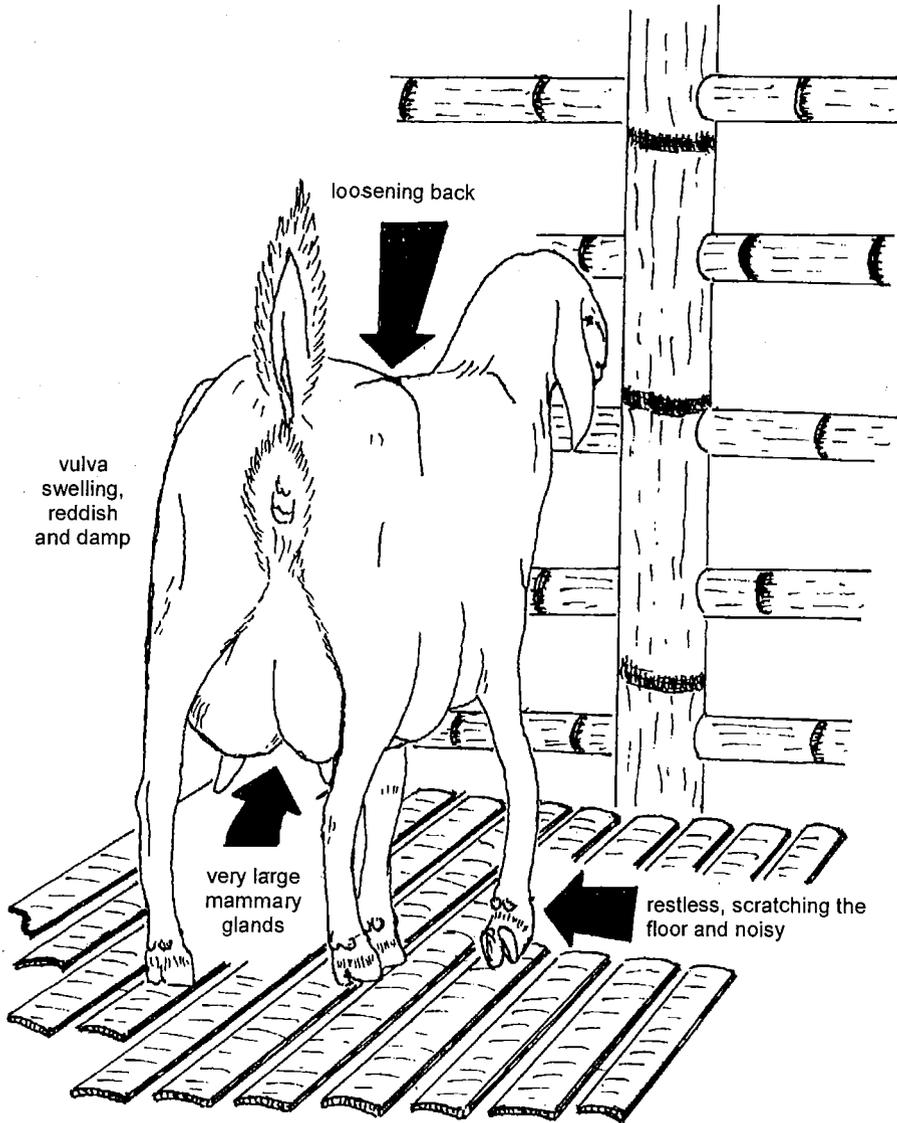
1. Relaxing of the hip muscles.
2. Mammary glands are very large and teats are firm.
3. The vulva is swollen, reddish and wet.
4. Restlessness, scratching the floor and making noise.
5. Declining appetite.
6. Sometimes the above signs may not be noticeable and the first sign of lambing is when the female begins to give birth.

### **Preparation for lambing:**

1. Clean the pens.
2. Prepare dry and clean bedding to absorb any liquid coming out during the birth process (dry straw or jute bag). Alternatively, the female can give birth on a slatted floor (spacing no wider than 1.3 cm) which should be cleaned afterward.
3. Prepare a 7% iodine solution for dressing the umbilical cord.
4. Prepare a place for the ewe and lamb after it is born. This place should have a narrow slatted floor (1.3 cm spacing) or a jute bag so that the lamb can stand without its legs falling through the slats.

## 8. PREPARATION FOR LAMBING

Signs prior to lambing



## **9. BIRTH POSITIONS OF LAMBING**

### **Normal lambing:**

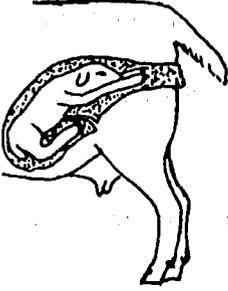
1. Anterior position
2. Posterior position
3. Normal twin lambing

### **Abnormal lambing:**

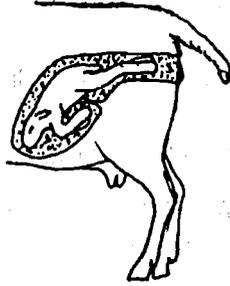
4. One of the front legs is backward
  5. The head is twisted backward
  6. Curling
  7. Upside-down position
  8. Abnormal twin lambing
- The position of the lamb, especially abnormal presentations, may cause difficulties in lambing. It is necessary to keep guard (watch from a distance) when a ewe is showing signs of lambing.
  - When the ewe shows any signs of difficulties, immediately provide any help following the proper procedures.

# 9. BIRTH POSITIONS OF LAMBING

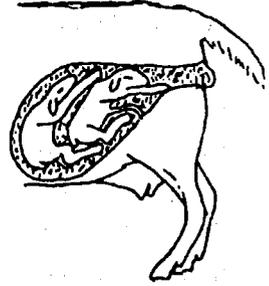
## Normal position



1. anterior position

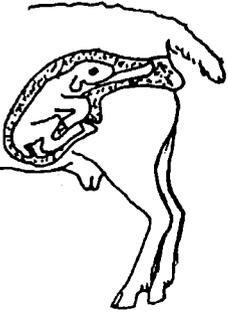


2. posterior position

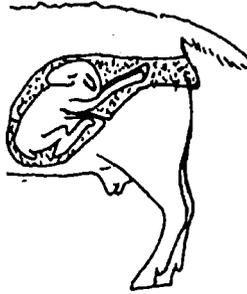


3. normal twins

## Abnormal position



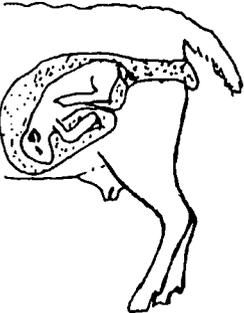
4. one of forelegs backward



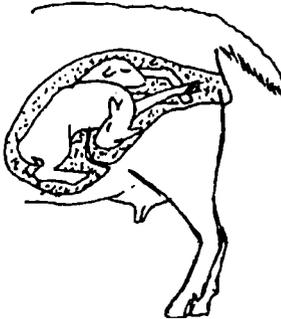
5. head twisted backward



6. curling



7. abnormal posterior position

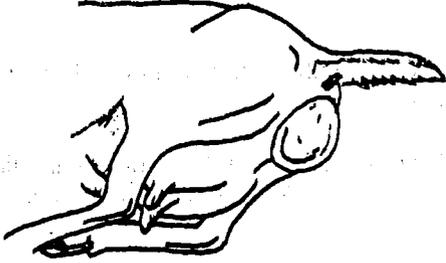


8. Abnormal twins

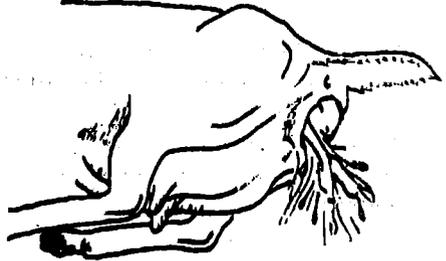
## 10. LAMBING PROCESS

- Amniotic sac (water bag) breaks.
- When the lamb begins to come out, the ewe will start to push with its abdominal muscles. The lamb is usually delivered within 1 to 1.5 hours. If not, the animal needs help with the birthing process.
- The placenta mixed with mucus and blood will usually come out within 4-12 hours after the animal is born.
- Dip the umbilical cord in a 7% iodine solution.
- Let the ewe lick the lamb dry. If the ewe does not want to lick, clean any fluid from the lamb's body by using a clean, dry cloth.
- If necessary, clean the nose and mouth of the newborn lamb to make it easier to breathe.
- Lambs should not be handled too much until after the ewe has accepted the lamb.

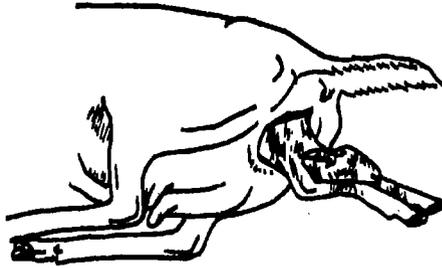
10. LAMBING PROCESS



amniotic sac is coming out

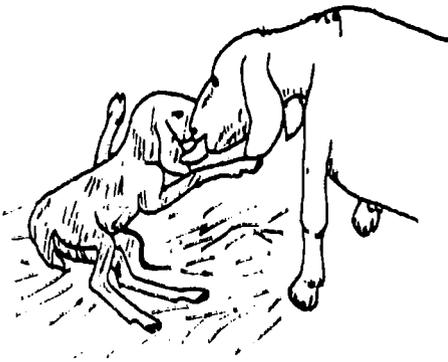


amniotic sac is broken

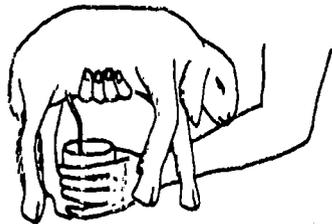


the lamb is coming out

let the ewe lick the lamb dry



dip the cut from placenta into iodine solution

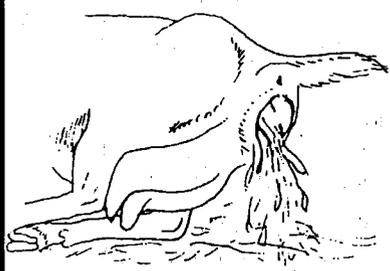
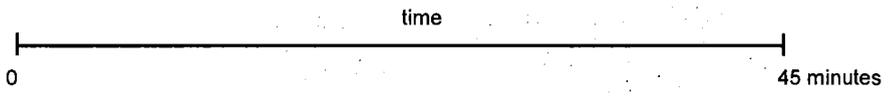


## **11. DIFFICULTIES IN LAMBING**

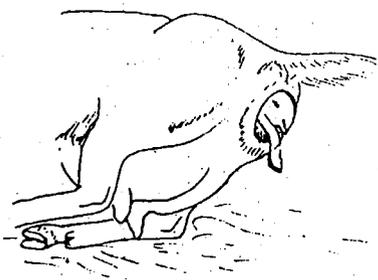
### **Difficulties may occur when:**

1. The lamb is not in a normal position.
  2. The ewe has narrow hips.
  3. The lamb is too big.
  4. The lamb/kid has died inside the pregnant animal (stillborn lamb).
  5. The ewe is in a weak or unhealthy condition.
- Difficulties in lambing can be anticipated when the lamb is not out after 45 minutes or an hour after the amniotic sac breaks.
  - Therefore, better care is required, especially for animals lambing for the first time, such as providing them with enough feed, water, exercise and peaceful surroundings.

# 11. DIFFICULTIES IN LAMBING

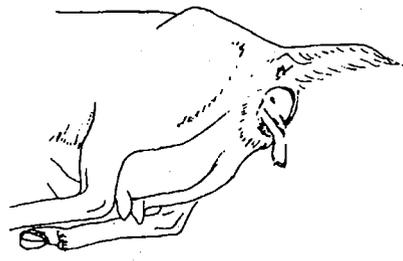


amniotic sac is broken



after 45 minutes  
the lamb is still not out

after 1 hour



the lamb is still not out

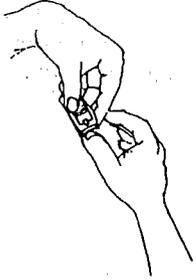
## **12. AIDS FOR LAMBING DIFFICULTIES**

**If all is going well DO NOT INTERFERE, the ewe will do it all by herself. If problems are noticed the following procedures can guide you.**

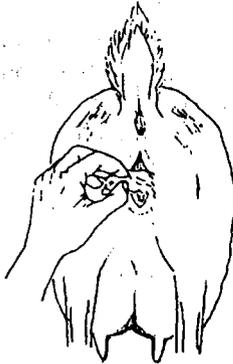
### **Procedures in helping the lambing process:**

- Lie the sheep down, gently, on her right side. An assistant should restrain her by holding her neck down.
- Clean the vulva and the surrounding area with soap.
- Wash your hands and lubricate them with soft soap.
- Insert your hand slowly into the vulva in a partially closed position.
- Feel and locate each part of the lamb's body such as the legs, and head and determine whether it is a single or twins.
- For the anterior position (front feet first) you should feel the head and the forelegs. If one of the legs is missing, insert your hand further to find it. Then, slowly pull the leg into the correct position and pull both legs gently to retrieve the lamb.
- For the posterior position (back feet first) both hind legs must be parallel. To make sure that they are hind legs, the hooves should point downward and the back should point upward. If the hooves point upward then the legs must be forelegs.
- If a part of the body is not in normal position, try to correct it slowly and pull gently to retrieve the lamb.
- To help the newborn's breathing, clean the mucus from the nose by using a piece of straw inside the nostril or grab the hind legs and swing the body carefully.
- Let the ewe lick the lamb dry.

## 12. AIDS FOR LAMBING DIFFICULTIES



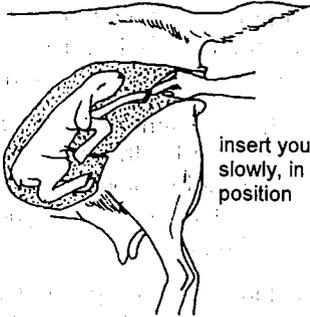
trim your nails



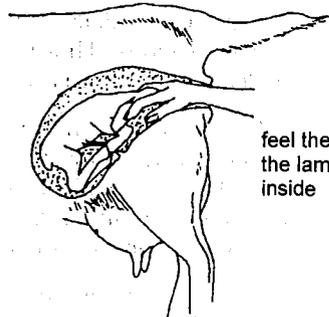
wash hands and the vulva  
with soap



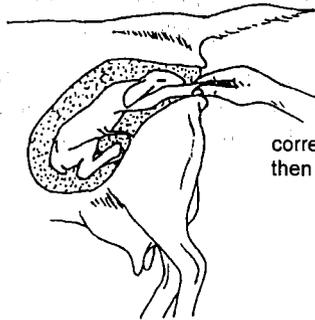
lather with soap as  
lubricant



insert your hand  
slowly, in a closing  
position



feel the part of  
the lamb's body  
inside



correct any wrong position carefully,  
then pull the lamb slowly

### 13. CARE FOR NEWBORN LAMB/KID

- The lamb should stand within 1 hour and suckle soon afterwards. If a lamb is very weak and is not making the effort to stand, help it to suckle by holding it to the ewe's teat. If it cannot suck, remove some milk from the teat, put the milk in a syringe and feed it to the lamb using a plastic tube.
- A newborn lamb which does not suckle within 4 hours because of the death of its mother should be given colostrum from another source as soon as possible. Continue to give colostrum for the first few days. A source of colostrum could be another sheep or goat giving birth at the same time or from a neighbor's animal.

#### **Preparing milk replacement:**

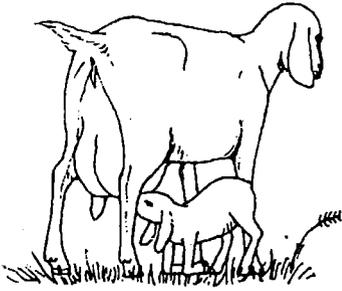
Mix thoroughly the following ingredients:

- 0.25-0.5 liters of cow's milk or powdered milk
- 1 teaspoon fish oil
- 1 chicken egg
- 1/2 tablespoon sugar

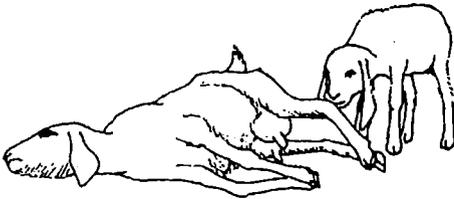
Forcefeed the lamb using a bottle, or with difficult cases a syringe with no needle on it, 3-4 times a day. If after 2 days the lamb has not defecated, give 1 teaspoon of mineral oil. A lamb will soon learn to drink the replacer from a baby bottle.

- A lamb without a mother can also be fostered to another suckling ewe. This procedure will present difficulties because the intended new mother will not want to accept a new lamb. There are several methods that can be used to foster lambs. In all cases the ewe and lambs should be placed together in a small pen.
  - \* Ewes identify their young by smell and the best time to foster a lamb onto a new mother is when the ewe is giving birth. After the ewe's natural lamb is born take the orphaned lamb and rub it against the new lamb and in the fluids expelled during birth or in the afterbirth. This will mask the odor of the orphaned lamb and trick the ewe into accepting it.
  - \* If a ewe's lamb dies at birth it may be skinned and the pelt put on the body of the orphaned lamb. The orphaned lamb's head and tail should be smeared with any of the dead lamb's body fluids available.
  - \* It may be necessary to tie the ewe's head so she cannot see the orphaned lamb and allow the new lamb to nurse. Eventually, the ewe will accept the new lamb. This process may take up to four days.

### 13. CARE FOR NEWBORN LAMB/KID



soon after birth, the lamb should suckle the ewe



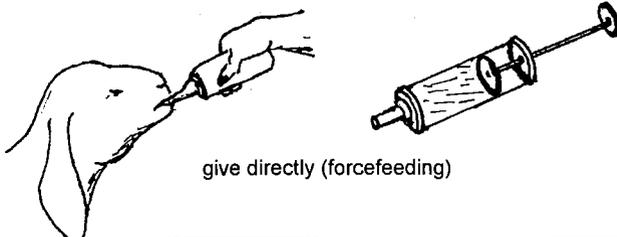
A lamb which does not suckle within 4 hours, due to ewe's death, should be given milk replacement from day 1

preparing milk replacement  
½ liter of cows, does or powdered milk

1 teaspoon of fish oil

1 chicken egg

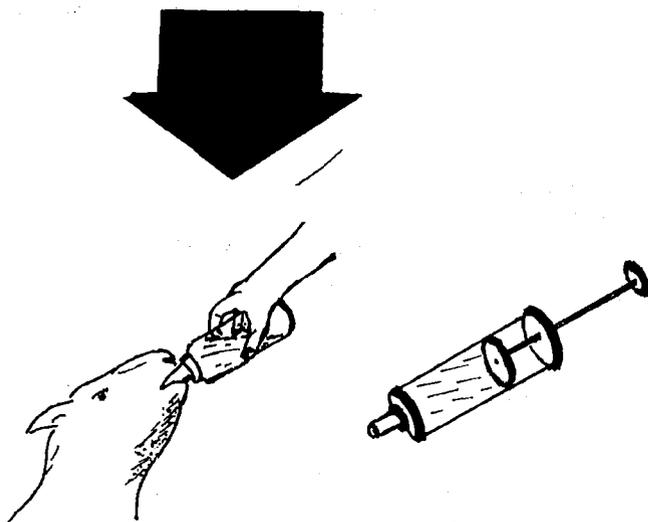
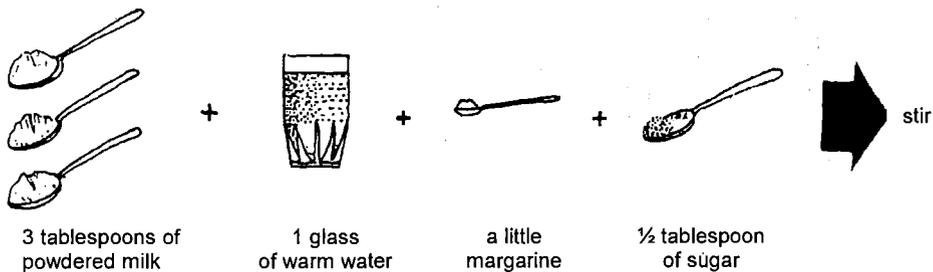
½ tablespoon of sugar



give directly (forcefeeding)

### 13. CARE FOR NEWBORN LAMB/KID

Give the milk twice daily and every week  
add 1 tablespoon of powdered milk for  
each feeding and also "rice milk"



Milk replacement feeding is given until 3 months of age.  
If powdered milk is not affordable, rice milk can be used  
instead. Starting from a month old, rice bran can be  
offered gradually

#### 14. PREWEANING CARE FOR LAMBS

- Suckling competition occurs in ewes with 3 or more lambs. The weaker lambs should be helped with milk replacement, orphaned lambs may require milk replacer also.
- Make a simple partition which the lambs, but not the ewe, can enter. In this way the lambs can avoid being stepped on by the ewe.
- Offer rice bran, soybean waste and other high quality, highly digestible feedstuffs to the lambs in the partition area starting at about 1 month of age. This will help train them to eat solid foods and increase their growth.
- Ewes with triplets should be given all the good quality forage and supplements they want to eat. This will help them to make more milk for their young.
- Lambs can be susceptible to diseases, such as diarrhea, which can lead to death. To decrease lamb mortality the lambs must be well fed and managed. The barn must be clean and free of manure. For more information see **16. Diarrhea** in the **HEALTH AND DISEASE TREATMENT AND PREVENTION** section.

## 15. INCREASING THE PRODUCTIVITY OF SHEEP AND GOATS

Production from animals kept for meat is determined by number of young produced per breeding ewe/doe per year, and the weight of those animals at weaning or at marketing.

### **Production is influenced by:**

**Genetics-** the characteristics the animal receives from its parents. This gives the animal potential to be big or small, give good milk, have lots of lambs, etc.

**Environmental factors-** how much it is fed, how good the feed is, diseases, management

*To improve production*, the farmer must improve both the genetics of the animals, getting a better breed and selecting the best animals born for breeding stock, and the environment, especially feeding and management to reduce disease.

Usually, production can be increased most rapidly by increasing the number of offspring weaned per breeding female per year.

## 16. INCREASING THE NUMBER OF LAMBS/KIDS WEANED PER YEAR

An indicator of how well a farmer is managing his breeding stock is the number of offspring weaned per year to a female. This is dependent upon lambing/kidding interval, litter size and survival rate as described below.

- **Lambing/kidding interval** is the number of days between each lambing or kidding. This can be as short as 200 days or longer than one year (365 days). It is used to calculate the number of lambings/kiddings per year.

$$\text{The number of lambings per year} = \frac{365 \text{ days in 1 year}}{\text{lambing interval}}$$

Examples:

1. If a doe kids every 230 days the number of kiddings per year =  $\frac{365}{230} = 1.58$  (1.6)

2. If a ewe lambs every 365 days the number of lambings per year =  $\frac{365}{365} = 1.0$

- **Litter size** is the number of lambs born per ewe per lambing. To determine the litter size, add up all the lambs born to a ewe and divide by the number of times she has lambed.

Examples:

1. If a ewe has lambed 2 times and had 1 lamb the first lambing and 2 lambs the next lambing, her average litter size is:  $\frac{1 \text{ lamb} + 2 \text{ lambs}}{2 \text{ lambings}} = \frac{3}{2} = 1.5$

2. If a doe has kidded 4 times and had 1 kid each time then her average litter size is:  $\frac{1+1+1+1}{4} = 1.0$

- **Survival rate** is the number of lambs/kids alive at weaning.

Example: A ewe has lambed 3 times having 2, 1 and 2 lambs for a total of 5. Of those lambs 4 survived to weaning.

$$\text{The survival rate is: } \frac{4 \text{ surviving lambs}}{5 \text{ total young}} \times 100\% = 80\%$$

**To increase the number of young weaned per female per year:**

1. Decrease the lambing/kidding interval. This can be done by good management of females after giving birth, feeding them good quality feed so that they are in good condition to be rebred.
2. Increase the average litter size. This can be done by selecting ewes or does that usually have twins. However, for females to regularly have twins there must be plenty of good forage and supplemental feed available. For some farms, it may be best to have one large lamb/kid rather than two smaller ones.
3. Increase survival rate. Survival is usually highest for single offspring and lowest for litters of three or more. Survival rate can be increased by: extra feed to the females before and after giving birth and good management such as keeping nursing females and young in a separate pen away from the other animals.

$$\text{Number of lambs weaned/ewe/year} = \text{litter size} \times \# \text{ lambings per year} \times \text{survival rate}$$

$$\text{Number of kids weaned/doe/year} = \text{litter size} \times \# \text{ kiddings per year} \times \text{survival rate}$$

## 16. INCREASING THE NUMBER OF LAMBS/KIDS WEANED PER YEAR

**Number of lambs weaned/ewe/year = litter size × # lambings per year × survival rate**

Examples:

Ewe No.	Average litter size		No. of lambings/year		Survival rate		No. of lambs weaned/year
1	2.0 only twins	×	1.0	×	0.8	=	1.6
2	1.5 singles and twins	×	1.8	×	0.85	=	2.3
3	1.0 only singles	×	1.8	×	0.90	=	1.6

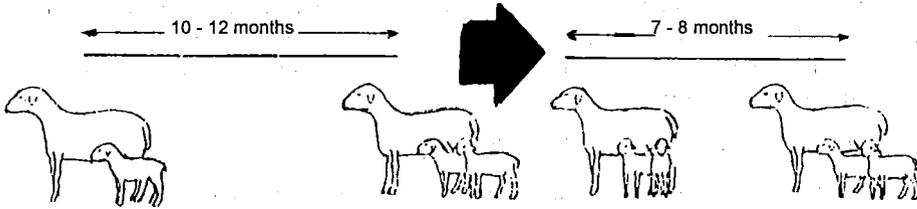
Decreasing lambing interval to increase the # of lambings per year is a good way to increase the number of lambs weaned per ewe per year.

- ⇒ Ewe 1 only lambs twins once each year with a survival rate of 80% giving 1.6 lambs weaned per year.
- ⇒ Ewe 2 usually has a mixture of singles and twins to have a litter size of 1.5. Ewe 2 lambs 1.8 times per year and due to good management has a survival rate of 85% giving 2.3 lambs weaned per year.
- ⇒ Ewe 3 has only singles but lambs 1.8 times per year and because her singles are large and strong has a survival rate of 90% giving her the same number of lambs weaned per year as Ewe 1.

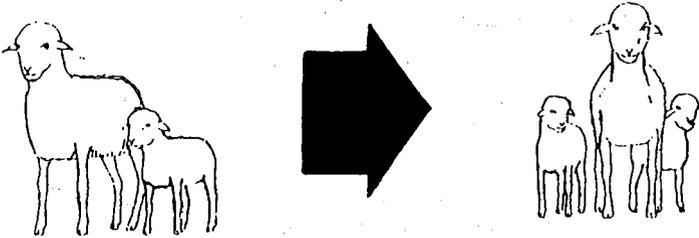
**Decreasing lambing interval and increasing survival rate are most important. This is done through better management and care of the ewes and lambs.** To have short lambing intervals the ewe must be mated with a fertile ram starting 35 - 40 days after lambing.

## 16.. INCREASING THE NUMBER OF LAMBS/KIDS WEANED PER YEAR

- reduce the lambing interval

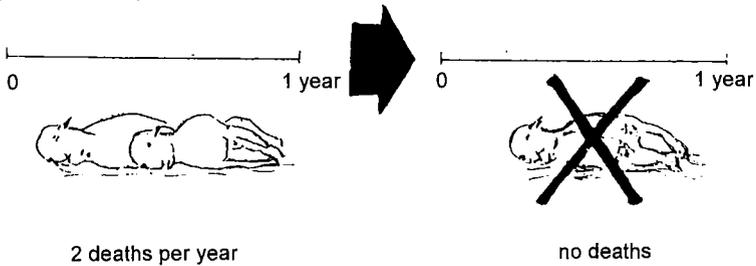


- increase the litter size



- through :
- select a ewe from twins and mate to a buck also from twins
  - give extra feed for two weeks before mating

- reducing lamb mortality rate



## 17. PRODUCTION RECORD CARDS

The success in supplying sheep and goat breeding stock is determined by the accuracy and consistency in recording the production data such as body weight, date of mating, date of birth, type of birth (single or multiple births), etc. This record keeping can be simplified in the form of a production record book for lambs/kids and ewes/does.

The book is useful not only in selecting animals but also in planning when the next mating or lambing period is for each ewe/doe because the information is always recorded. This book can help in shortening the lambing/kidding interval and in improving management procedures.

Use the information in production books to:

- ⇒ plan matings and rebreeding after lambing to shorten lambing interval
- ⇒ prevent inbreeding by knowing when to change rams/bucks
- ⇒ rate breeding females by calculating productivity using weight of young weaned per female per year. This is an indicator of mothering ability and milk production.
- ⇒ select offspring of the highest rated females as replacement stock
- ⇒ select animals to sell and plan a marketing timetable
- ⇒ calculate growth rate of young (grams per day)
- ⇒ set goals for improving management. For example, lowering lamb mortality or increasing growth rate.

When selling breeding stock to other farmers use the above information, such as ewe productivity or growth rate, to increase the value of your animals.

## 17. PRODUCTION RECORD CARDS (continued)

### Lamb/Kid Record

Each animal in a flock should be recorded in a record book similar to this example. Lambs should be numbered consecutively according to birth date.

Lamb No.	Birth date	Dam No.	Sire No.	Sex M,F	Birth wt.	Weaning		6 mo.		Date sold/ slaughtered	Remarks
						Date	Wt.	Date	wt.		
7001	14/1/97	3021	4001	F	1.9	20/4/97	14.0				
7002	3/2/97	4033	4001	M	1.3	6/5/97	14.7				
7003	3/2/97	4033	4001	F	1.2	6/5/97	10.2				



## 17. PRODUCTION RECORD CARDS (continued)

### Ewe/Doe Index

Records such as the lamb/kid record and the annual ewe/doe record are needed to determine which animals to sell and which animals to keep in the breeding flock. Do this using a ewe/doe index calculating kg offspring weaned per year since first lambing/kidding.

Production since 1st lambing per month = total kg lambs weaned/(age now in months - age at 1st lambing in months)

Production since 1st lambing per year = (total kg lambs weaned/(age now in months - age at 1st lambing)) × 12

Example: for ewe #2010 below production since 1st lambing per month =  $92/(54-15) = 92/39 = 2.36$  kg lamb weaned per month since 1st lambing

For production since 1st lambing per year multiply by 12 =  $2.36 \times 12 = 28.3$  kg lamb weaned per year since 1st lambing.

Ewe No.	Age at 1st lambing, months	Age now, months	No. lambings	No. lambs born	No. lambs weaned	Total weaning weight, kg	Production since 1st lambing, kg		Remarks
							month	year	
1049	18	62	5	1,2,2,3,2 (10)	1,1,2,1,1 (6)	61	1.39	16.6	
2010	15	54	6	1,2,2,1,2,1 (9)	1,2,2,1,2,1 (9)	92	2.36	28.3	keep lambs for breeding
3021	17	41	3	2,1,2 (5)	1,1,2 (4)	39	1.62	19.5	
4033	20	30	2	1,3 (4)	1,1 (2)	24	2.10	25.2	

Using this calculation, rate ewes in the flock for decisions on which ewes to sell, which ewes to keep and which lambs should be kept for breeding stock. Using this calculation when selling can also give greater value to high producing ewes and their offspring.

## 18. PRODUCTION CALENDAR FOR SHEEP AND GOATS

One of the technical aids in planning a breeding program is the "Production Calendar" containing information on:

- ⇒ mating date
- ⇒ approximate lambing date
- ⇒ approximate weaning date
- ⇒ approximate date for remating a ewe after lambing
- ⇒ approximate estrus cycle length
- ⇒ approximate first estrus for a young female
- ⇒ approximate first mating for a young female
- ⇒ approximate time for selling young males

By setting the date and month of mating in the calendar, a Breeding Table and Breeding Wheel can be used to obtain approximate dates for lambing, weaning, rebreeding and the dates for mating and selling the offspring.

For example, if mating is on the 1st of January, turn the inner circle until the mating arrow points to 1st January, if the mating is successful, the ewe is expected to lamb between May 22 and June 1. We can also determine the range for weaning and rebreeding for the ewe from the Breeding Wheel.

### Breeding Table

Pregnancy and Lambing					
Date of mating	Date of lambing (approximate)	Date of mating	Date of lambing (approximate)	Date of mating	Date of lambing (approximate)
Jan. 1	May 30	May 1	Sept. 27	Sept. 3	Jan. 30
6	June 4	6	Oct. 2	8	Feb. 4
11	9	11	7	13	9
16	14	16	12	18	14
21	19	21	17	23	19
26	24	26	22	28	24
31	29	31	27	Oct. 3	Mar. 1
Feb. 5	July 4	June 5	Nov. 1	8	6
10	9	10	6	13	11
15	14	15	11	18	16
20	19	20	16	23	21
25	24	25	21	28	26
Mar. 2	29	30	26	Nov. 2	31
7	Aug. 3	July 5	Dec. 1	7	April 5
12	8	10	6	12	10
17	13	15	11	17	15
22	18	20	16	22	20
27	23	25	21	27	25
April 1	28	30	26	Dec. 2	30
6	Sept. 2	Aug. 4	31	7	May 5
11	7	9	Jan. 5	12	10
16	12	14	10	17	15
21	17	19	15	22	20
26	22	24	20	27	25
		29	25	31	29

## 19. PRODUCTION CALENDAR FOR SHEEP/GOATS

To determine when a ewe will lamb if mated on September 4:

Bring the arrow for "ewe mating" (by turning the inner circle) to the number 4 in the month of September. Then the ewe is expected to lamb- (the arm for "lambing") on January 29 (January 24 to February 3, or approximately 5 months).

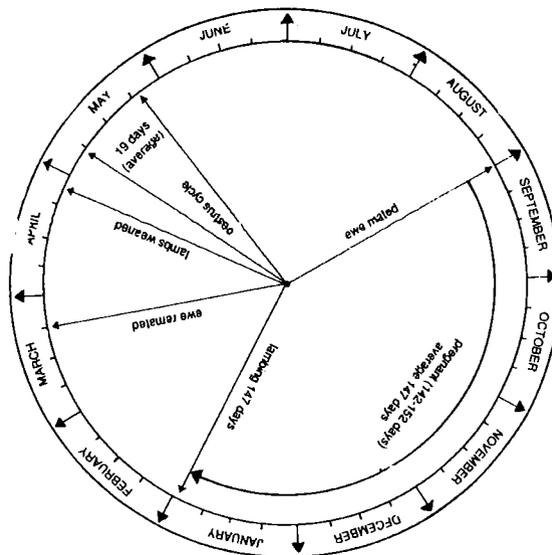
With this production calendar, we can plan the production of sheep/goats according to local conditions.

For example: In Nusa Tenggara Timur, Indonesia, mortality of kids born in the dry season is very high. If a farmer wants to have his goats kid after the dry season, December or January, the farmer should move the inner wheel until the arrow for lambing points to January. Then look at the arrow for mating and see when his doe should be mated (late August).

Another example: This can also be a marketing tool. Suppose the Islamic fasting season ends April 30, and a farmer wants to have 8 month old lambs to sell. He weans his lambs at three months old, meaning five months of growth. Count back from April five months to November, point the arrow for lambs weaned at the end of November. Look at the arrow for lambing (end of August) and for breeding (end of March). Thus, if a farmer wants to have 8 month old lambs to sell in April of 1998, he must mate his ewes in March of 1997.

### Breeding Wheel

To construct the Breeding Wheel, make a copy of the breeding wheel. On the copy, carefully cut along the inner circle. Using a small pin, make a hole in the middle of the cut out inner circle and the middle of the intact wheel. Attach the two circles in the middle with the cut out inner circle on top and able to spin. Then try the examples above.



## 19. IDENTIFICATION OF ANIMALS

Providing some means of identifying the animals can make it easier for the owner to identify and control them. The identification number should be recorded in the production record book.

### Methods of identification:

1. Giving names to the animals based on body markings.

Examples:

- an animal with spotted colors may be called Spot
- an animal with a large body may be called Stud, etc.

This method can be adopted only if the number of animals is small (less than 10 animals). When the number is larger, the proper method is by assigning numbers to each animal.

2. Assigning numbers to animals.

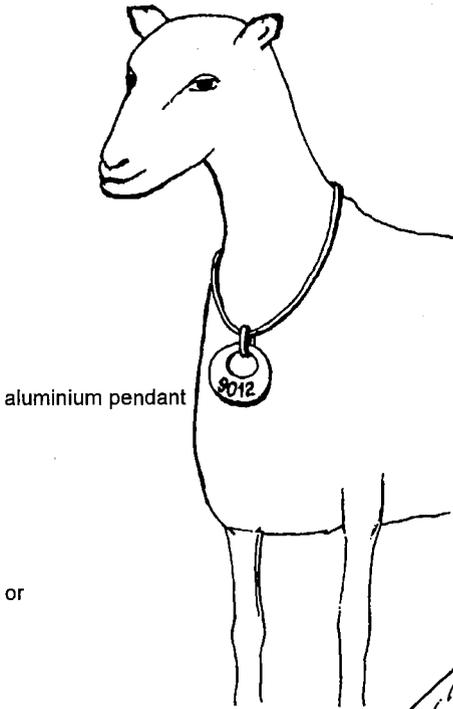
A number can be branded or tattooed on the ear, or by writing it on a piece of wood or an aluminum tag hung around the neck.

The number consists of 4 digits. The first shows the year the animal was born, and the next three digits show the order of when the animal was born in that year.

Examples:

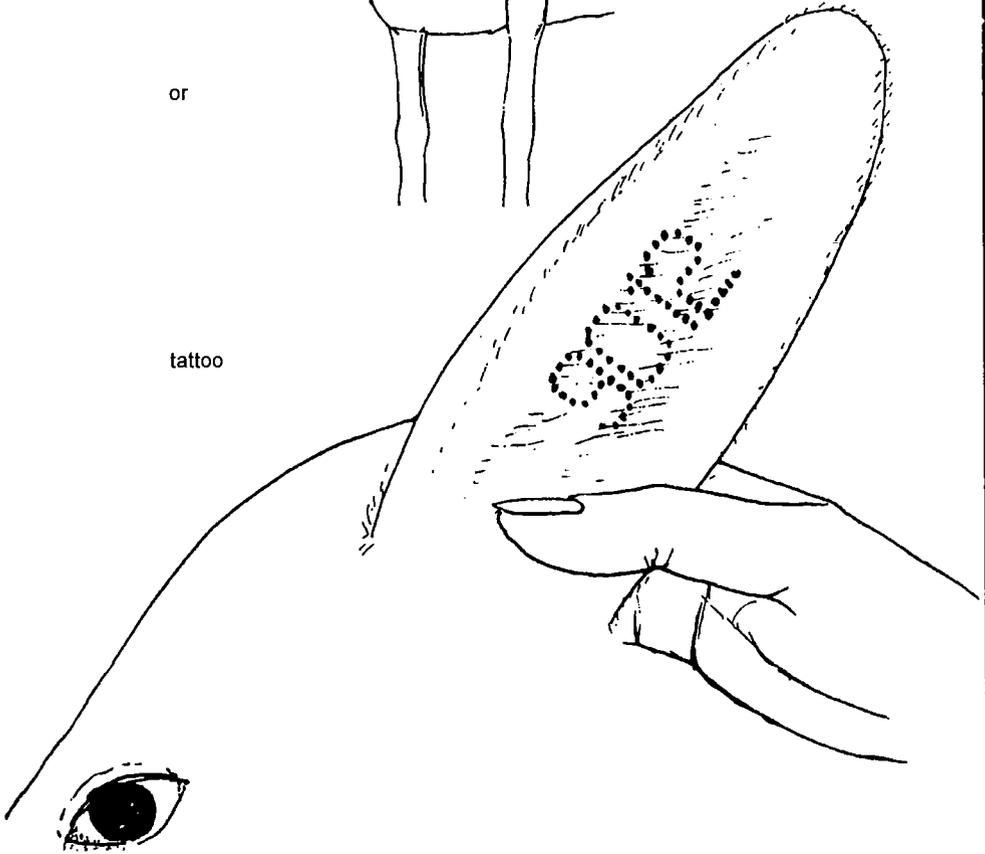
- No. 6012 - 6 means that the animal was born in 1996, 012 means that the animal was the twelfth animal born in 1996.
- No. 0007 - represents the seventh animal born in 1990.

19. IDENTIFICATION OF ANIMALS



or

tattoo





# **NUTRITION AND FEEDING STRATEGIES**

- 1. What to feed?**
- 2. Grasses**
- 3. Types or species of grass**
- 4. Legumes**
- 5. Tree legumes**
- 6. By-products**
- 7. Providing salt & minerals**
- 8. Water**
- 9. Housing considerations for feeding**
- 10. Feeding and how much to feed**
- 11. Supplements**
- 12. Where will tree legumes grow?**
- 13. Where do tree legumes fit into my farming system?**
- 14. How do I grow tree legumes?**
- 15. Considerations for coconut plantations**

## 1. WHAT TO FEED?

Animals, like people, need a variety of feeds to grow well. If a person eats only rice he will grow slowly. If an animal eats only grass, it will grow slowly also. There are other things to feed an animal to help it grow faster, produce healthier lambs/kids and more milk so its lambs grow better.

### What can be fed to a sheep or goat?

1. **Grass.** This is the main part of their diet. Animals obtain grass either by grazing or having it cut and fed to them. Grass provides the animal with energy and some protein and some minerals.
2. **Legumes.** Legumes are added to the diet to provide the animal with protein and minerals for growth and production of lambs/kids or milk. These can be gathered from forage lands or can be leaves from crops such as beans, peanuts or peas.
3. **Tree leaves.** Leaves of some trees can provide protein to the animal. These are easy to grow and can provide a long term source of good feed.
4. **By-products.** These are such things as rice bran, cassava meal, soybean meal, tofu by-product and many others and can provide energy and protein to the animal. These are generally inexpensive and very useful when a farmer wants his animals to grow faster.
5. **Household food wastes.** These are things such as sweet potato leaves and peels, dried cassava leaves and others that can also be fed and are useful to the animals.
6. **Grains.** Sheep and goats can also be fed grains such as sorghum and corn. animals fed these feeds will grow well. However, these are expensive and often are not affordable nor economic to use as animal feeds.
7. **Minerals.** Animals also need salt and minerals in their feed so they grow well. Ordinary salt, limestone and purchased mineral mixes can be fed in small amounts.
8. **Water.** Water is essential for animals just as it is in people. Some animals need more water than others, such as ewes or does giving milk.

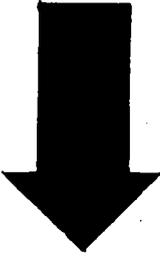
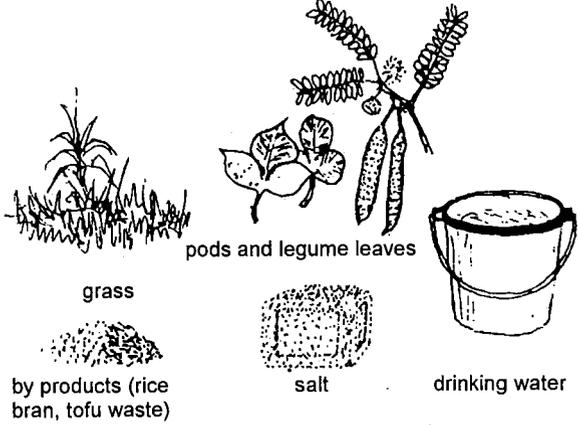
# 1. WHAT TO FEED?

a. Not sufficient

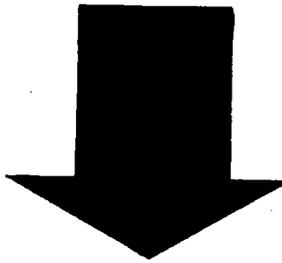


only grasses

b. Correct feeding



thin, small  
and weak



fat, big  
and healthy

## 2. GRASSES

Sheep and goats need more grass than any other feed. The two ways animals obtain grass is by grazing and having grass cut and fed to them.

### Grazing

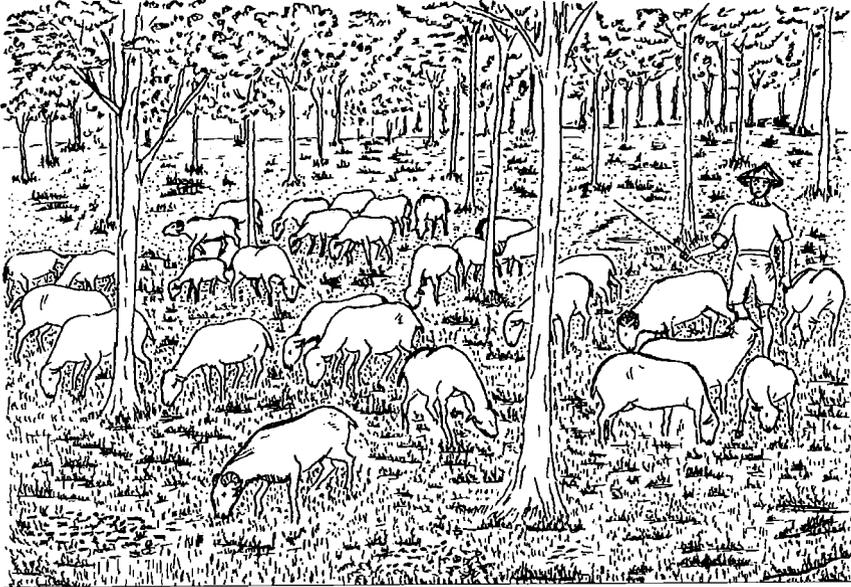
If there is land nearby with grass it is best to let sheep and goats graze.

- Animals should graze for as long as possible. Unless a sheep or goat grazes from early morning to late afternoon (8 or more hours) additional forage must be cut and fed to them.
- The grazing area should have plenty of grass for the animals to eat.
- Sheep and goats need a shepherd to keep them in the correct area, prevent theft, attack by dogs or animals becoming lost.
- Rotate or change the grazing area every 8-12 weeks. That area should then be left alone and not grazed or cut. This allows the worms and worm eggs that are in the manure from the sheep to die. It also allows the grass to regrow. After 8-12 weeks, the animals can return to the area as few worm larvae and eggs are left alive, reducing the contamination rate (see **4. Worms** in the **HEALTH AND DISEASE** section). However, if the grazing area is used by other farmers' animals it will become contaminated with worm larvae and eggs from those animals. If, possible, try to coordinate grazing among farmers in your area.
- Within the larger areas to be rotated each 8-12 weeks, do not allow animals to graze small areas so long that the forage is damaged and will not regrow. To do this the area, inspect the area before grazing and remove animals when it is estimated that over one half the forage in any small area has been eaten.
- The grazing area can be of native grasses and legumes or can be planted with "introduced" species that usually produce more grass.

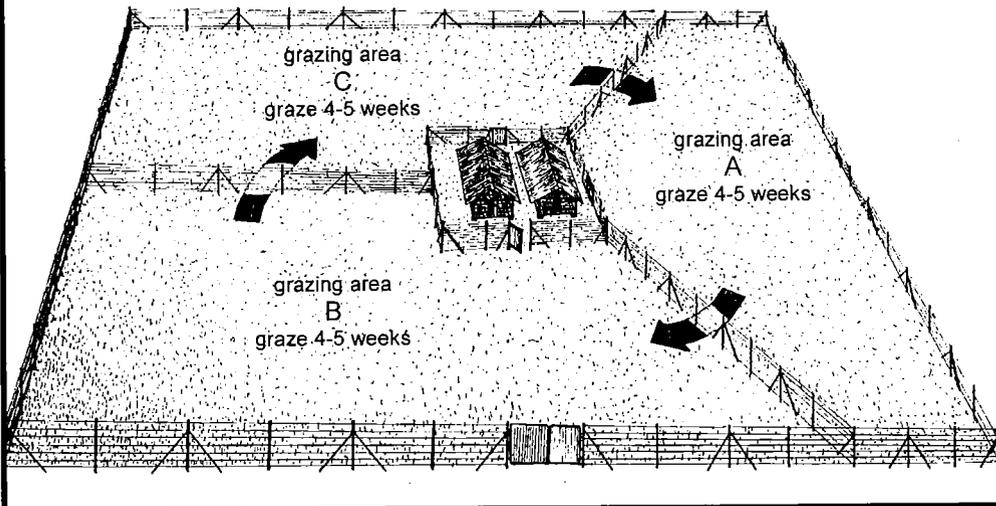
## 2. GRASSES

### Grazing

– sheep or goats should graze as long as possible each day



- the grazing area should be rotated so that each area is left ungrazed for 8-12 weeks
- this helps to reduce worm problems



## 2. GRASSES (continued)

### Cut and Carry

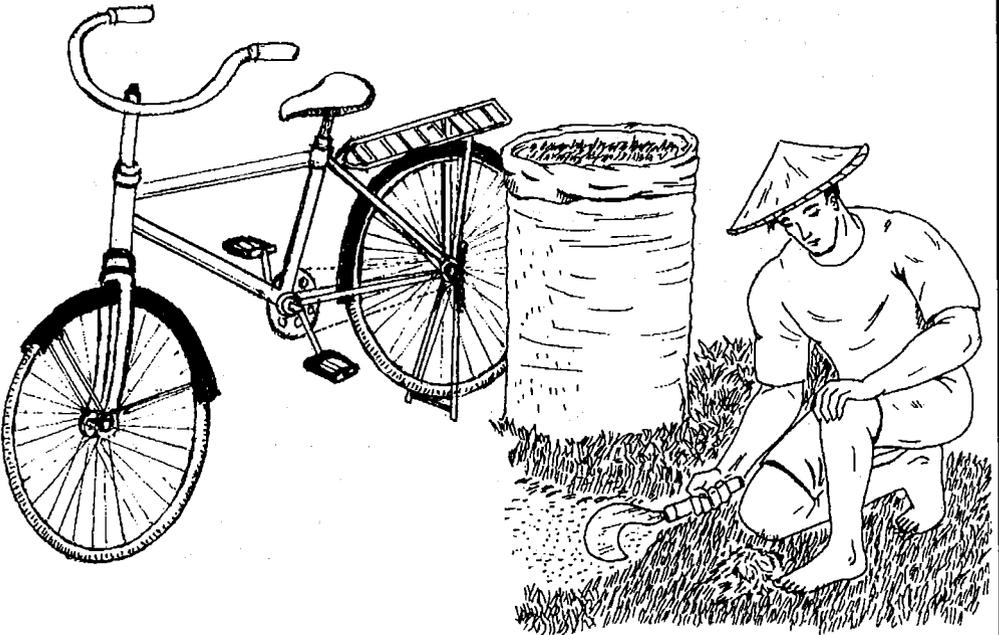
For animals kept in pens and for animals that may only graze for 4-5 hours per day, grass needs to be cut and fed to the animals.

- Cut forages from ungrazed areas. This will keep the worm infection rate low.
- Select young immature forage. The grass should be green and not yet flowered or have formed seed. This is better for the animals than older grass.
- Select more leaves than stems. Leaves are easier for the animals to digest than stems.
- Cut grasses and legumes in the afternoon after the morning dew has dried. This also helps to keep the number of worm larvae and eggs low.
- Cut a mixture of grasses and legumes. Sheep and goats are selective eaters and a wide variety will allow them to select what they want to eat.
- Tree leaves should also be cut and fed to the animals (see **TREE LEGUMES**).
- Feed sheep and goats as much forage as they want to eat. Because they select the best parts to eat a lot of forage must be harvested. A rule of thumb is to feed enough forage so that approximately 1/3 is left after a few hours. Later, the animals will eat more. Leftover forage in the morning should not be burned but composted with the manure. (see **9. Making manure compost** in **MANAGEMENT AND HOUSING** section). With experience a farmer will learn which forage species his animals like and how much to cut.
- The number of animals a farmer can take care of depends on the amount of forage available for grazing, the amount that can be cut and the time a farmer has for harvesting forage.
  - For example: a 20 kg animal can eat between 3.5 and 4 kg of forage. However, because some of the grass harvested is not well liked by the animal (it may be too old or have too tough stems) more grass will have to be cut. Possibly 6 kg forage needs to be cut for each 20 kg animal. Larger animals will eat more. The farmer must observe his animals when feeding to see which grasses and grass parts are preferred.

## 2. GRASSES (continued)

### Cut and Carry

- cut forage from ungrazed areas in the afternoon after dew has dried
- select immature forage - before grass has started to form seeds
- select more leaves than stems
- cut a mixture of grass, legumes and tree legumes



### 3. TYPES OR SPECIES OF GRASS

#### Native grasses

- ◇ are well liked by animals and are of good quality when young
- ◇ individual species vary from location to location
- ◇ generally low producing but very persistent

#### Introduced grasses

- ⇒ are very high producing grasses
- ⇒ must be planted by seed or through vegetative cuttings and need care to become established
- ⇒ are well liked by animals and animals fed these species can produce well
- ⇒ feed more than one species of introduced grass. Sheep and goats like to have a variety and may eat more if fed more than one species.
- ⇒ some types are best for grazing and others are better for cut and carry. A farmer can select which type to plant.
- ⇒ to find out where these grasses may be obtained contact your livestock extension agent

#### Species for cut and carry

These species are grasses that grow in bunches and are easily cut and carried. Examples of these species are: *Andropogon gayanus*, *Paspalum atratum* and *Panicum maximum* Hamil. These species are well suited to planting in smaller areas near the barn and can provide a supplemental source of forage to that gathered off farm.

#### Species for grazing

These species are low growing and generally spread well. They are suited for planting in larger areas where animals will be grazed. Some examples of these species are: *Brachiaria brizantha*, and *Brachiaria humidicola*.

**Some suggested grass species for Cut and Carry and Grazing.** Other species are also available, check with a local livestock agent to determine which species are best for your area.

Environmental conditions	Cut and Carry	Grazing
High rainfall, short dry season	Fertile soil King grass <i>Pennisetum purpureum</i> <i>Panicum maximum</i>	Native grasses <i>Stenotaphrum secundatum</i> <i>Paspalum guenoarum</i>
	Waterlogging <i>Paspalum atratum</i>	
Low rainfall, long dry season	<i>Panicum maximum</i> <i>Andropogon gayanus</i>	Native grasses <i>Paspalum guenoarum</i>

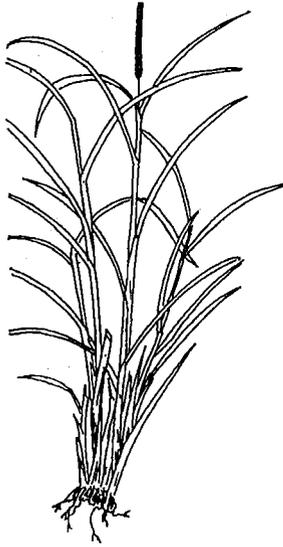
### 3. TYPES OR SPECIES OF GRASS

#### Introduced Grasses

- generally produce more grass than native species
- need care to plant and establish
- some are best for cutting, others for grazing
- consider land available, feeding method and labor for gathering grass when deciding which species to plant



*Pennisetum purpureum*



*Setaria sphacelata*



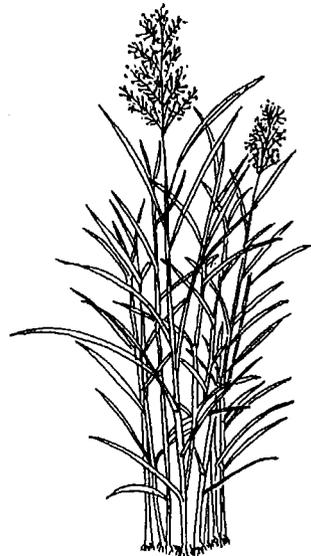
King grass



*Brachiaria humidicola*



*Brachiaria decumbens*



*Panicum maximum*

#### 4. LEGUMES

Legumes should be fed to sheep and goats to provide protein for growth and production. A legume is generally a plant that produces a pod with seeds like a bean or pea. Peanuts are also legumes.

- ◇ cut legumes when young and feed along with grasses
- ◇ legumes can be planted mixed with grasses in strips
- ◇ many tropical legumes are not as well liked as grass by sheep and goats
- ◇ the amount to feed depends on the animal and type of production. Pregnant females and nursing females need more legume than adult males. That is because the females are producing offspring and milk. Young animals also need more legumes as they are growing.

As with grasses there are introduced species of legumes that are higher producing than native species.

##### Introduced species.

Some introduced species of legumes are: *Stylosanthes guianensis*, the vines *Centrosema pubescens* and Siratro, and *Arachis pintoi* and *Arachis glabrata*. These last two species are very shade tolerant and could be planted by farmers with rubber trees.

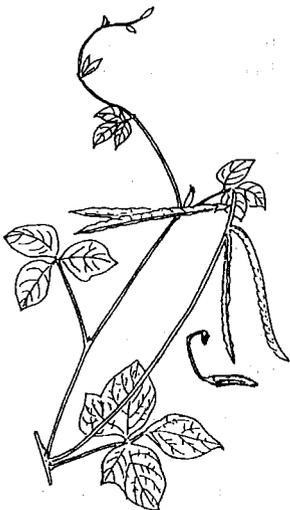
**Some suggested legume species for Cut and Carry and Grazing.** Check with a local livestock agent for species adapted for your area.

Environmental conditions	Cut and Carry	Grazing
High rainfall, short dry season	Acid soil <i>Stylosanthes guianensis</i>	Fertile soil <i>Centrosema pubescens</i> <i>Pueraria phaseoloides</i> Infertile soil <i>Stylosanthes guianensis</i>
Low rainfall, long dry season	Acid soil <i>Stylosanthes guianensis</i>	<i>Stylosanthes guianensis</i> CIAT 184

#### 4. LEGUMES

##### Legumes

- need to be fed along with grass
- should be cut when young
- introduced species that give good production are available
- introduced species need care to plant and establish



*Macroptilium atropurpureum*  
(DC.) (Siratro)



*Pueraria lobata*  
(Kudzu, *Pueraria thumbergianus*)



*Centrosema pubescens*



*Pueraria phaseoloides*  
(*Pueraria javanica* Benth)



*Stylosanthes guianensis*  
(Stylo, Brazilian stylo)



*Arachis hypogaea*  
(Groundnut, Peanut)

## 5. TREE LEGUMES

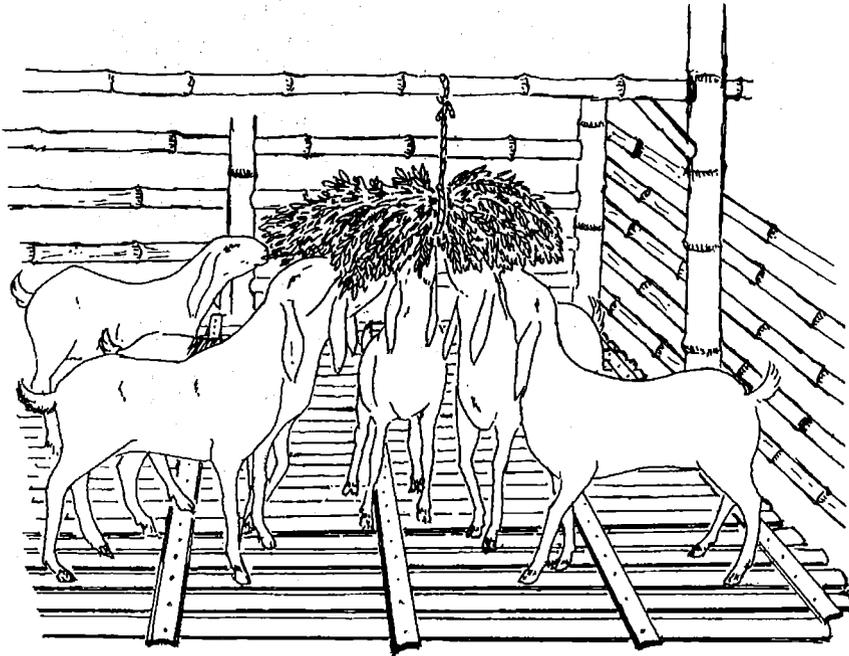
Some trees are also legumes and feeding their leaves provide sheep and goats with a good source of protein. Some examples of these are gliricidia, leucaena, calliandra and sesbania.

- ⇒ Leaves and small stems are eaten by animals. Sheep and goats will strip and eat the bark from small gliricidia stems.
- ⇒ Cocoa plantations can be good sources of leucaena and gliricidia as they are used for shade for the cocoa crop. Check with plantation management before taking any tree leaves.
- ⇒ Tree leaves can take the place of other harvested legumes. Feed tree leaves at no more than 30% of the forage fed to an animal or no more than 1 part leaves to 3 or 4 parts grass.
- ⇒ Cut branches at 1 meter height and put small branches in the feed troughs or tie them together and hang in the barns. Sheep, and especially goats, like their feed above the ground and will select the parts to eat.
- ⇒ Like other legumes, animals that are pregnant, have lambs or that are growing need more tree leaves than other adult animals.
- ⇒ Plant tree legumes in fence rows around the house or in small areas protected from grazing near the barn and fertilise with manure compost.
- ⇒ Plant introduced grasses between rows of trees for cut and carry forage.
- ⇒ More than one type of tree should be planted and fed, for example gliricidia and calliandra or leucaena. Then if one tree species dies or suffers insect attack leaves of the other species can be fed.
- ⇒ Harvests can be made approximately every 10 weeks if there is adequate rainfall.
- ⇒ Choose which tree species to plant depending on your soil, climate and types of crops produced.
- ⇒ Local extension agents will be able to assist in selecting the most appropriate tree for you.
- ⇒ For more information on what tree legumes to grow and how to do it see **WHERE WILL TREE LEGUMES GROW?, WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM?** and **HOW DO I GROW TREE LEGUMES?** later in this chapter.

## 5. TREE LEGUMES

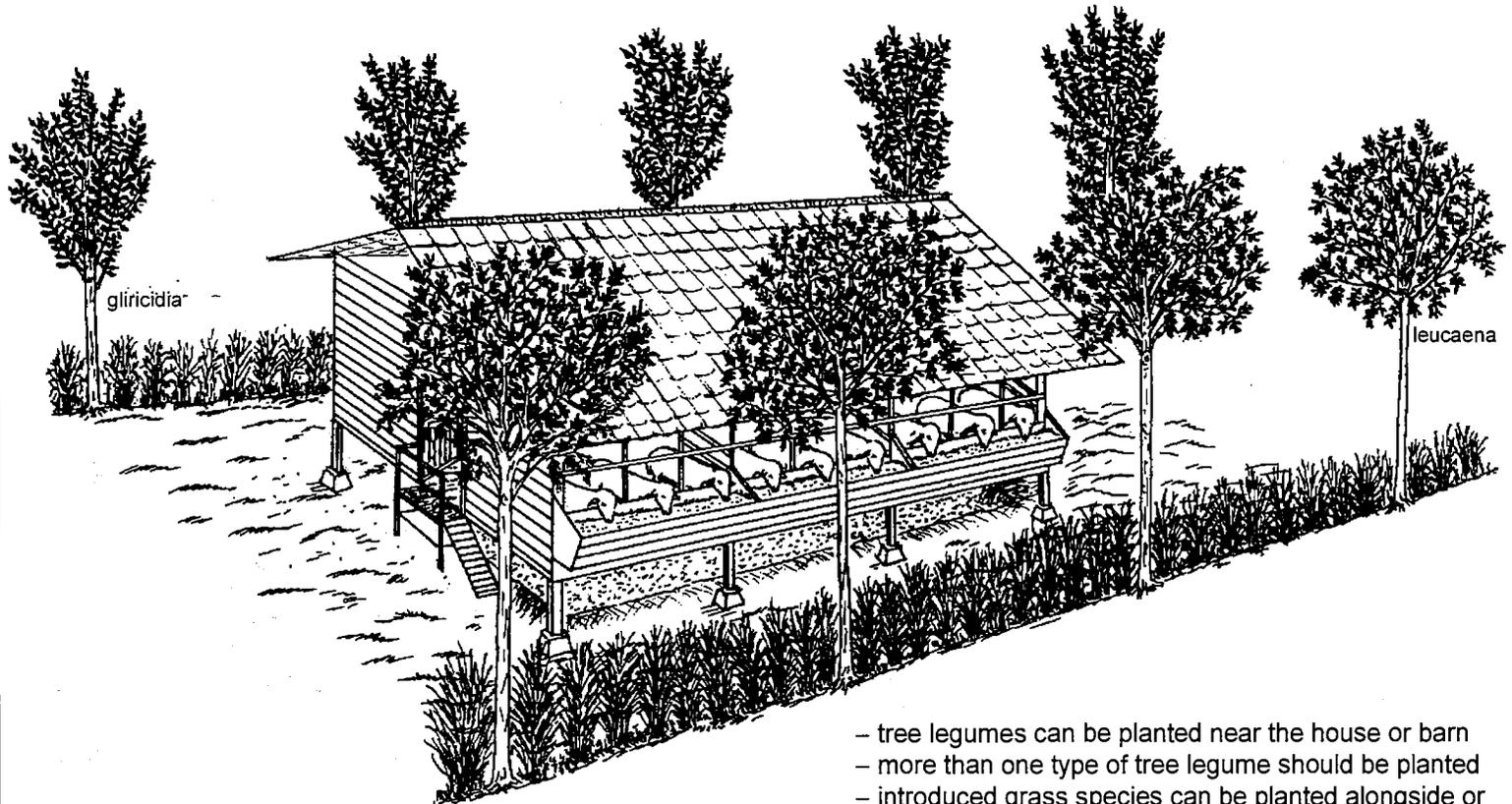


– tree legume branches are cut one meter off the ground



- branches can be tied together and hung in the barn
- sheep and goats will select the parts to eat

## 5. TREE LEGUMES



- tree legumes can be planted near the house or barn
- more than one type of tree legume should be planted
- introduced grass species can be planted alongside or between rows for extra forage

## 6. BY-PRODUCTS

By-products are waste materials of crop or food processing. Some of the main by-products fed to sheep and goats are: rice bran, cassava meal, tofu waste, palm oil mill effluent, palm kernel cake, and others. These provide energy and protein to the animals. They can be fed singly but can also be mixed to form better feeds.

**Rice bran** - can be fed as an energy source to females along with limestone and salt. Feeding limestone and salt will help prevent a mineral imbalance. Is inexpensive. Can be mixed with other ingredients to make a concentrate feedstuff.

**Tofu waste** - is both a source of energy and protein. Can be fed up to 1 kg per animal per day. Is an excellent feed fed alone or mixed with rice bran, limestone and salt to make a more complete supplement.

**Cassava meal** - is an energy source. Is dusty and should be mixed with other feeds.

**Palm oil mill effluents** - are difficult to feed if your farm is not near a factory because the effluent is mostly water. Two kinds that hold the most promise for animal feeds are palm oil sludge and ex decanter solid waste. Ex decanter solid waste forms molds very quickly and is most practical fed fresh. It can be stored in a barrel covered with a thin layer of molasses. Ex decanter solid waste can be mixed with rice bran, cassava meal, palm kernel cake, molasses to form a concentrate suitable for feeding.

**Soybean meal, cottonseed meal, coconut meal** - are protein sources fed in small quantities and are generally more expensive. Should be mixed with rice bran or with rice bran and cassava meal. Use these if you want to start a business fattening lambs for market.

**Fish meal, salted fish waste** - are protein sources. Only small amounts are used. Fish meal is more expensive than salted fish waste but both can be used. Need to be mixed with other ingredients like rice bran, cassava meal. These should be used in a fattening business or for animals that need extra protein such as pregnant, nursing ewes and fast growing lambs.

**Palm kernel cake** - can supply both energy and some protein. Is high in the mineral copper and cannot be fed alone but must be mixed with rice bran or rice bran and cassava meal.

**Rubber seed meal** - is a protein source. Rubber seed meal cannot be fed without processing to remove a dangerous compound. To make your own rubber seed meal: Gather rubber seeds from plantation areas. Break the shell off by pounding with a stone or wooden mallet and remove the seed. Soak the seed in water for 2 days to remove compounds that can be harmful to the animal. Dry in the sun and pound into a powder. Mix the powder with rice bran and other ingredients to make a supplement for feeding.

**Molasses** - is not a by-product but is an energy feed. It can be difficult to obtain and store. Can be fed alone or mixed with other ingredients to make a more complete feed. Is generally not practical for small flocks.

**Urea** - Urea is also not a by-product but can be fed to sheep and goats to help them make protein. It is dangerous to feed too much urea. Urea is never fed alone and must be mixed with other ingredients to form a concentrate. Some example concentrate mixes are included in the **SUPPLEMENTS** section.

## **7. PROVIDING SALT & MINERALS**

Sheep and goats require minerals and salt to grow and to increase appetite and feed intake.

Providing ordinary salt or a purchased mineral mixture can fulfill this requirement.

### **SEVERAL WAYS TO PROVIDE SALT OR MINERALS**

#### **A. Place the salt inside a bamboo lick**

In this way the salt will not be wasted and the animal can lick the bamboo as it needs the salt.

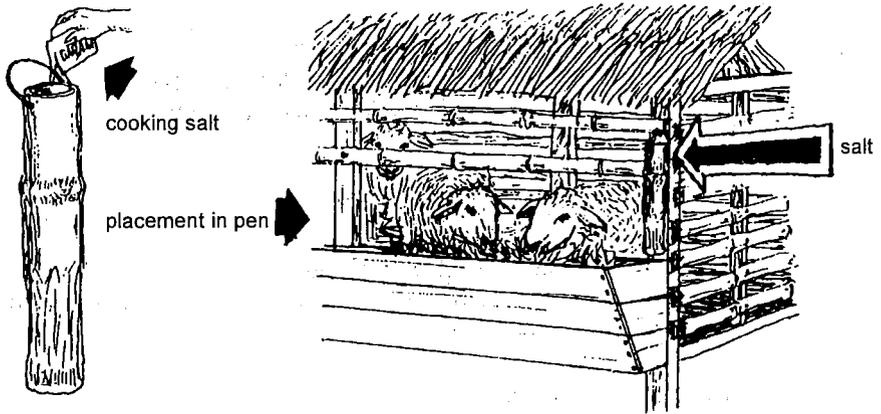
Method to make a bamboo salt lick:

- ⇒ use a large mature bamboo tube (6-9 cm diameter)
- ⇒ cut into a 1 ½ segment length (see drawing)
- ⇒ peel off the outside layer of the bamboo
- ⇒ open the top and keep the bottom closed
- ⇒ attach a string or piece of wire to the top of the bamboo in order to hang it in the barn
- ⇒ pour the salt + mineral mixture and very little water into the bamboo
- ⇒ hang the bamboo in a corner, 75-100 cm above the floor

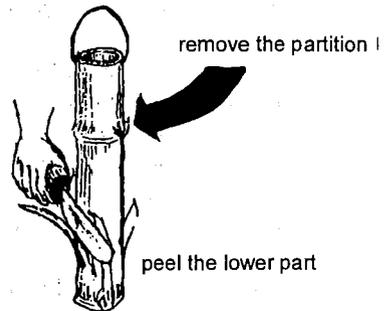
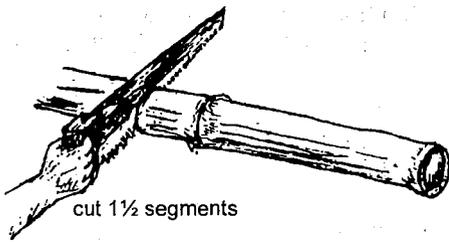
#### **B. Place the salt in a small bucket and tie it to the inside wall of the pen.**

## 7. PROVIDING SALT & MINERALS

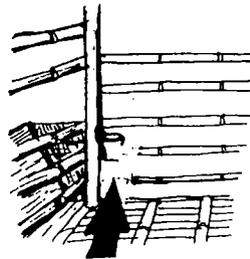
A.



- preparing salt container made of bamboo



B



put salt in a small bucket and fix it on the wall

## 7. PROVIDING SALT & MINERALS (continued)

### C. Make a salt/mineral block and hang it in the pen.

A salt/mineral block allows the animals to lick and get salt whenever they want. It also lasts a long time and is a very efficient way to provide minerals to animals.

#### Materials needed to make mineral blocks are:

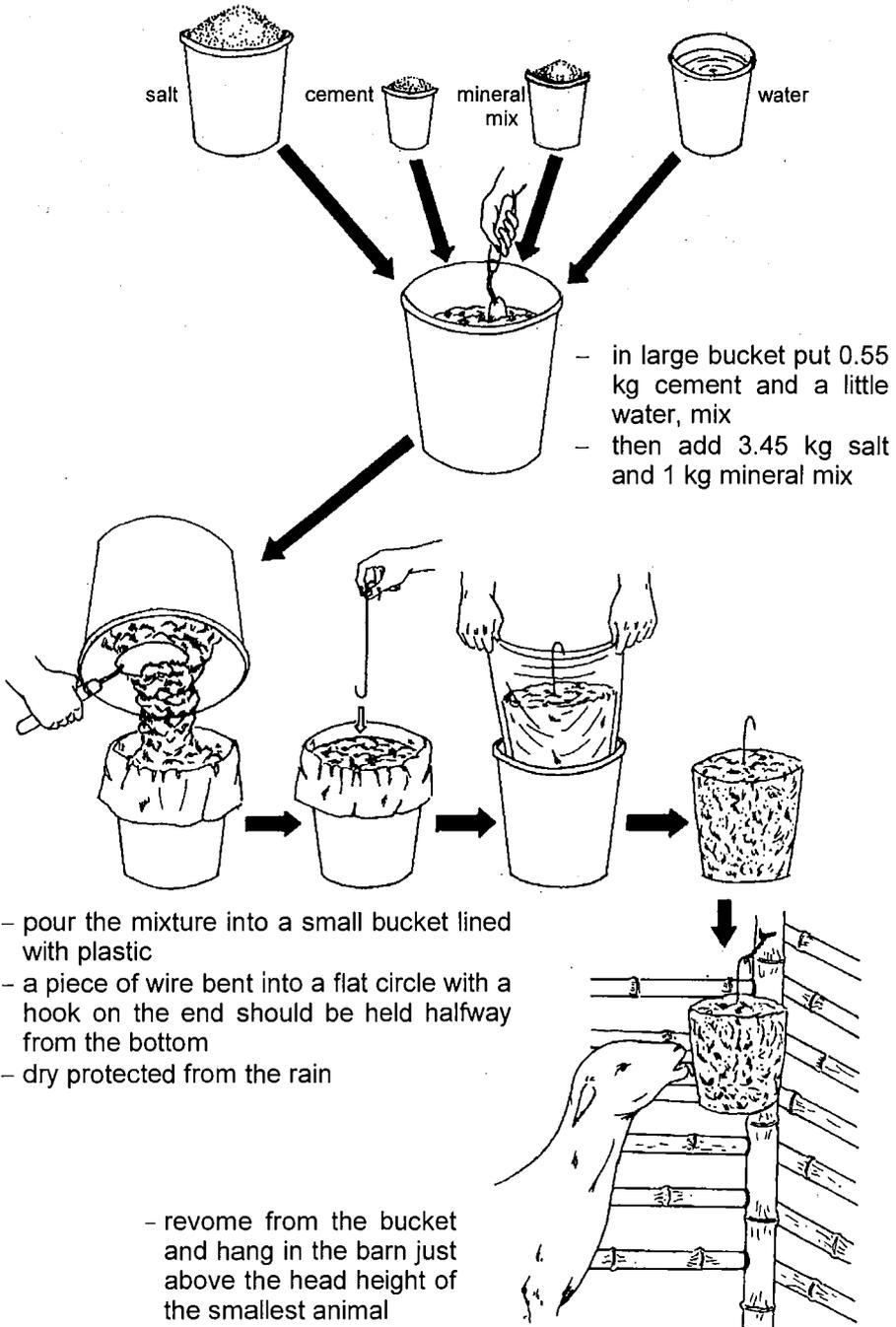
- ◇ commercial mineral mix, 1 kg per block made (Mixes for beef cattle can be used but not mixes for dairy cattle as they have too much of the mineral copper.)
- ◇ salt, 3.45 kg per block
- ◇ cement, 0.55 kg per block
- ◇ water
- ◇ small plastic buckets, 4-5 liter capacity
- ◇ strong wire to put into the blocks so they can be hung in pens after the block hardens
- ◇ plastic bag
- ◇ large bucket for mixing

#### Method to make a mineral block:

- ⇒ line the small pail with a plastic bag so that the finished blocks can be removed easily.
- ⇒ bend 40 cm wire into a flat circle with a hook above for hanging
- ⇒ in the large bucket put the cement with a little water. Add the mineral powder and salt.
- ⇒ hold the wire with the circle halfway to the bottom of the lined pail and pour the mixture in
- ⇒ move the pails to a place protected from rain and leave for about four days until dry
- ⇒ after dry, remove the block from the plastic bag and hang in the pen just above the height of the heads of the smallest animals

## 7. PROVIDING SALT & MINERALS (continued)

### C. Make a salt/mineral block and hang it in the pen.



## 8. WATER

The animal's body is 70% water.

If the animal loses 20% of its body water it will cause death. Water is necessary for all life functions including digestion of food.

It is important to have water at all times.

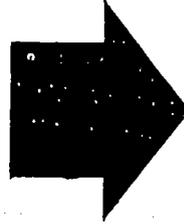
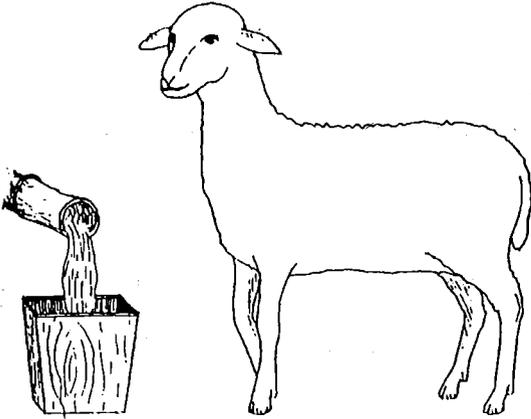
The amount of water an animal needs varies depending upon:

- Physiological state of the animal, young animals comparatively require more water than adults, lactating ewes require more water than nonlactating ones
- Animals fed on old or mature forages require more water than those fed on young forages.

Water requirement for sheep and goats is about 1.5-2.5 liters per day.

Drinking water has to be clean and the water container has to be cleaned every two days.

## 8. WATER



the body of sheep/  
goats is 70% water



full with  
clean water

provide enough water for all animals,  
particularly for young, pregnant and  
lactating animals



empty



sheep/goats  
need more  
water during  
hot weather



mature grass



Animals fed mature grass  
require more water than  
animals fed young grass



young grass

\* Pregnant and lactating  
ewe require more water

## 8. WATER (continued)

### Water containers

Water containers can be either purchased or made by the farmer. Some examples follow:

#### A. Plastic pail

- ⇒ should be placed near the feed trough
- ⇒ in the barn it should be placed where it will not easily be tipped over or made dirty with feces.

#### B. Made from wood

- ◇ the size of the container depends on the number of animals, a typical size is in the drawing
- ◇ wood should be nailed together and then sealed and painted black so it will last longer
- ◇ it should be placed near the forage supply and where it will not be tipped or made dirty

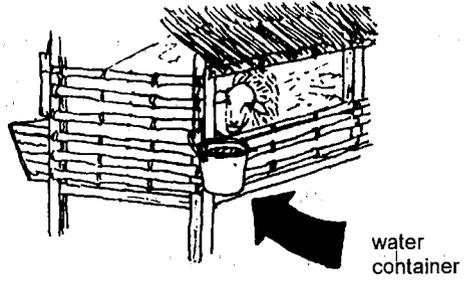
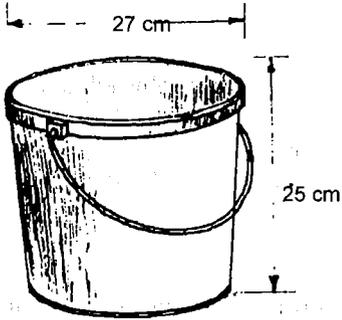
#### C. Large diameter bamboo or plastic pipe

- \* bamboo or plastic pipe used should be large
- \* if pipe is used, the ends must be closed
- \* the length is dependent on barn size and animal number
- \* the pipe or bamboo is split in half and nailed to the rear of the barn

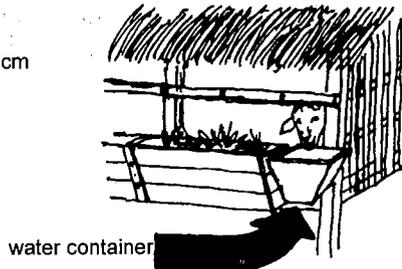
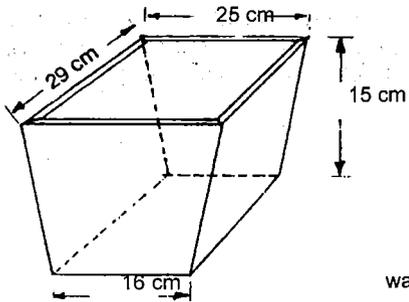
## 8. WATER (continued)

### WATER CONTAINERS

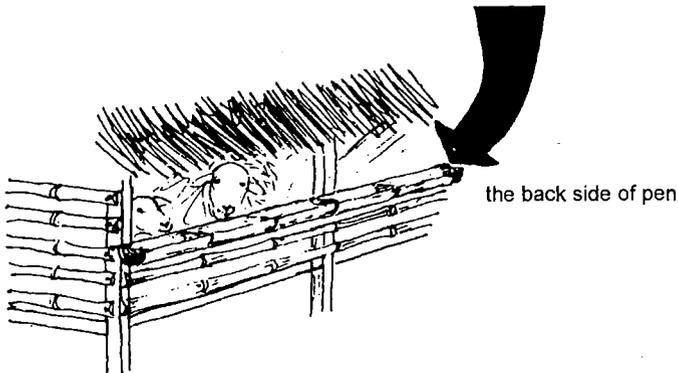
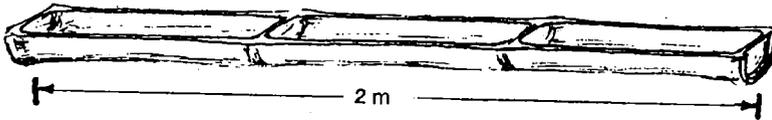
#### A. Plastic bucket



#### B. Box made of thick board (13 mm)



#### C. Large bamboo halves



## 9. HOUSING CONSIDERATIONS FOR FEEDING

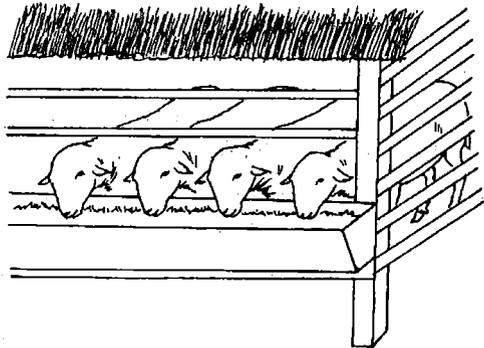
Feed requirements for sheep and goats are different from one animal to another depending on their physiological status such as pregnant or lactating females, young or non-pregnant females, adult males and young fast growing lambs/kids. Animals should be fed according to their status and to do this animals need to be placed in separate pens. Using pens can also help with control of disease, mating and management (see **BREEDING STRATEGIES AND RECORD KEEPING** section and **MANAGEMENT AND HOUSING** section).

Place animals in pens according to their sex, age and physiological status, for example:

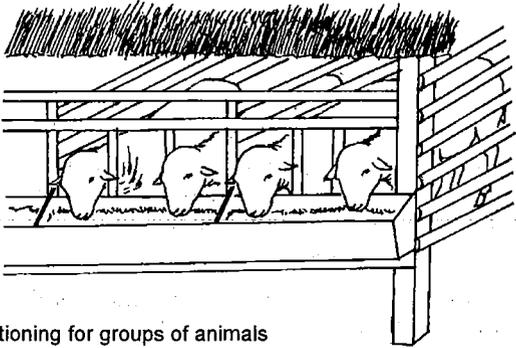
- pregnant females and those with lambs/kids
- young replacement females before being old enough to mate
- adult males
- weaned lambs/kids

Separate pens are needed so that the animals do not compete for their food. If, for instance, adult males are put in the same pen as females with young offspring the adult males will push the young away from the feed trough. The offspring will not get enough feed and will grow slowly. They may also be injured by the ram/buck and become ill. Older ram/buck lambs need to be separated from female offspring or else they may mate. This is inbreeding and can lead to unhealthy and poor growing offspring.

9. HOUSING CONSIDERATIONS FOR FEEDING

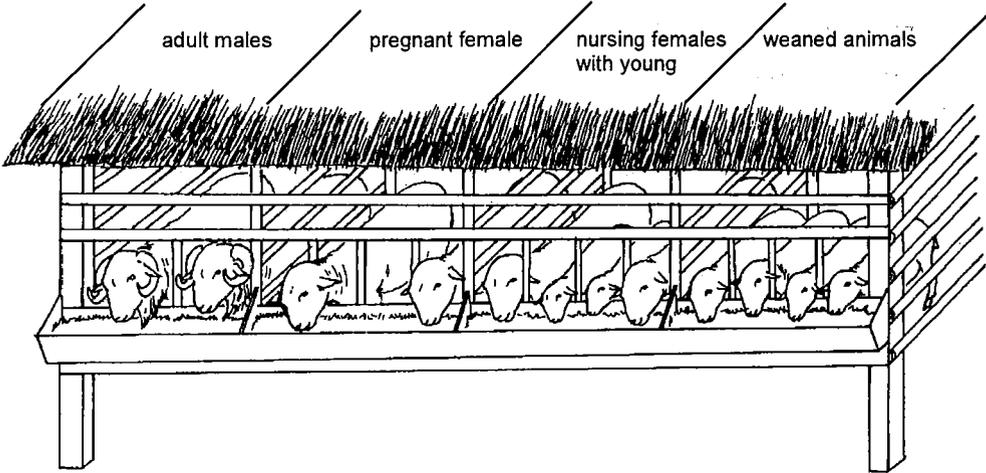


incorrect feed trough animals competing for feed



correct housing

- partitioning for groups of animals



adult males

pregnant female

nursing females with young

weaned animals

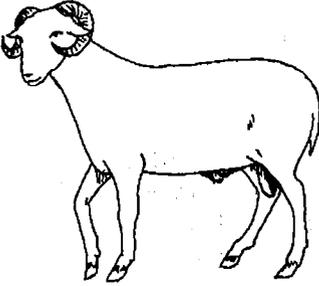
## 10. FEEDING AND HOW MUCH TO FEED

With time and experience an observant farmer will learn what feeds his animals like and how much they will eat. Some guidelines for feeding different groups of animals follow.

1. **Adult males.** Adult males used for breeding need to be well fed to keep their body condition in order to be able to mate. Feed:
  - as much grass as they want.
  - legumes or tree leaves, up to 1 part tree leaves or legumes for every 4-6 parts grass. More can be fed if there is a great supply.
  - if legumes are not available, a small amount of concentrate or by-product such as tofu waste can be fed, for example 500 g tofu waste per head per day.
  - if feed is in great supply, feed grasses, legumes and the small amount of concentrate
2. **Young, replacement females.** Farmers will want to select their best female young to use for breeding. After these animals are weaned, but before they are big and old enough to breed they need extra food for growth. Feed:
  - as much grass as they want.
  - these animals need to receive tree leaves or legumes, 1 part to every 3 parts grass, or more if available
  - some concentrate or by-product will also help these animals to grow so that they will be large and in good shape for breeding at 9-10 months of age. They can receive 250-300 grams (or one glass or handful) of a mixed concentrate containing rice bran, tofu by-product, limestone and salt or up to 1 kg per head tofu by-product or 200 grams rice bran alone
3. **Pregnant females.** Pregnant females need feed for the growth of their offspring. If a farmer knows when a female will give birth, 2-3 weeks prior to that date she should be fed the same feed as a lactating animal (see # 4). Females in early pregnancy should receive:
  - plenty of forage
  - tree legumes or legumes 1 part to every 3 parts grass, more if possible
  - some concentrate, 200 g per day per head mixed concentrate or 500 g tofu waste

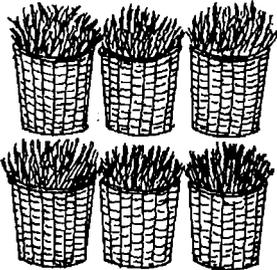
# 10. FEEDING AND HOW MUCH TO FEED

## 1. Adult males



### Forage

- all they can eat
- fed 1 part legume/tree leaf for six parts grass

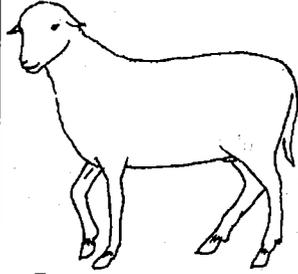


### Concentrate/By-product

- can be substituted for legume
- can be fed in addition especially in times of frequent mating
- approximately 200 grams (one handful)



## 2. Replacement females



### Forage

- all they can eat
- fed 1 part legume/tree leaf for three parts grass

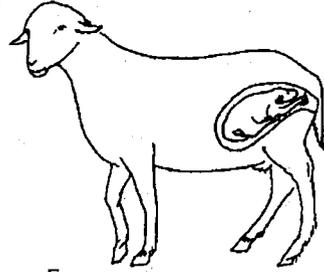


### Concentrate/By-product

- needed for growth
- prepare for mating
- 200 - 300 grams daily

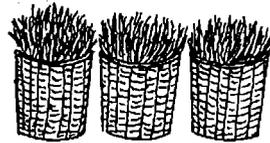


## 3. Pregnant females



### Forage

- all they can eat
- fed 1 part legume/tree leaf for three parts grass



### Concentrate/By-product

- extra energy and protein needed for fetus
- 200 -250 grams daily
- in late pregnancy feed the same as a lactating female

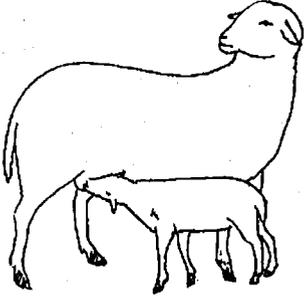


## 10. FEEDING AND HOW MUCH TO FEED (continued)

4. **Lactating females or those close to parturition.** These animals need the most feed as their bodies are producing either milk or lambs/kids. These animals need:
  - plenty of forage
  - tree leaves or other legumes 1 part to every 3 parts grass
  - concentrate 250 - 300 grams per day or 1 kg tofu waste
  
5. **Young lambs/kids** who are still nursing can begin to eat other foods at about six weeks of age. They should be fed high quality feeds to help them grow and get them used to eating food other than their mother's milk. The feed needs to be high quality because they can eat only a little. They should receive:
  - young forage with plenty of leaves, few stems
  - tree leaves
  - concentrate, adjust the amount needed according to how much the lambs eat but should be there for them free choice. Tofu by-product can be fed along with rice bran.
  - the feed should be in a part of the barn partitioned so that only the lambs/kids can reach it. This prevents the adult animals from eating the feed intended for the young animals.
  
6. **Weaned lambs/kids.** Offspring can be weaned at 3 months of age. At this time they can grow very fast with a high quality diet. They should receive:
  - young forage with plenty of leaves
  - tree leaves, all they want
  - concentrate, all they want, this needs to be adjusted as they grow. They can be started with 50 - 75 grams per day and the amount increased. If tofu waste is fed, they can start with 200 g per day.

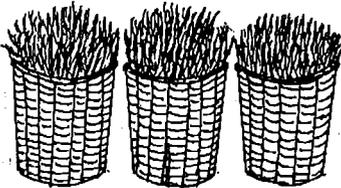
## 10. FEEDING AND HOW MUCH TO FEED (continued)

### 4. Lactating females



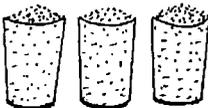
#### Forage

- all they can eat
- fed 1 part legume/tree leaf for three parts grass

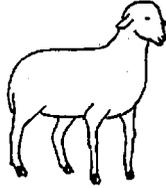


#### Concentrate/By-product

- needed for energy to produce milk
- 300 grams daily

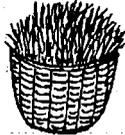


### 5. Young, nursing lambs/kids



#### Forage

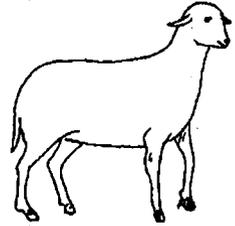
- young forage with few stems
- need to get used to eating grass
- tree leaves
- will eat very little as are still nursing



#### Concentrate/By-product

- must be high quality
- will eat small amounts
- needs to be in place where dams cannot get to it

### 6. Weaned lambs/kids



#### Forage

- lots of leafy forage and tree leaves
- must be young and high quality



#### Concentrate/By-product

- will start eating a little
- amount must be increased as appetite increases

## 11. SUPPLEMENTS

Supplements are fed in addition to forage and contain nutrients that are deficient or not found in the forage. Supplements provide extra energy and protein to animals that require it. These animals may be ewes/does in late pregnancy or lactating. Young lambs/kids require some feed to get them used to eating concentrate and help them when they are weaned. Weaned offspring and young animals a farmer wants to grow for the market need supplements so they grow faster. **For supplements to show the greatest benefit, the animals must be healthy and well managed.** A sick animal, or an animal infested with worms will not do well even with very high quality feed.

Supplements can be either tree legumes, a single feed or a mixed supplement using several of the ingredients discussed previously in **BY-PRODUCTS**. Crop by-products such as cassava leaves can also be used as a supplement.

The supplement used depends on:

- ⇒ the performance expected from the animals. Higher performance, faster growth for example, may take a supplement with more nutrients.
- ⇒ availability of ingredients.
- ⇒ cost of ingredients. This is the main determinant of supplement make up.

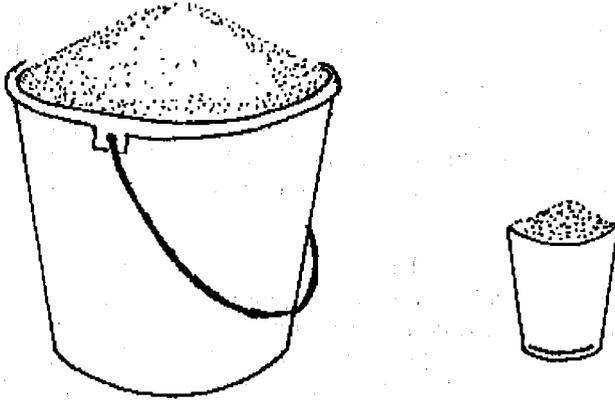
Livestock extension agents, livestock research centers and universities are excellent places to obtain supplement formulas and information for your area. Some examples of supplements that could be used are:

**Rice bran.** Fed to pregnant or lactating females. One to two handfuls per animal each day can help provide extra energy. When feeding rice bran some limestone should be mixed with the rice bran or made available for the animal to eat. For every 5 liter pail rice bran, add a small handful limestone and salt. This is especially important for males that are fed large amounts of rice bran. Rice bran has high amounts of the mineral phosphorus. If fed in large amounts to ram lambs without feeding limestone urinary stones could develop (see **19. Urinary stones** in the **HEALTH AND DISEASE TREATMENT AND PREVENTION** section).

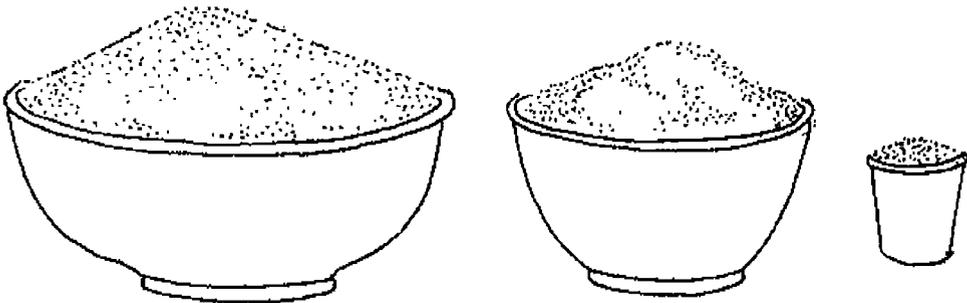
**Tofu by-product.** Fed alone or mixed with rice bran and other ingredients. Some sample mixtures would be:

1. In a 20 liter basin, fill it  $\frac{3}{4}$  full with tofu by-product, of the remaining space, fill  $\frac{1}{2}$  with rice bran, add a small amount of salt and  $\frac{1}{4}$  handful limestone. This is enough to supplement roughly 18 animals. Additionally, mineral mix, two spoonfuls, could be added.
2. Fill a 20 liter basin 90% full with tofu by-product, fill the remainder with rice bran. Add a small handful each of limestone and salt. Again, mineral mix could be added.
3. Tofu by-product can be fed alone. Additions of limestone, salt and mineral mix supply needed minerals. This should especially be done if a farmer does not want to make mineral block but feed mineral directly to his animals.

## 11. SUPPLEMENTS



- for each 5 liter pail of rice bran a small handful of salt and limestone should be added



- tofu by-product can be fed mixed with rice bran, salt and limestone
- it can also be fed alone

## 11. SUPPLEMENTS (continued)

**Rubber seed meal.** Fed mixed with tree leaves such as gliricidia in equal parts. It can also be mixed with concentrates. An example would be to feed equal parts of rubber seed meal and the following concentrate (4 kg rice bran, 3 kg cassava meal, 2.5 kg molasses, 100 g fish meal, 100 g urea, 150 g limestone)

**Cassava leaves.** Cassava leaves can be picked from the lower part of the plant after the plant is 4 months old. After one picking, the plant should be left for one week before a second picking. Wilt the leaves for one day before feeding to remove dangerous compounds. These are a protein source and can be mixed with another supplement such as rice bran to provide additional energy. Cassava leaves can be toxic when fed in large quantities to animals not used to eating them. Make sure leaves are wilted before feeding.

**Cassava meal.** This is an energy source and can be mixed with rice bran or tofu by-product or both. It is a very dusty feed and should not be fed alone. Mix with equal parts rice bran or tofu by-product in place of rice bran in the above examples. It has less protein than rice bran.

**Molasses, palm kernel cake.** These supplements may be difficult to obtain and store. They can be mixed into complete supplements high in energy and protein. An example, by fresh weight, of a concentrate mixture used by a large commercial flock is: 22 kg palm kernel cake, 8.5 kg cassava meal, 5 kg rice bran, 13 kg molasses, 1 kg fish meal, 1.5 kg limestone, 250 grams urea, 600 grams salt and 500 grams mineral mix. This formula makes slightly over 52 kg concentrate.

## 11. SUPPLEMENTS (continued)



- harvest cassava leaves from the bottom of cassava plants
- wilt the leaves for one day before feeding

## 12. WHERE WILL TREE LEGUMES GROW?

### **Leucaena (*Leucaena leucocephala*)**

Leucaena is a very nutritious and well-liked tree legume for feeding to ruminants but has several limitations as to where it will grow.

Leucaena is well suited to:

- ⇒ fertile, well drained soils
- ⇒ low to medium rainfall
- ⇒ warm temperatures

Leucaena is not suited to:

- ◆ strongly acid soils
- ◆ infertile soils
- ◆ waterlogged soils
- ◆ cool, mountainous regions

Other tree legumes are better in these types of areas.

### **Giricidia (*Giricidia sepium*)**

Giricidia is also very nutritious and is far easier to establish than leucaena, but giricidia may be less well liked than leucaena. This problem can be overcome by training young animals to eat giricidia. This may take several weeks.

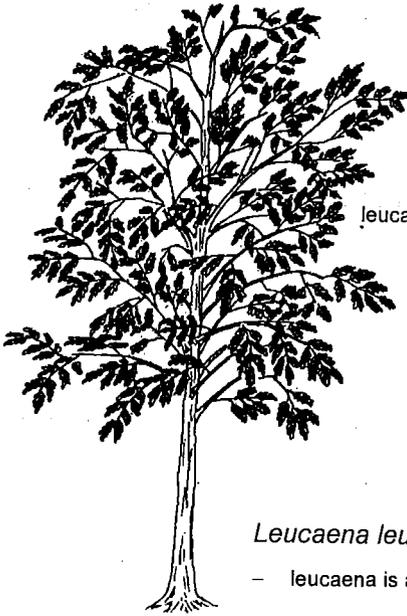
Giricidia is well suited to:

- ⇒ fertile soils
- ⇒ low-high rainfall
- ⇒ warm-hot temperatures

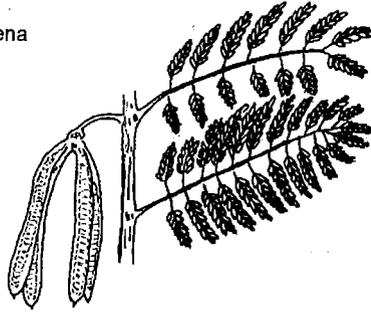
Giricidia will grow better than leucaena in:

- ◆ strongly acidic soils
- ◆ waterlogged soils
- ◆ infertile soils

12. WHERE WILL TREE LEGUMES GROW?

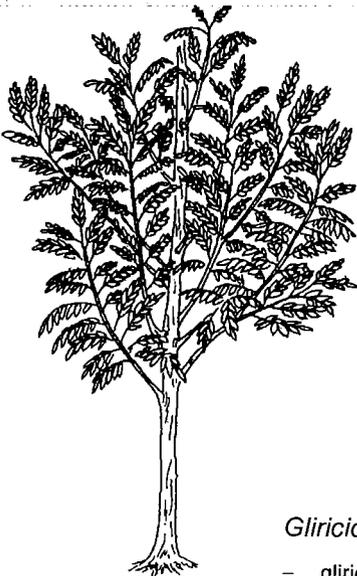


leucaena



*Leucaena leucocephala*

- leucaena is a very nutritious and well liked tree legume



gliricidia



*Gliricidia sepium*

- gliricidia is also good for sheep and goats and is easy to grow

## 12. WHERE WILL TREE LEGUMES GROW? (continued)

### **Calliandra (*Calliandra calothyrsus*)**

Calliandra is less nutritious than leucaena and gliricidia and this is reflected in ruminant growth rates, but calliandra is highly productive in high rainfall and cool regions.

Calliandra is well suited to:

- ⇒ moderate-highly fertile soils
- ⇒ medium-high rainfall
- ⇒ cool-hot temperatures

Calliandra will grow better than leucaena and gliricidia in:

- ◆ strongly acidic soils
- ◆ high rainfall regions
- ◆ cool mountainous regions

### ***Sesbania sesbans* and *Sesbania grandiflora***

*Sesbania*'s are nutritious legumes that are short-lived, weak perennials, and have great value in intensively cropped areas.

*Sesbania sesbans* is well suited to:

- ⇒ low-moderately fertile soils
- ⇒ seasonally waterlogged soils
- ⇒ strongly acidic soils
- ⇒ cool-hot temperatures

*Sesbania sesbans* grows rapidly from seed and produces abundant early forage. It is limited by its short life span of 2-4 years and its poor drought tolerance.

*Sesbania grandiflora*

*Sesbania grandiflora* is suited for use on paddy bunds, because its upright growth throws little shade onto crops. The lateral branches of *Sesbania grandiflora* are cut for forage and the trunk is used for pole timber.

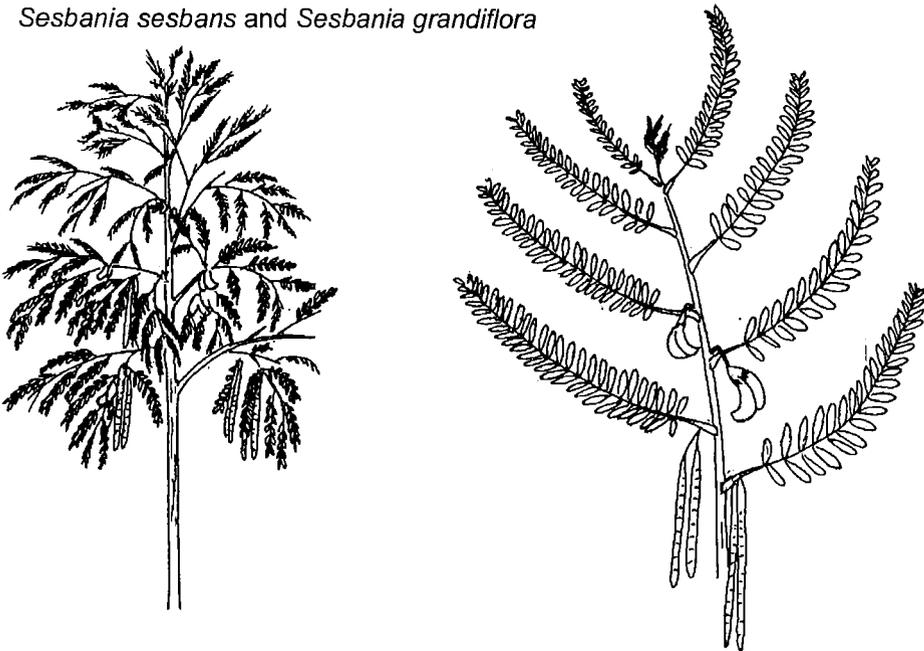
## 12. WHERE WILL TREE LEGUMES GROW? (continued)

*Calliandra calothyrsus*



- calliandra is less nutritious than leucaena or gliricidia but grows well in cool, mountainous regions

*Sesbania sesbans* and *Sesbania grandiflora*



- sesbanias are short lived perennials but are of great value in heavily cropped areas

### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM?

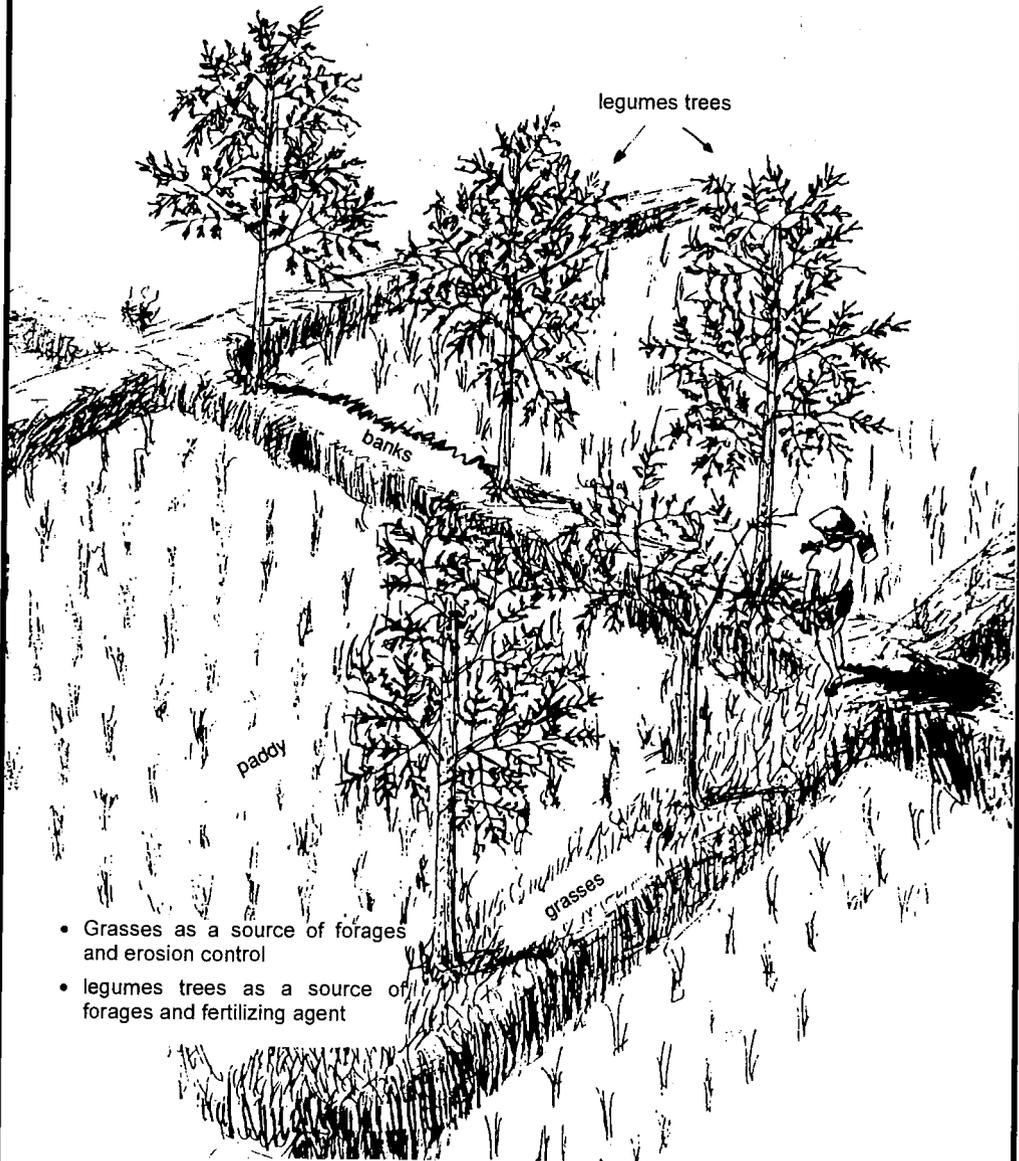
#### Tree legumes in cropping systems

In crop farming regions, availability of land is often a major constraint to production of forages. Cash crops must utilise the majority of arable lands, but tree legumes can be integrated into cropping systems around paddy bunds, as living fences or as alley crops in upland farming areas.

1. **Paddy bunds** are underutilised areas, generally covered with low quality grasses.
  - ⇒ vigorous improved grasses such as *Splenda setaria* or *Brachiaria humidicola* grass provide excellent erosion control and are also a source of feed
  - ⇒ integrate tall growing tree legumes to provide a protein-rich feed and a source of timber. In eastern Indonesia, *Sesbania grandiflora* is the preferred species for this purpose. Lateral branches are cut to reduce shading of the rice crop, encourage upright growth for pole production and provide forage.

### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM?

#### PADDY BUNDS



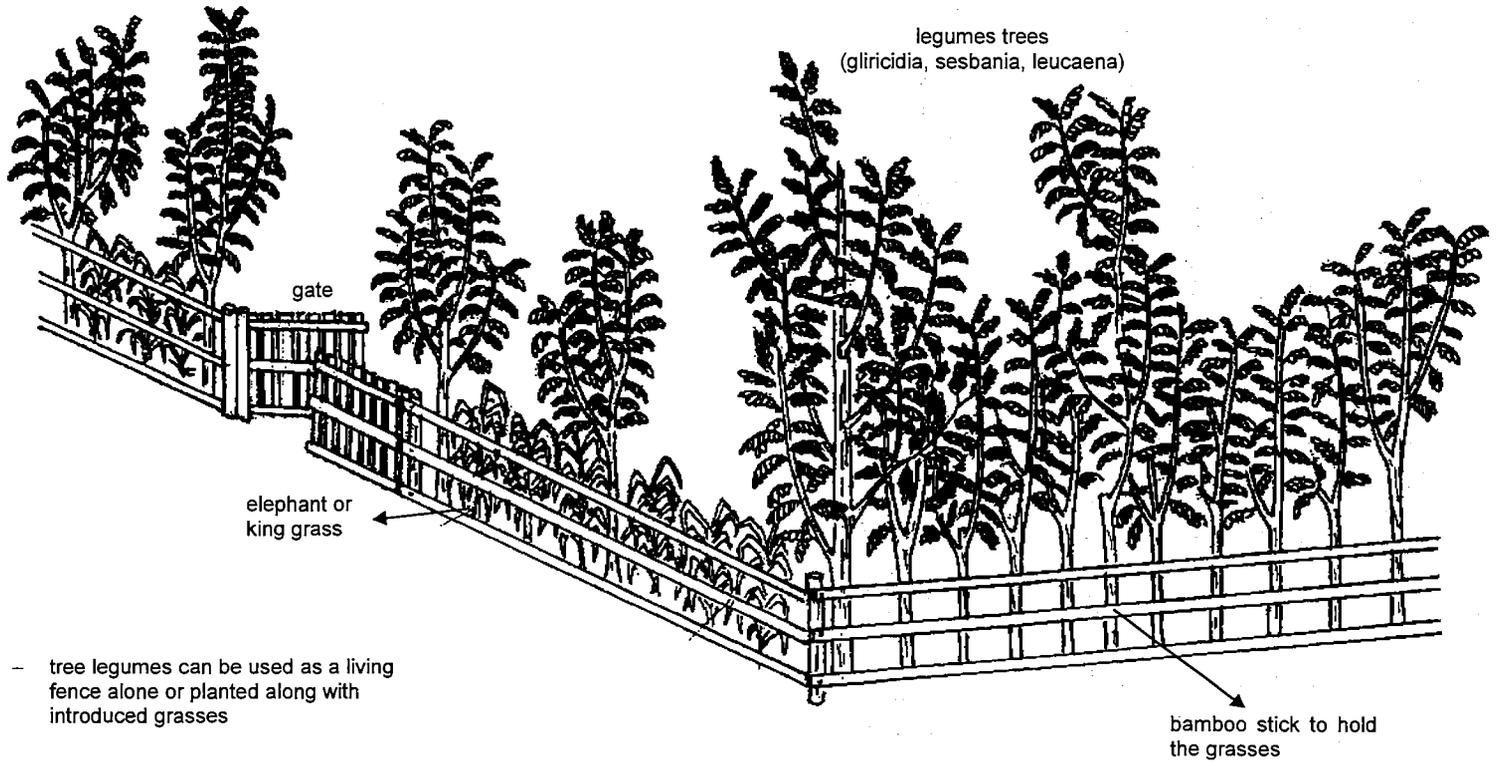
- Grasses as a source of forages and erosion control
- legumes trees as a source of forages and fertilizing agent

### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM? (continued)

2. **Living fences** are primarily erected to provide security for home and crops but provide forage as a secondary product.
  - ⇒ generally tree legumes such as gliricidia, erythrina, jatropha, calliandra and leucaena are used in living fences
  - ⇒ legumes that grow readily from stem cuttings are often used (gliricidia, erythrina and jatropha)
  - ⇒ erect fences using tree legumes as posts, with elephant grass planted between trees spaced 1-2 m apart and supported with bamboo rails
  - ⇒ alternatively, plant tree legumes very densely (20-30 cm apart) in rows to form a dense barrier
  - ⇒ lop fences on a rotational basis to supply forage

### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM?

#### LIVING FENCE AREAS



- tree legumes can be used as a living fence alone or planted along with introduced grasses

### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM? (continued)

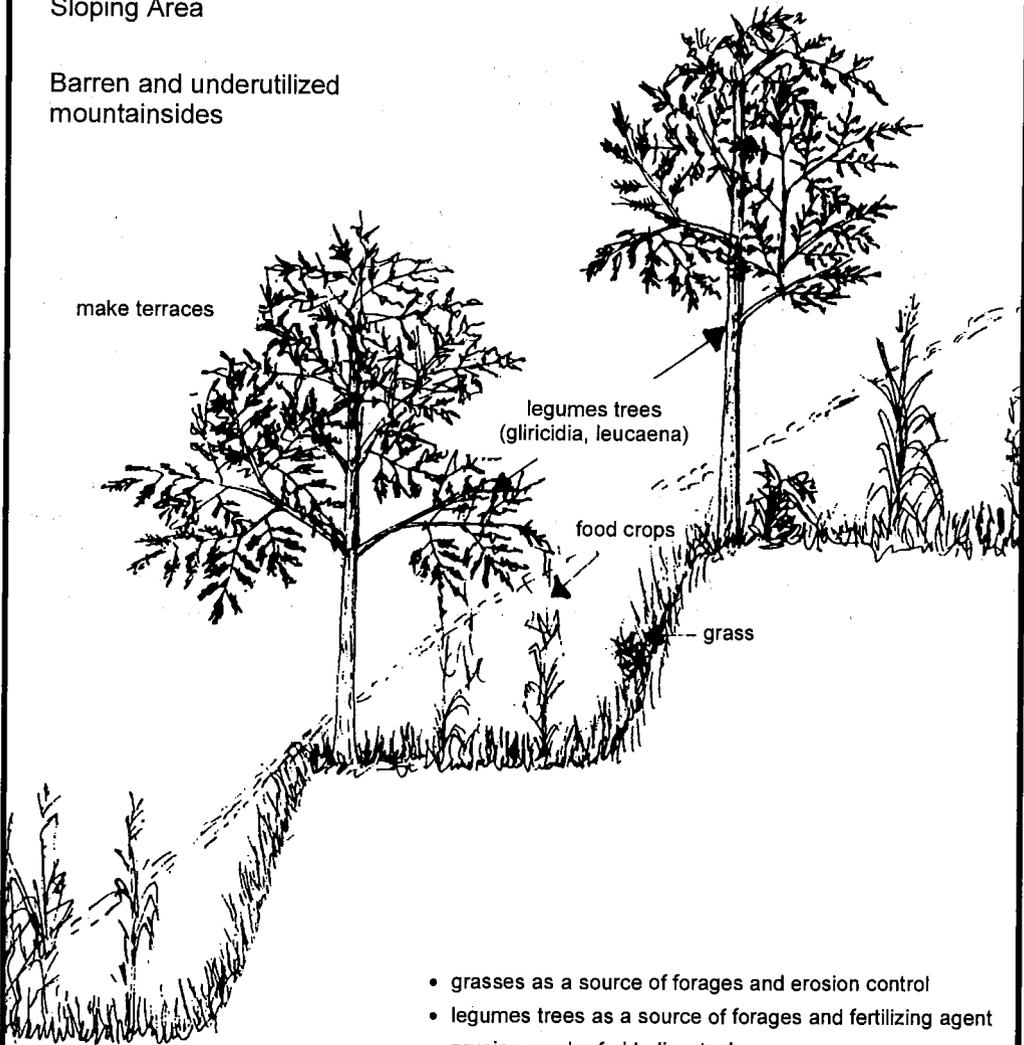
3. **Tree legume alleys** planted on the contour in upland cropping areas form terraces that reduce soil erosion and provide a nitrogen source for crop growth. In between the legume alleys crops can be planted.
  - ⇒ leucaena, gliricidia and calliandra are favored for contour planting
  - ⇒ dense hedges planted at 15-40 cm spacings are best if erosion control is a priority
  - ⇒ harvest tree legumes prior to planting crops to prevent excessive competition for water and nutrients with the crop
  - ⇒ prunings can either be fed to ruminants or used as a green manure to enhance crop growth
  - ⇒ during the dry season the legume alleys can be grazed or cut for ruminant feed
  
4. **Tree legumes can be integrated into the house garden** in intensively cropped lowland areas, either as shade trees or as perimeter fences. This system is well suited to cropping areas using draught animals, as the forage source is in close proximity to the animal shelter.

### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM? (continued)

#### TREE LEGUME ALLEYS

Sloping Area

Barren and underutilized  
mountainsides



- grasses as a source of forages and erosion control
- legumes trees as a source of forages and fertilizing agent
- pruning can be fed to livestock

### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM? (continued)

#### *Tree legumes in plantation systems*

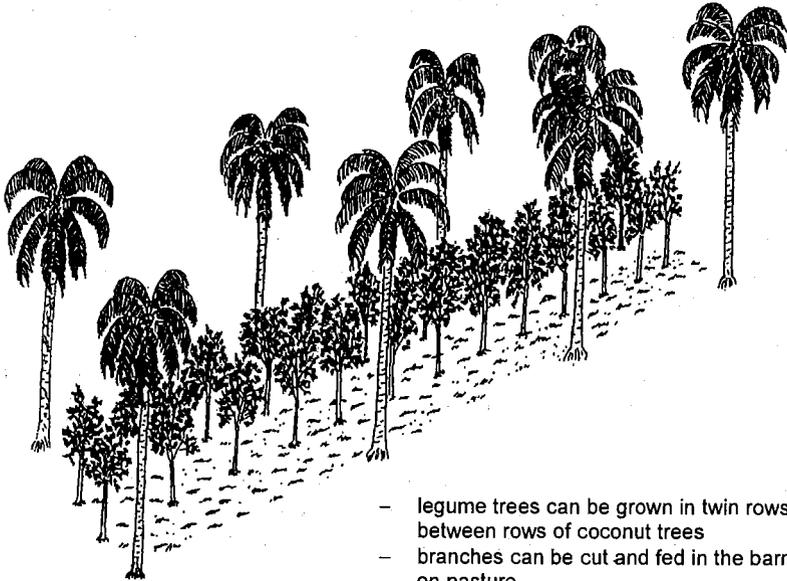
1. **Coconut plantations.** A range of forages including tree legumes can be grown underneath mature coconut plantations.
  - ⇒ leucaena, gliricidia and calliandra have all been successfully grown under coconuts
  - ⇒ twin rows of legume alleys can be planted centrally between rows of coconuts
  - ⇒ align tree legumes so as to allow for easy maneuvering of an ox cart or truck
  - ⇒ graze tree legumes directly or cut for stall feeding
2. **Rubber and oil palm plantations** provide little opportunity for integration of tree legumes because of the low light penetration through their canopies. Recent adoption of a hedgerow planting arrangement for rubber has allowed integration of forages and other crops into the inter-rows. For smallholder rubber holdings, farmers could plant tree legumes in areas where older trees have died.

#### *Tree legumes in open grazing systems*

**Open grazing systems** throughout Asia are usually communally owned and therefore improvement of pasture areas is difficult due to lack of animal control. If land can be securely fenced the opportunity exists to establish protein banks using tree legumes. This involves dense planting of a well-fenced paddock that is either cut for stall feeding or is directly grazed for 1 hour each day. It must be emphasised that unless stock are effectively kept out of the protein bank it is unlikely that the tree legumes will survive.

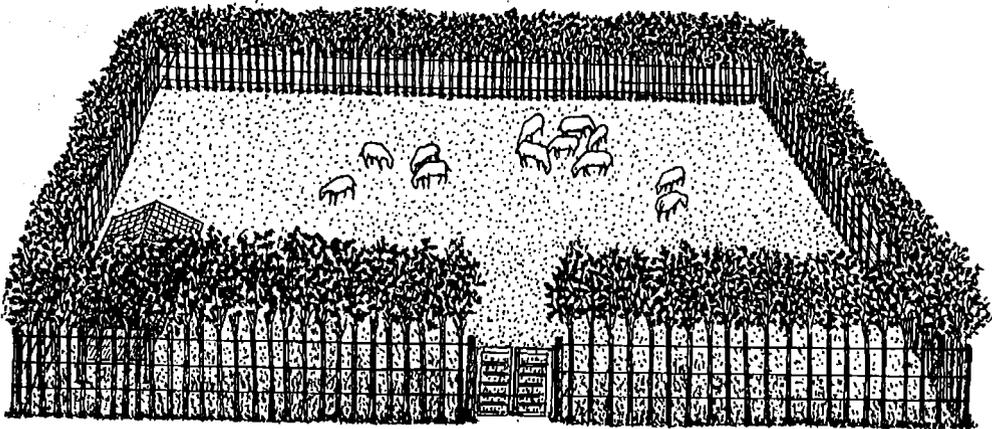
### 13. WHERE DO TREE LEGUMES FIT INTO MY FARMING SYSTEM? (continued)

#### Coconut plantations



- legume trees can be grown in twin rows between rows of coconut trees
- branches can be cut and fed in the barns or on pasture.

#### Open grazing systems



- a securely fenced area is required to keep livestock out
- tree legumes are planted very densely and livestock are let in to graze or users of the communal grazing area cut branches for stall feeding

## 14. HOW DO I GROW TREE LEGUMES?

Tree legumes are grown from seed or from stem cuttings, depending on the species. *Leucaena*, *calliandra* and *Sesbania grandiflora* are usually grown from seed to produce seedlings that are transplanted into the field. *Sesbania sesbans* is usually planted directly into the field from seed, whereas *gliricidia* is best planted from stem cuttings. Seedlings should be prepared so that they are ready for planting into the field at the beginning of the wet season. Here are some practical tips for growing tree legumes for your farm.

### **Seed treatment**

#### **a) Seed scarification**

Many of the tree legumes have seeds with hard seed coats that must be treated so that water can enter the seed for germination to occur. *Leucaena*, *calliandra* and *sesbania* all have hard seed coats that prevent germination unless treated. *Gliricidia* seed does not require any scarification treatment for germination.

*Small seed lots*:- The safest way to treat seed is to nick the rounded end of the seed with a knife or nail-clippers. Only a small nick is required to allow germination.

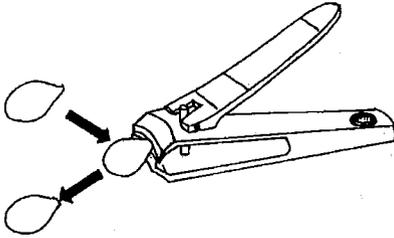
*Large seed lots* (>5000 seeds) may be treated by briefly submerging seed in boiling water. This technique requires considerable planning and preparation as seeds can easily be killed by the submersion in boiling water.

1. Prepare a germination container to plant 500 seeds in rows of 100 seeds.
2. Count out 5 lots of 100 seeds.
3. Boil 2-3 litres of water.
4. Plant the first lot of 100 seeds directly into the germination container, taking care to mark the position of the row.
5. Boil the remaining 4 lots of seed for 2, 4, 8 and 16 seconds respectively. Each seedlot should be removed and cooled rapidly after boiling.
6. Plant into the germination container, taking care to mark the position of each row.
7. After 8 days, count the number of germinated seedlings for each boiling treatment.
8. The seedlot due to be planted should be boiled to obtain greatest germination.
9. When boiling large seedlots, the volume of water boiled should be equivalent to 10 times the volume of seed.

## 14. HOW DO I GROW TREE LEGUMES?

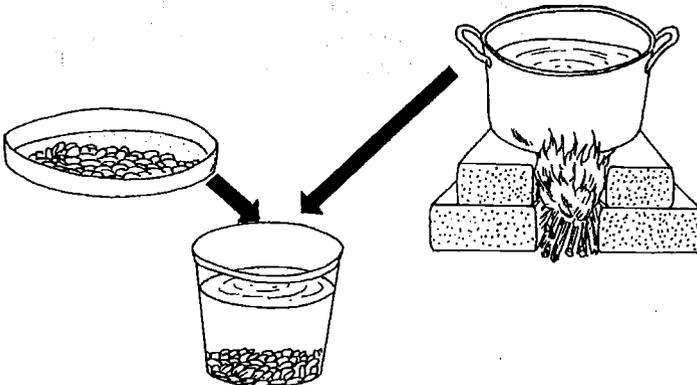
### Seed scarification

#### Small seed lots

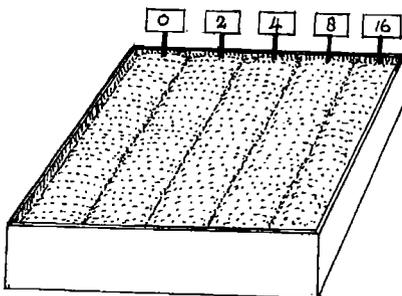


- use a knife or nail clippers to make a small nick in the rounded end of the seed
- do not cut at the pointed end as this will kill the seed

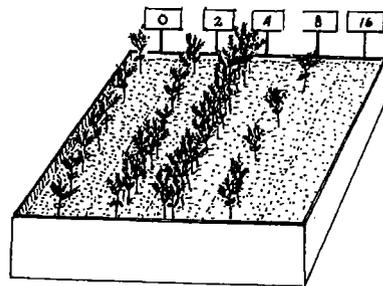
#### Large seed lots (>5000 seeds)



- put different samples of seeds in boiling water for 0, 2, 4, 8 and 16 seconds



- plant in a germination box in rows labeled for each time treatment



- after 8 days, count the number of seedlings for each treatment
- use the treatment that gives the best results to prepare the rest of the seeds for planting

## 14. HOW DO I GROW TREE LEGUMES? (continued)

### b) Seed inoculation

Tree legumes are valued for their ability take nitrogen from the air and make it into their own nitrogen fertiliser using Rhizobium bacteria. To be able to do this, the correct bacteria must be present. You may be able to purchase the bacterial inoculant locally. If so the inoculant needs to be applied to the seed.

*Commercial inoculum* may be available from the your Department of Agriculture or from agricultural stores. There are two ways to apply commercial inoculum.

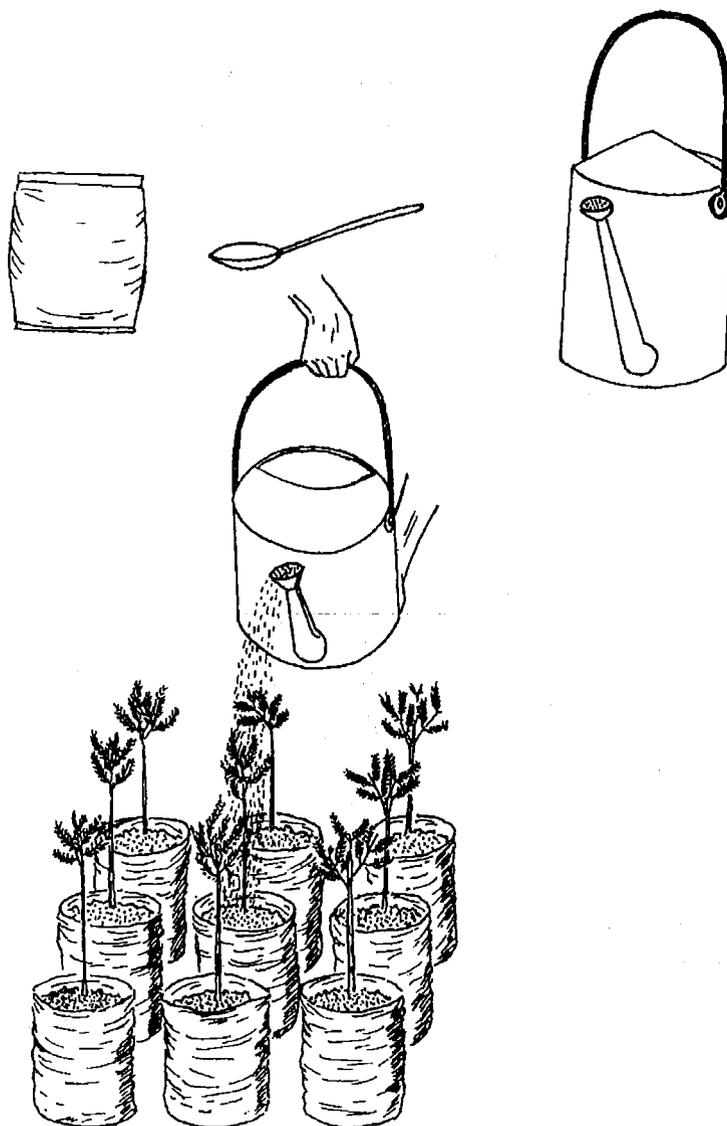
1. Mix the inoculant with water in a watering can and pour over the tree legume seedlings soon after planting in the nursery. One tablespoon of inoculant should be mixed in 9 litres of water.
2. Apply the inoculant to the seed using a "sticker". A sticker could be gum arabic or coconut juice. The inoculant is made into a damp paste with the sticker and then mixed thoroughly with the seed immediately prior to planting.

*Soil as inoculum*:- If inoculants are not available, collect soil from around the base of a healthy, vigorous tree of same species of tree legume growing in your district. This soil will contain the correct bacteria. Sprinkle this soil onto your seedlings in the nursery and water well.

## 14. HOW DO I GROW TREE LEGUMES? (continued)

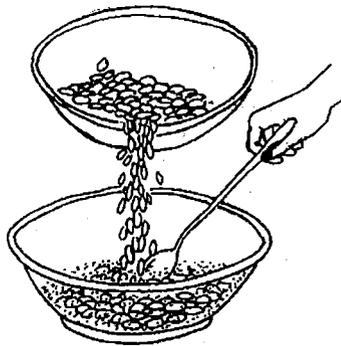
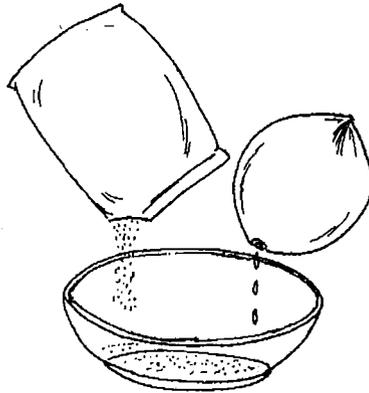
### Seed inoculation

#### *Commercial inoculum*



commercially purchased inoculant can be mixed with water, 1 tablespoon inoculant to 9 liters water, and poured over young seedlings

#### 14. HOW DO I GROW TREE LEGUMES? (continued)



- purchased inoculant can also be mixed with a "sticker" such as a small amount of coconut juice to form a paste which can be stuck to the seeds before planting

## 14. HOW DO I GROW TREE LEGUMES? (continued)

*Soil as inoculum*



- soil from a healthy tree of the same species can be used to inoculate tree seedlings
- dig soil from around the base of the tree, sprinkle this soil over the seedlings and water



## 14. HOW DO I GROW TREE LEGUMES? (continued)

### Growing tree legume seedlings

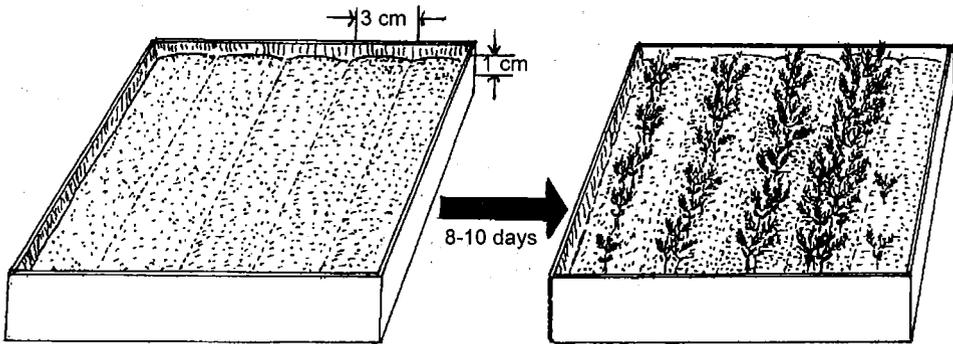
***Now that your legume seed has been scarified and inoculated it should be planted immediately.*** Seed can be planted in a germination container or directly into poly bags filled with a soil:compost mixture.

### Germination container

1. Treated seed can be germinated in river sand (not beach sand) in a shallow germination container. If river sand is not available use a free-draining sandy loam soil to germinate the seed.
2. Make a series of rows, 1 cm deep into the sand and 3 cm apart.
3. Plant seeds into the rows and cover with sand.
4. Place container in a shaded location and water daily.
5. After 8-10 days the first primary leaves will emerge and the seedlings can be planted into individual poly bays.
6. Seedlings can be easily damaged during transplanting.
7. Remove an intact portion of the sand with 10-20 seedlings from the germination container and place into a bucket of clean water. The sand will fall away from the roots and the seedlings can be removed without damage. Pick the seedlings up by the cotyledons rather than by the roots or stem. Carefully plant in pots.

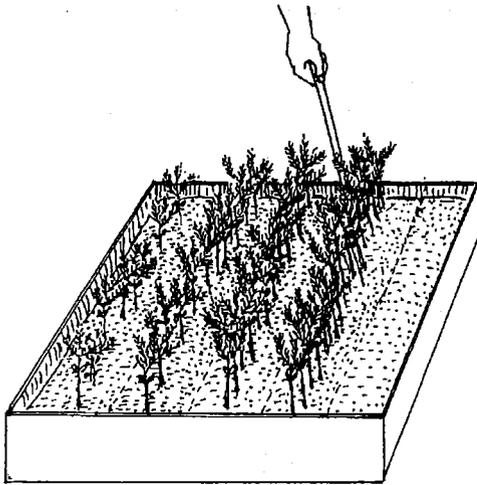
## 14. HOW DO I GROW TREE LEGUMES? (continued)

### Germination container

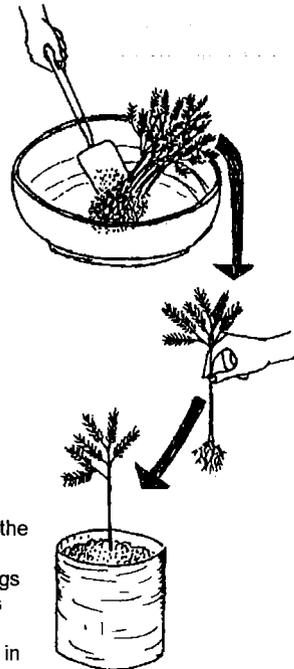


- fill with river sand
- distance between ditches 3 cm, 1 cm deep

seedlings



- remove a portion of the seedlings (10-20) with sand still attached and put into a shallow basin of clean water



- the soil will fall off the roots in the water
- to avoid damaging the seedlings pick them up by the coyledons rather than stem or roots
- seedlings can then be planted in pots or poly bags

## **14. HOW DO I GROW TREE LEGUMES? (continued)**

### **Potting up seedlings**

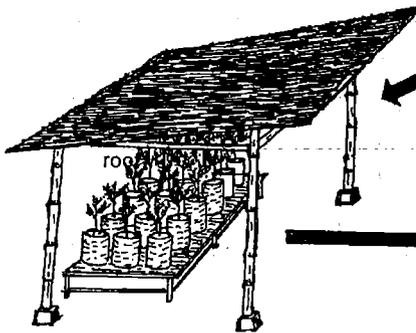
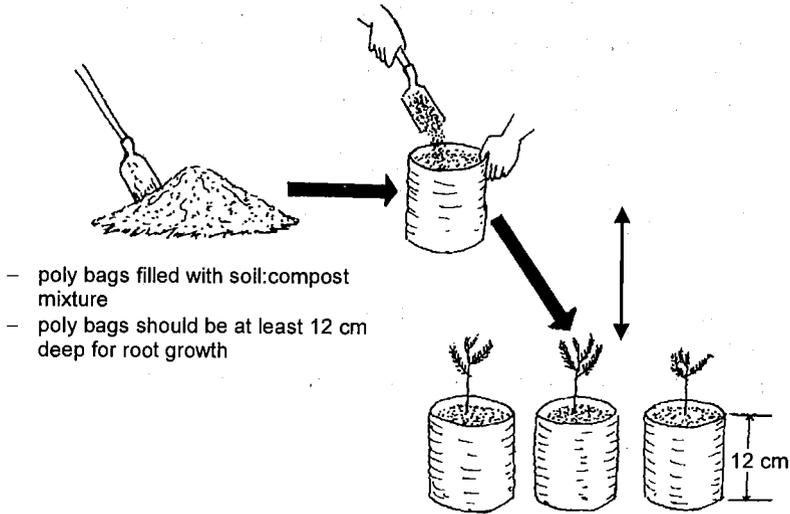
- seedlings should be planted into pots at least 120 mm deep to allow good root development
- pots can be poly bags, plastic or clay pots or bamboo sections
- the potting mix should be a free-draining sand or sandy loam
- add well-composted manures to the potting mix at a ratio of 1 part compost to 10-20 parts mix
- place pots in the shade of trees and water daily
- the seedlings should be ready for transplanting after 2-3 months
- to prepare seedlings for transplanting into the field they need to be hardened off by simply placing the seedlings in full sun for 2 weeks prior to transplanting

### **Field planting**

- the site to be planted should be clean of weeds
- dig a hole for planting at least twice the depth of the poly bag or pot
- mix a handful of well-composted manure or NPK fertilizer into the loose soil in the planting hole
- firm the soil around the seedling to exclude air from around the roots
- mulch an area of 1 meter around the base of the seedling to prevent weed growth
- keep weeded for 3-6 months after transplanting to encourage rapid establishment

## 14. HOW DO I GROW TREE LEGUMES? (continued)

### Potting up seedlings

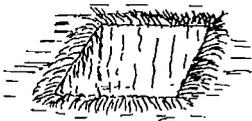


- place in shade and water daily for 2-3 months before field planting

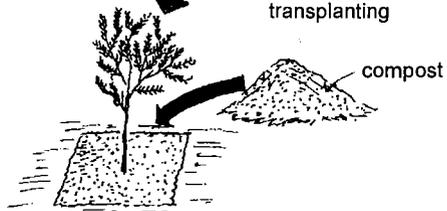


- to prepare for field planting, move poly bags into the sun 2 weeks prior to transplanting

### Field planting



- dig a hole for planting twice the depth of the poly bag



- mix compost with soil in the hole
- when planting, firm soil around roots
- keep area around trees weeded until established

## 14. HOW DO I GROW TREE LEGUMES? (continued)

### Vegetative propagation of gliricidia

The ease with which gliricidia can be vegetatively propagated is an important feature of this tree legume. Gliricidia is commonly used for living fences because of this feature. The size of the gliricidia stem used is dependant on method of fence construction. The Oxford Forestry Institute has studied gliricidia extensively and the following section on vegetative propagation is largely taken from Stewart *et al.* (1996).

### Gliricidia posts to support bamboo or barbed wire fences

- Select gliricidia stems that are 1.5-2 years old, about 6 cm in diameter and 2.5 m long.
- Stems should be straight and free of branches and the bark colour should be brownish-green. Stems should be cut at a slant at the sprouting end to prevent rotting.
- Take a knife and make several cuts on the end to be planted to stimulate root growth.
- Stems should be planted upright to a depth of 30-40 cm.

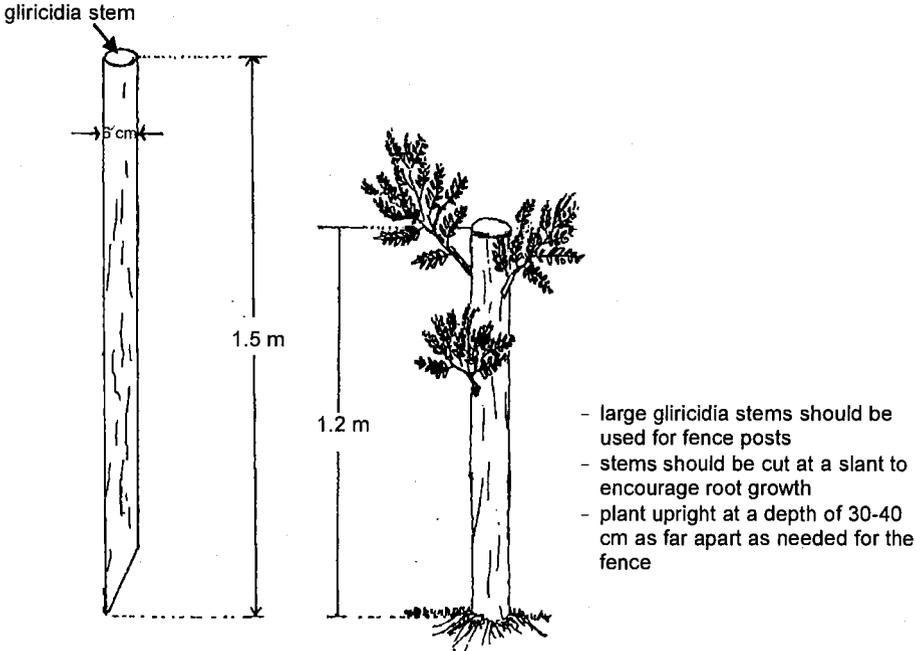
### Gliricidia cuttings for a stockades or for general fodder production

- Select gliricidia stems that are at least 6 months old, 50 cm long.
- Stems should be cut at a slant at the sprouting end to prevent rotting.
- Make several cuts on the end to be planted to stimulate root growth.
- Dense planting will produce an effective stockade and produce more forage.
- Cuttings should be planted on an angle to encourage rooting.
- Stems can be planted closely, 10 - 20 cm apart, to form a dense barrier (such as a living fence) or farther apart, 50 cm, for general fodder production.

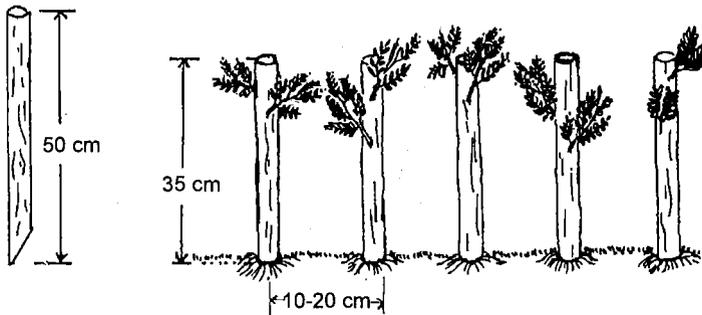
# 14. HOW DO I GROW TREE LEGUMES? (continued)

## Vegetative propagation of gliricidia

### Gliricidia posts to support bamboo or barbed wire fences



### Gliricidia cuttings for a stockades or for general fodder production



- smaller stems can be used to establish trees for fodder production
- stems should be planted at an angle
- plant closer for a dense barrier or farther apart (50 cm) for general fodder production

## 15. CONSIDERATIONS FOR COCONUT PLANTATIONS

### General

- Coconut trees should be tall enough to allow enough light to reach the ground for forage growth.
- Fencing may have to be provided to keep the animals in designated areas. Shepherding could also be done. *Gliricidia sepium* or *Erythrina* species can be used a living fence post to provide a source of tree legumes to the animal.
- Sheep or goats should be introduced into areas with palm tree spacing of about 8 x 8 meters.
- The area should have existing forage feed.
- The site should be far away from populated areas where dogs commonly stray.

### Management of native pasture

Uproot or cut the following to allow useful grasses and legumes to grow.

- *Imperata cylindrica*
- *Lantana camara*
- *Zingiber zerumbet*
- *Chromolaena odorata*
- *Trimfeta pilosa*

Periodically clip kudzu (*Peuraria* sp.) as animals prefer the young shoots.

Grasses, legumes, broadleaves and shrubs/trees preferred by goats and sheep (an example from the Philippines):

#### Grasses

*Cyrtococcum* sp.

*Paspalum conjugatum*

*Axonopus compressus*

*Cenhoteca lapacea*

*Schaemum aristatum*

*Digitaria* sp.

*Cyperus* sp.

*Eleusine indica*

#### Legumes

*Mimosa pudica*

*Centrosema pubescens*

*Pueraria lobata*

*Pueraria phaseoloides*

*Moghamia strobilifera*

*Calopogonium mucunoides*

*Cassia tora*

*Desmodium scorpius*

*Desmodium pulcellum*

#### Broadleaves

*Blechnum pyramidatum*

*Norreria leavis*

*Curcuma zedoaria*

*Cyathula prostrata*

*Elephantus spicatus*

*Hyptis rhomboidea*

*Ipomea batatas*

*Mikania cordata*

#### Shrubs/Trees

Coconut

*Musa* sp

*Psidium guajava*

*Sida rhombifolia*

*Triumfeta pilosa*

*Urena lobata*

*Leucaena leucocephala*

*Gliricidia sepium*

#### Rotational grazing

- ⇒ to lessen parasite infections paddocks should be left ungrazed for 8-12 weeks
- ⇒ four to five paddocks preferred
- ⇒ animals should be moved when over 50% of the forage has been eaten

## 15. CONSIDERATIONS FOR COCONUT PLANTATIONS (continued)

### Management of improved pasture

#### Species to plant

- ⇒ give preference to creeping species such as stargrass, *Brachiaria humidicola* and viny legumes such as *Centrosema pubescens*

#### Pasture establishment

- ⇒ plow the land and allow it to fallow before the rainy season. Before planting, plow and harrow again to get rid of weeds.
- ⇒ cuttings of signal grass or humidicola may be planted at 50 cm spacing within a row and 50-70 cm between rows
- ⇒ broadcast signal grass or humidicola seeds at 3-5 kg per hectare
- ⇒ centrosema can be sown at the rate of 8 kg/ha
- ⇒ pasture can be grazed after about six months

Fertilisation. Fertiliser requirements will vary according to local conditions and cost. An example of what could be applied is:

- ⇒ apply a complete fertiliser such as (14-14-14) at time of planting
- ⇒ apply 1-2 bags ammonium sulfate (21-0-0) per ha of pasture towards the end of the rainy season
- ⇒ 1 bag of phosphate per hectare at the start of the dry season
- ⇒ potassium chloride (0-0-60) at 2 kg/coconut tree

Weeding. Newly established pastures need to be weeded to keep out undesirable species.

Carrying capacity. A properly managed improved pasture can support up to 12-20 animals per hectare per year with appropriate supplementation (150-300 grams/day) when forage availability is low.

### Tree legume management

- ⇒ fodder trees can be used as live fence posts
- ⇒ plant simultaneously with fencing towards the end of the rainy season
- ⇒ wait six months before grazing or cutting
- ⇒ cut trees 1-1.5 meters to encourage regrowth with the leaves fed in the barn or pasture

### Feeding

- ⇒ during the dry season concentrates should be fed at 150-300 grams per day
- ⇒ crop residues such as corn stover, fruit tree leaves and peelings, sugarcane tops among others can be fed
- ⇒ other feeding recommendations are found earlier in the **Nutrition and Feeding Strategies** section



## **MANAGEMENT AND HOUSING**

- 1. Animal shelters**
- 2. Building an animal barn**
- 3. Animal barn design**
- 4. Elevated barn and its parts**
- 5. Barn construction**
- 6. Partitions for animal barns**
- 7. Management of the barn**
- 8. Maintaining cleanliness of the animal barn**
- 9. Making manure compost**
- 10. Animal health care**
- 11. Considerations for large flocks**
- 12. Materials needed for a large sheep barn, estimates for 100 ewe flock**

## **1. ANIMAL SHELTERS**

**Raising sheep or goats intensively demands adequate animal housing.**

**The barn has several functions:**

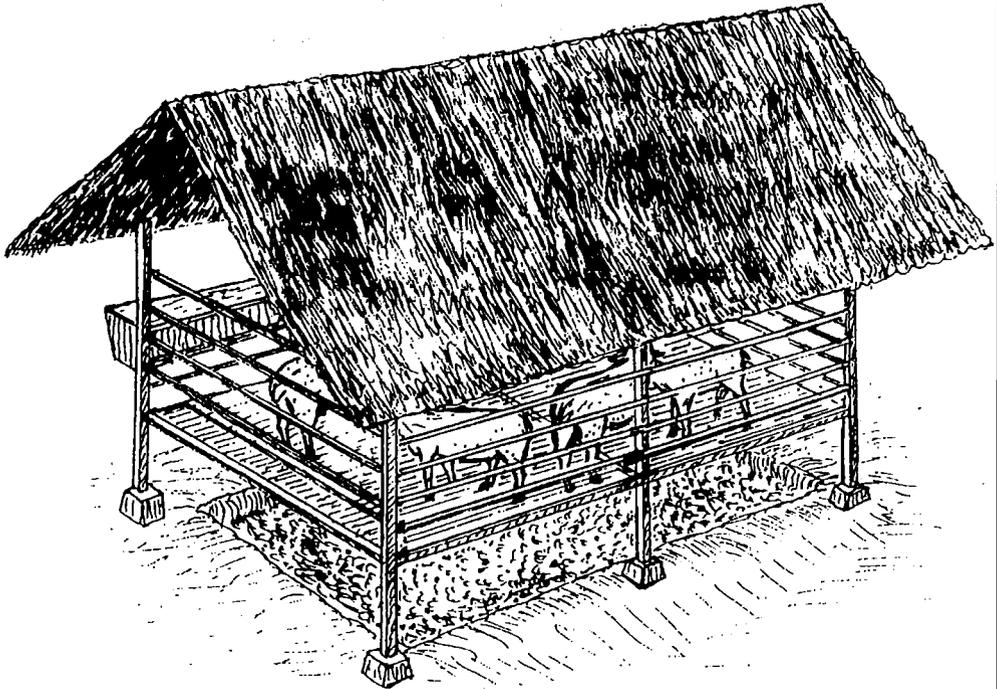
- protects the animals from predators
- prevents theft of animals
- prevents the animals from damaging trees and crops
- provides a place to sleep and rest
- provides a place for mating and giving birth
- provides a single location for collecting manure
- provides a place to take care of sick animals
- makes management and control of the animals easier

**When considering these functions, there are several things to be noted:**

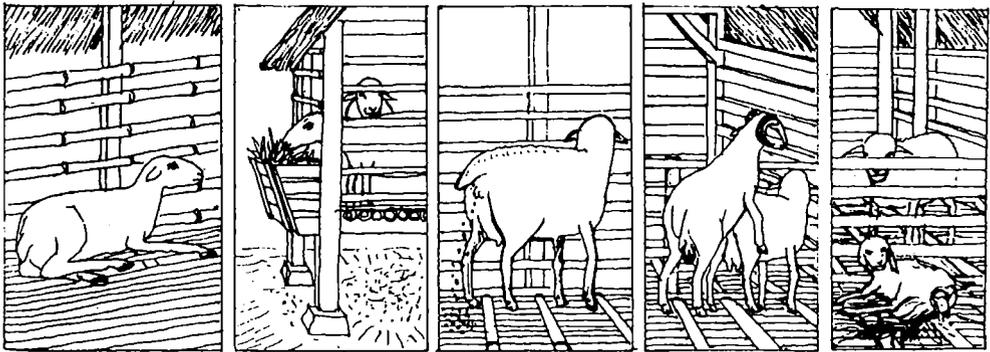
- the animal barn should be strong to last a long time
- the barn has to be maintained regularly
- the animal barn has to be cleaned routinely to help keep the animals in a healthy condition
- repairs should be made immediately so that the damage will not spread
- the size of the barn should be according to the number of animals being raised

# 1. ANIMAL SHELTERS

## ANIMAL BARN AS A SHELTER



## ANIMALS BARN AS A PLACE FOR ANIMAL ACTIVITIES



resting

eating

excreting

mating

lambing

## **2. BUILDING AN ANIMAL BARN**

### **Considerations when building an animal barn:**

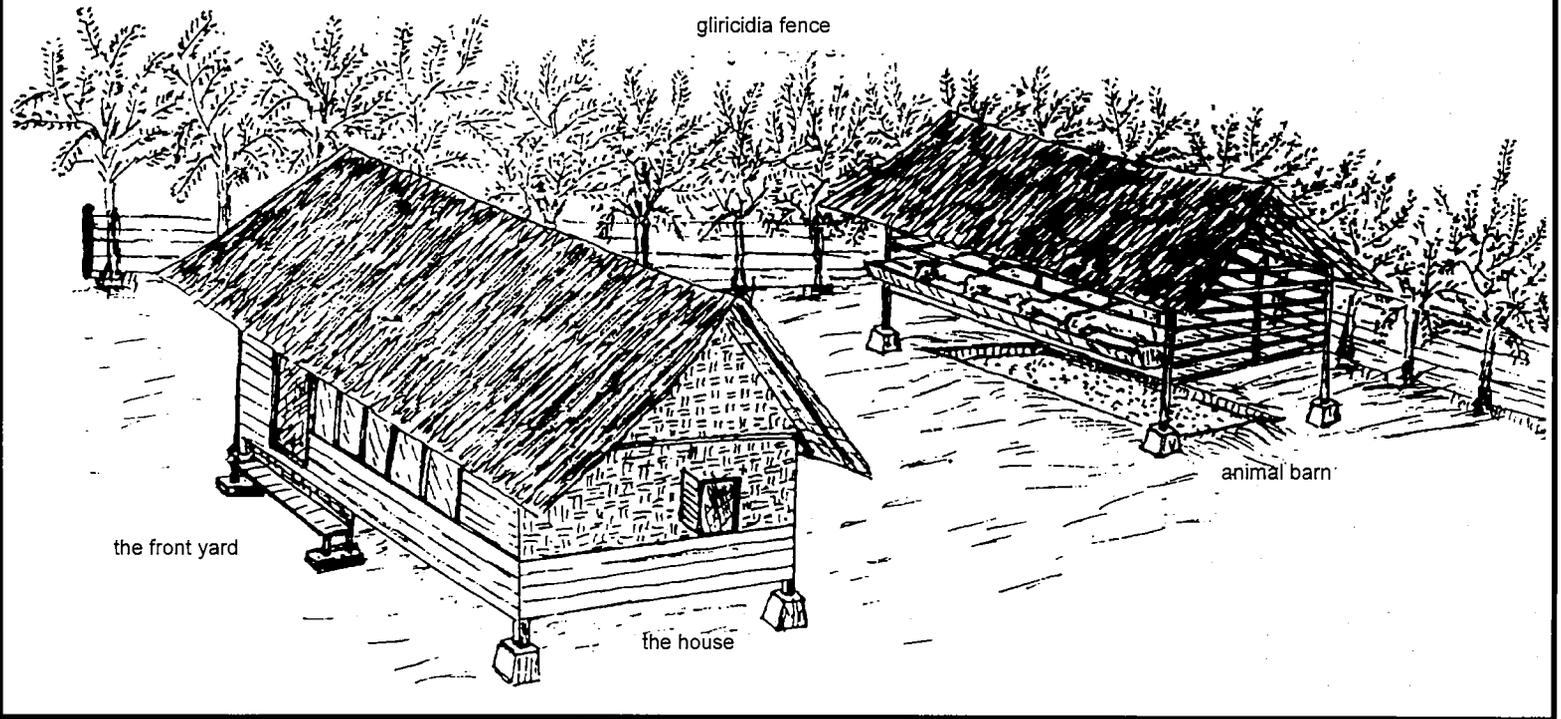
- choose a dry area that is not likely to be flooded with water
- the distance between the animal barn and a farmer's well should be quite far (at least 10 meters)
- the animal barn should receive the morning sunshine evenly and be well ventilated
- protected from direct wind, especially at night
- close enough to the farmers house for security at night

### **Materials for building an animal barn:**

- available in the local area
- inexpensive but strong enough to last a long time
- be able to resist rot and insects

## 2. BUILDING AN ANIMAL BARN

1. Located behind the house.
2. The distance from the well to the barn should be a minimum of 10 meters.
3. Close enough to the house for security.



### **3. ANIMAL BARN DESIGN**

The best design for a sheep or goat barn is to have it elevated off the ground with slatted floors. This is especially true for areas with lots of rain. This type of barn can help keep the animals healthy and productive. While there is no minimum height for the distance from the ground to the floor, a height of at least 60 cm allows for easy cleaning underneath and is not too high that animals or people have a hard time entering.

#### **Advantages of a raised barn:**

- cleaner because feces and urine fall through the floor to the ground
- easier to clean
- barn floor stays drier
- drier floor reduces the growth of germs and flies which can carry disease
- easier to collect manure for use or sale

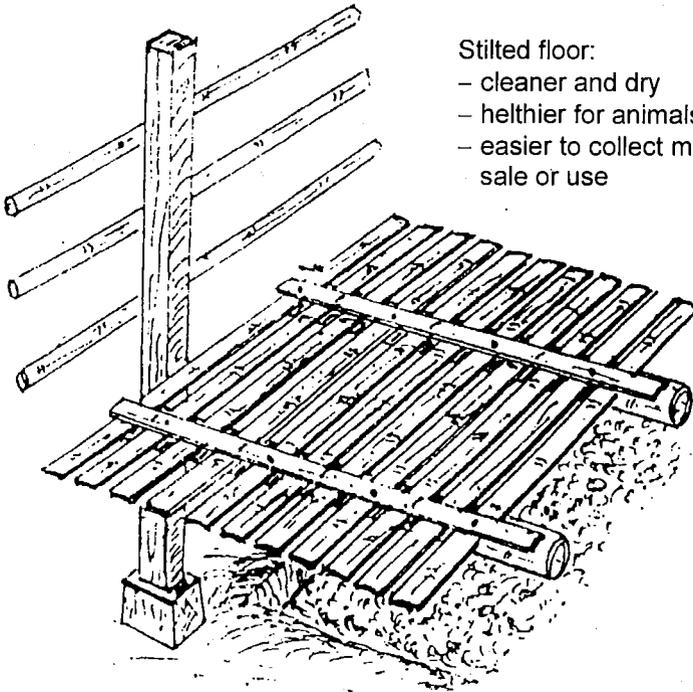
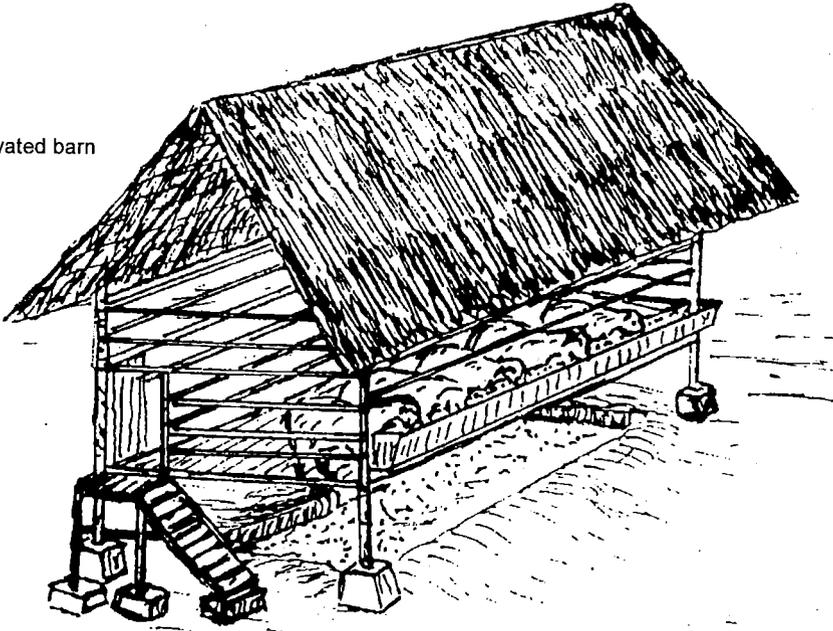
#### **Disadvantages of a raised barn:**

- costlier to build
- harder to expand when animal numbers increase
- animals may fall through holes in the floor if not well maintained

While there are disadvantages, the advantages, especially of reduced disease, make the building of a raised barn better in the long run.

### 3. ANIMAL BARN DESIGN

elevated barn



- Stilted floor:
- cleaner and dry
  - healthier for animals
  - easier to collect manure for sale or use

## 4. ELEVATED BARN AND ITS PARTS

### 1. Roof

- ⇒ provides a shelter to protect the animals from rain and heat.
- ⇒ materials that can be used:
  - palm leaves/palm fronds
  - grasses
  - roof tiles
  - zinc sheeting and others
- ⇒ slope of roof is important. Palm leaf/frond and grass roofs need greater slope than roofs of zinc sheeting. Greater slope is also needed in areas with high rainfall.
- ⇒ a large overhang is needed to keep rain from blowing in to keep the sheep dry.

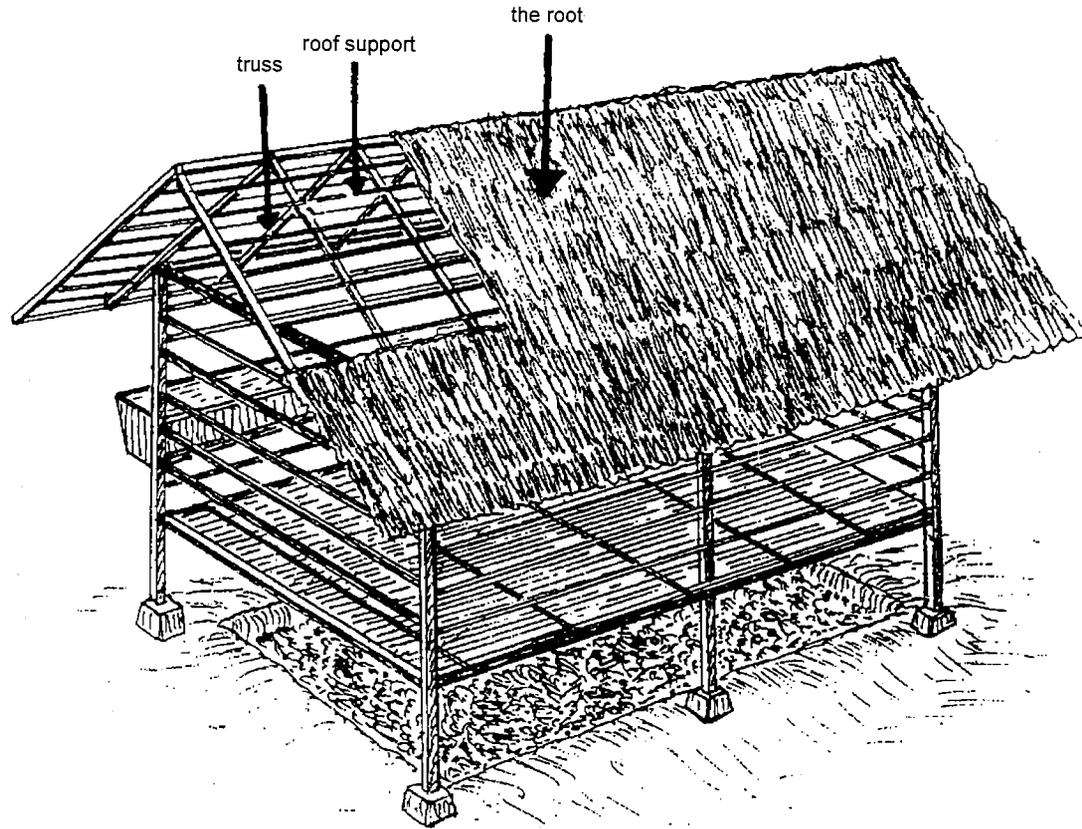
### 2. Roof trusses:

- ⇒ provides support for the tile supports and roof materials
- ⇒ materials:
  - bamboo (diameter  $\pm$  5 cm)
  - sago palm timber
  - coconut palm

### 3. Roof tile supports:

- ⇒ provides support for roof materials
- ⇒ materials:
  - split bamboo
  - roof made from palm leaves or grasses does not require roof tile supports and these are tied directly to the roof trusses.

#### 4. ELEVATED BARN AND ITS PARTS



## 5. BARN CONSTRUCTION

### 1. Main column/frame

- ⇒ supports the whole pen and animal load
- ⇒ materials:
  - timber ± 12 x 12 cm
  - split coconut trees
  - large trunks, thick bamboo (diameter ± 14 cm)

### 2. Horizontal frames

- ⇒ supports the slotted floor and animal load
- ⇒ materials:
  - timber ± 12 x 12 cm
  - split coconut trunks
  - large, thick bamboo (diameter ± 14 cm)

### 3. Purlins

- ⇒ supports the roof supports and roofing materials
- ⇒ materials:
  - wood 12 ± 6 cm
  - bamboo (diameter ± 10 cm)

### 4. Vertical frames:

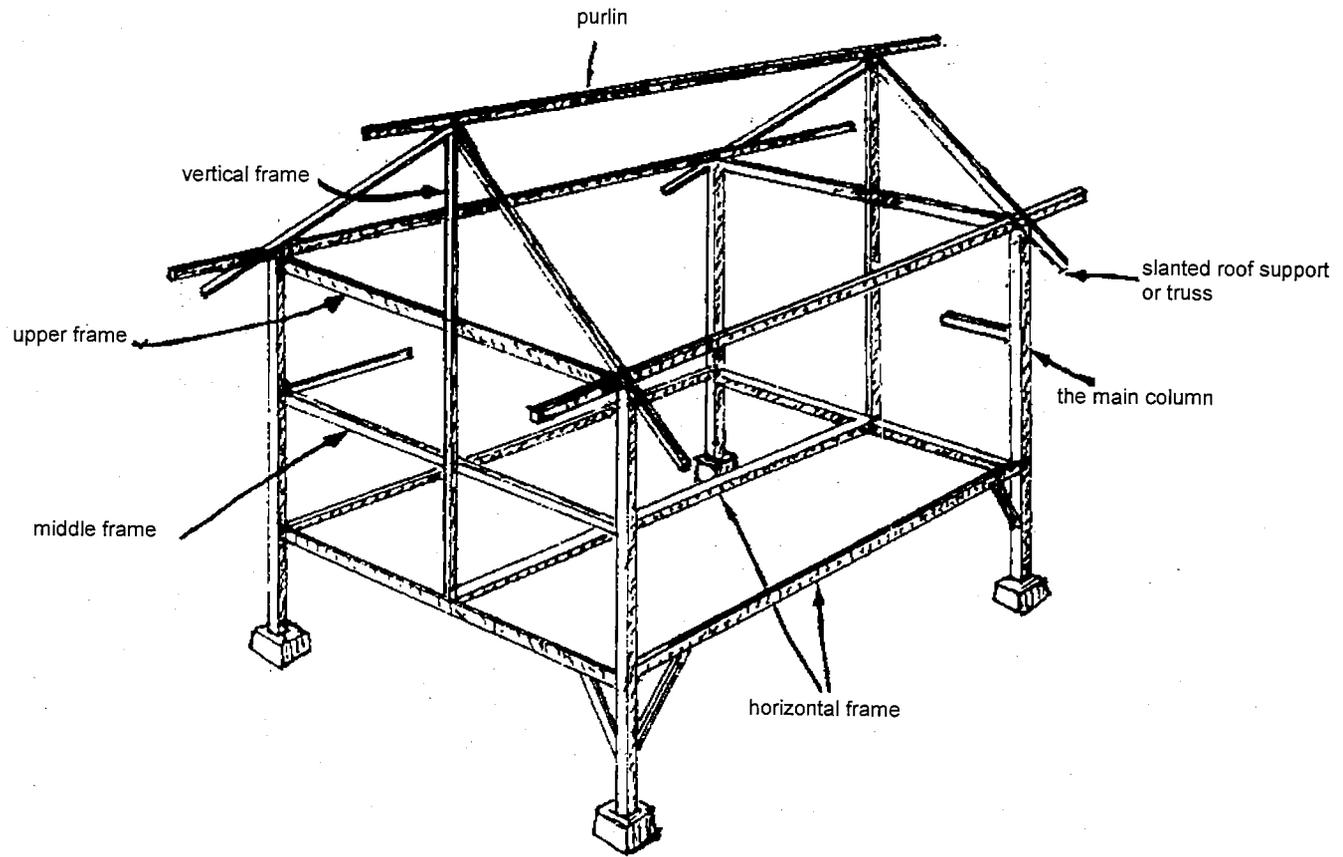
- ⇒ supports purlins
- ⇒ materials:
  - wood ± 12 x 6 cm
  - bamboo (diameter ± 10 cm)

### 5. Middle frames

- ⇒ strengthens the entire barn and holds up the walls
- ⇒ materials:
  - wood ± 12 x 6 cm
  - bamboo (diameter ± 10 cm)

**Note:** For large commercial units more sophisticated barn designs are needed. For these barns only commercial timber should be used for framing purposes.

## 5. BARN CONSTRUCTION



## 5. BARN CONSTRUCTION (continued)

### 6. Bracing

- ⇒ makes the entire construction stable
- ⇒ materials:
  - wood  $\pm$  12 x 6 cm
  - bamboo (diameter  $\pm$  10 cm)

### 7. Walls

- ⇒ functions as a barrier to keep the animals in the pens. Walls should not be solid but open to allow air movement keeping the pens dry. This reduces the chance of pneumonia and decreases growth of disease carrying germs. Only in areas where nighttime temperatures get extremely cold should some walls be solid.
- ⇒ materials:
  - wooden boards with spaces between
  - small bamboo poles (diameter  $\pm$  5 cm) or split bamboo.
  - the distance between poles is 5 - 10 cm for adult animals and 5 cm or less for lambs and kids
  - the distance between poles for the front wall with the feed trough should be 20 cm so animals can get their heads through to eat.

### 8. Floor supports

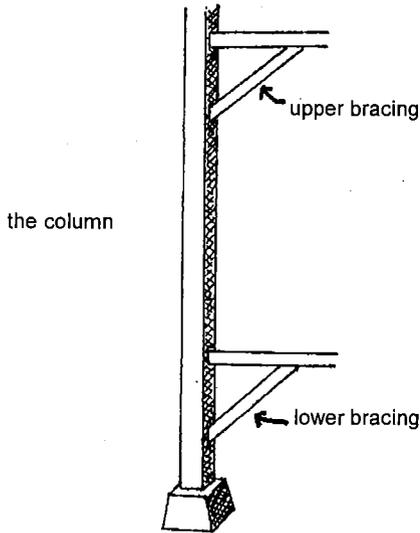
- ⇒ supports the weight of the floor and weight of the animals
- ⇒ materials:
  - bamboo poles (diameter  $\pm$  7 - 8 cm)
  - timber
  - distance between the floor supports is  $\pm$  20 cm

### 9. Floor

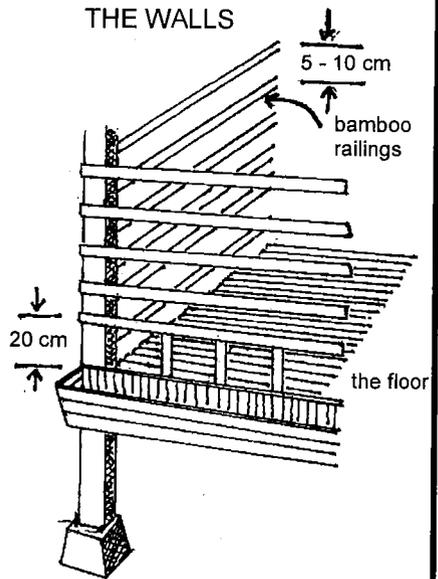
- ⇒ provides a platform for supporting the weight of the animals
- ⇒ materials:
  - wooden boards with a  $\pm$  2.5 cm thickness,  $\pm$  4 - 6 cm width
  - split bamboo ( $\pm$  3 - 4 cm width)
  - spacing between board should be 1.5 cm for adults and 1.3 cm for lambing pens due to the small size of lamb's legs
  - a matchbox on edge with a width of 1.5 cm is easy to use when nailing the floor down to get the correct spacing
- ⇒ for all but the smallest barns, the use of commercial wood for flooring is preferred. It is more expensive but will last much longer and the evenness of the slats is much better for the animals than the uneven surface of bamboo floors. Wooden floors will also not break as easily and will result in less animal injuries.

## 5. BARN CONSTRUCTION (continued)

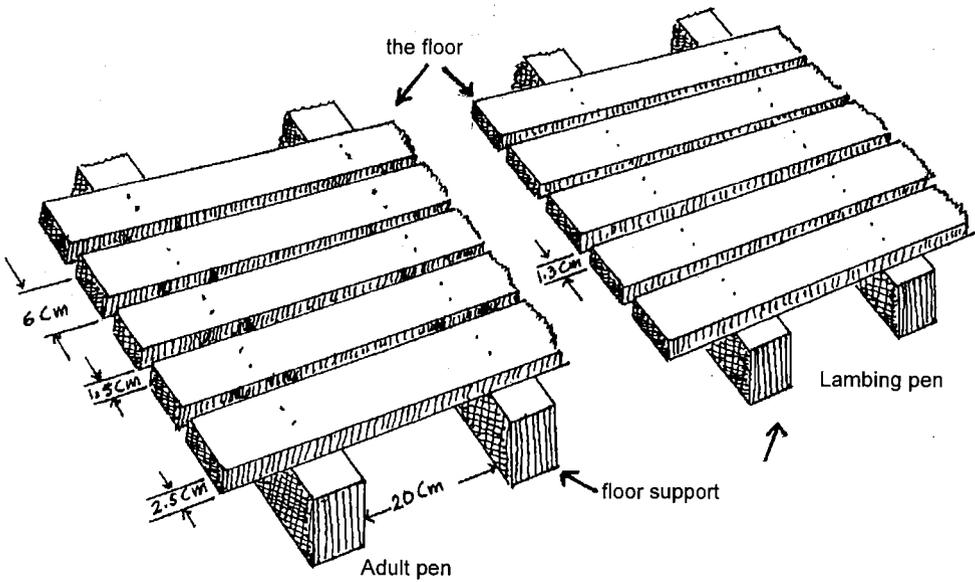
### BRACING



### THE WALLS



### THE FLOOR



## 5. BARN CONSTRUCTION (continued)

### 10. Stairs

- ⇒ used by both animals and people to enter the barn. They should be strong enough to support the weight of people entering the barn.
- ⇒ materials:
  - wooden boards
  - the flat sides of split coconut or other tree trunks
  - crosspieces nailed on them serve the purpose of holding them together and providing footholds for animals and people
  - need to be wide enough so that animals can easily enter and exit the barn without falling
  - can be straight out from the barn or lay along the side
  - can be removeable for storage at night to prevent predators and people from climbing to the barn door

### 11. Feed trough

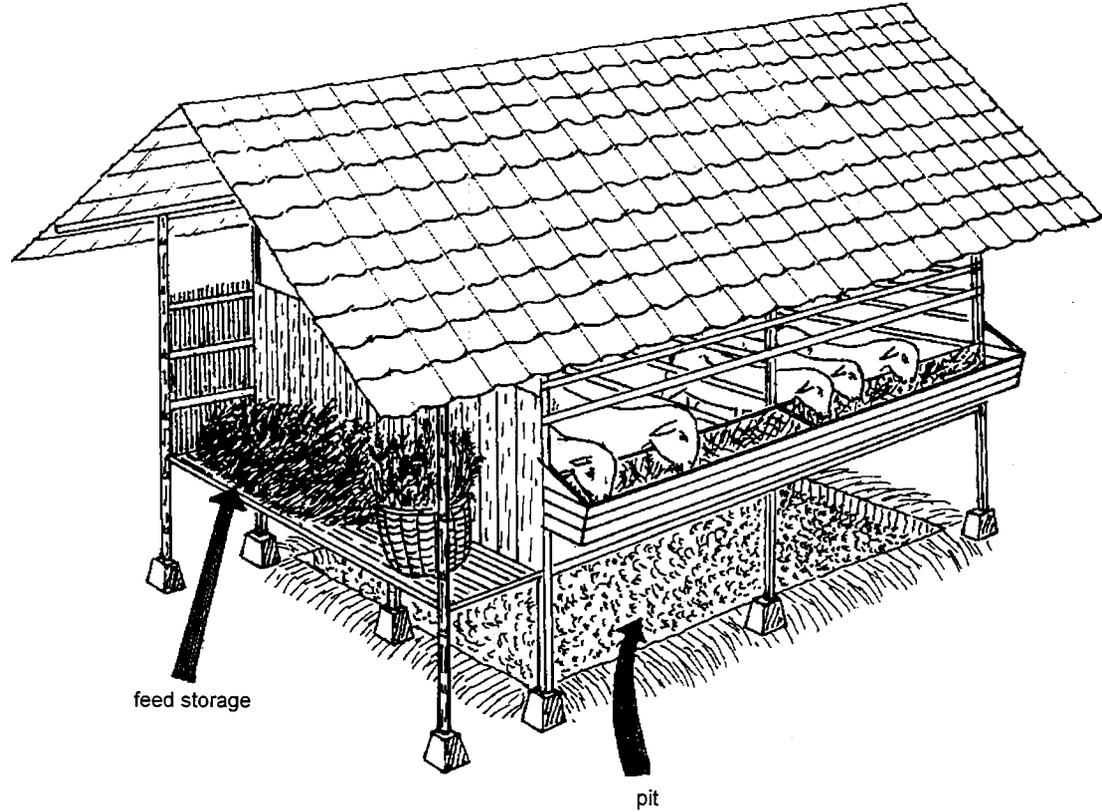
- ⇒ keeps the forages from falling to the ground and should prevent the animals from walking on their feed
- ⇒ materials:
  - boards
  - bamboo mats
  - usually hung on the wall outside the pen easily accessible for feeding and cleaning
  - width is  $\pm$  30 cm
  - depth is  $\pm$  20 cm
  - should run the length of the barn, minimum 30 cm per adult animal
  - the young lambs cannot usually reach the feed trough and a step may be added inside that allows the young lambs to step up and reach the feed
- ⇒ should be cleaned daily of uneaten forage and any dirt or feces that may have fallen in. Compost this material with manure. (see **9. Making Manure Compost**)

### 12. Feed storage

- ⇒ provides an area for storing the forages before being offered to the animals
- ⇒ do not locate it too close to the animal pens or it may be contaminated with manure

5. BARN CONSTRUCTION (continued)

FEED TROUGH AND FEED STORAGE

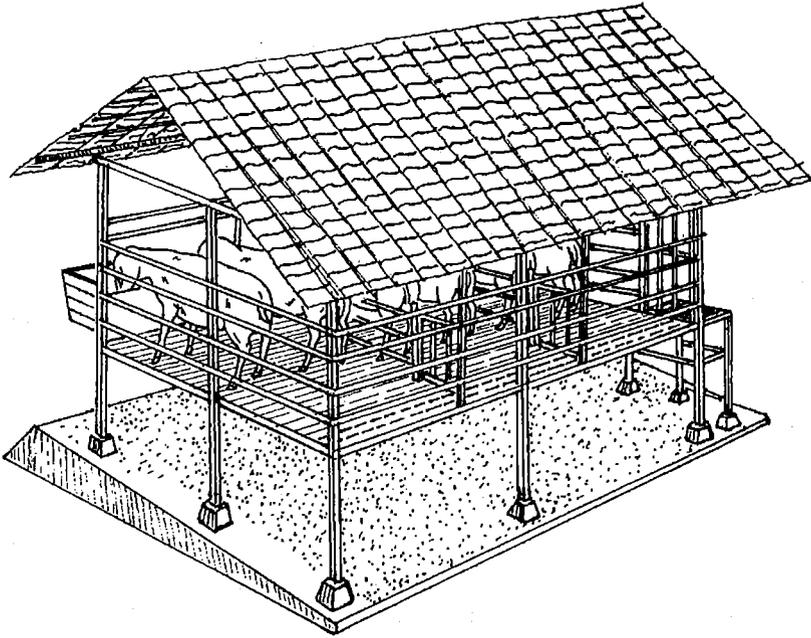


## 5. BARN CONSTRUCTION (continued)

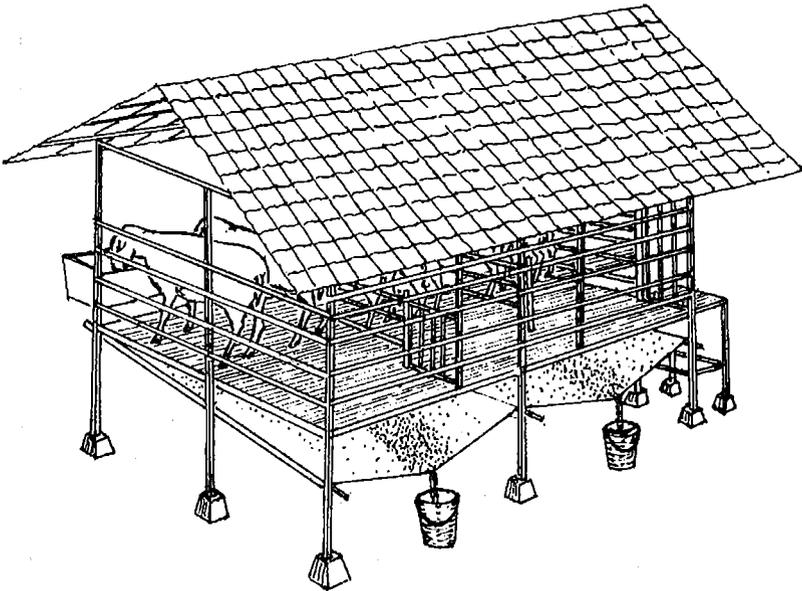
### 13. Underneath the pen

- ⇒ provides a waste area for feed residues, manure and urine
- ⇒ construction can be one of the following:
  - a pit, 40 - 50 cm deep, with a ridge around the pit higher than ground level to prevent the pit from becoming flooded.
    - cheapest alternative
    - manure can be left to build up for 1 - 2 weeks
  - the area under the barn may be laid with concrete sloped to one side to allow urine to run off and not accumulate.
    - more expensive
    - an remove manure using a pole with crosspiece from side, no need to crawl under barn
  - for small barns a sheet of plastic, sloped to drain into a bucket, can be nailed underneath. The bucket can be located at the middle of one end or under a hole in the middle of the plastic.
    - collects urine with manure increasing fertiliser value for crops and compost
    - keeps area very neat, clean and dry
    - bucket must be emptied often
    - cost of plastic sheet
    - probably not practical for large flocks
- ⇒ the frequency of cleaning depends upon the type of manure collection method used. Pits should be cleaned every 1 - 2 weeks, concrete slabs should be scraped weekly and buckets under plastic will need to be emptied as needed but at a maximum of every 2 - 4 days.

## 5. BARN CONSTRUCTION (continued)



- a concrete slab sloped to one side underneath the barn makes manure collection easier



- for small barns a plastic sheet sloped to a bucket will keep the area clean and also catch urine increasing fertiliser value

## 6. PARTITIONS FOR ANIMAL BARN

### A. Animal barn partitions (pens)

- ⇒ It is necessary to have separate pens in an animal barn.
- ⇒ The advantage of the partitions is to separate the animals based on their physiological status. There are several advantages to partitioning a barn:
  - feeding the animals according to their needs is easier
  - a mating schedule is easier to follow
  - helps prevent inbreeding
  - the males will not disturb the other animals
  - lactating ewes can look after their lambs better
  - the pregnant ewes can give birth in a more relaxed environment
  - mating when too young can be prevented
  - sick animals can be isolated
- ⇒ Within these groups some further distinctions may be made. For example, in larger flocks group animals according to age and size. Weaned ram lambs of the same size should be together and not mixed with younger, smaller animals or the smaller animals will not be able to compete for feed and will grow more slowly. Also, pregnant females close to parturition should be penned separately from adult males and nursing females. Partitions on adult male pens should be high enough so that they cannot jump out.

### B. Size of pens, space / animal

⇒ adult males (>12 months old)	1.0 - 1.2 m <sup>2</sup>
⇒ adult females (>12 months old)	0.7 - 1.0 m <sup>2</sup>
⇒ lactating females	0.7 - 1.0 m <sup>2</sup>
⇒ + 0.5m <sup>2</sup> for each kid/lamb	
⇒ young males/females (7-12 months old)	0.75 m <sup>2</sup>
⇒ weaning kids/lambs (3-7 months old)	0.50 m <sup>2</sup>

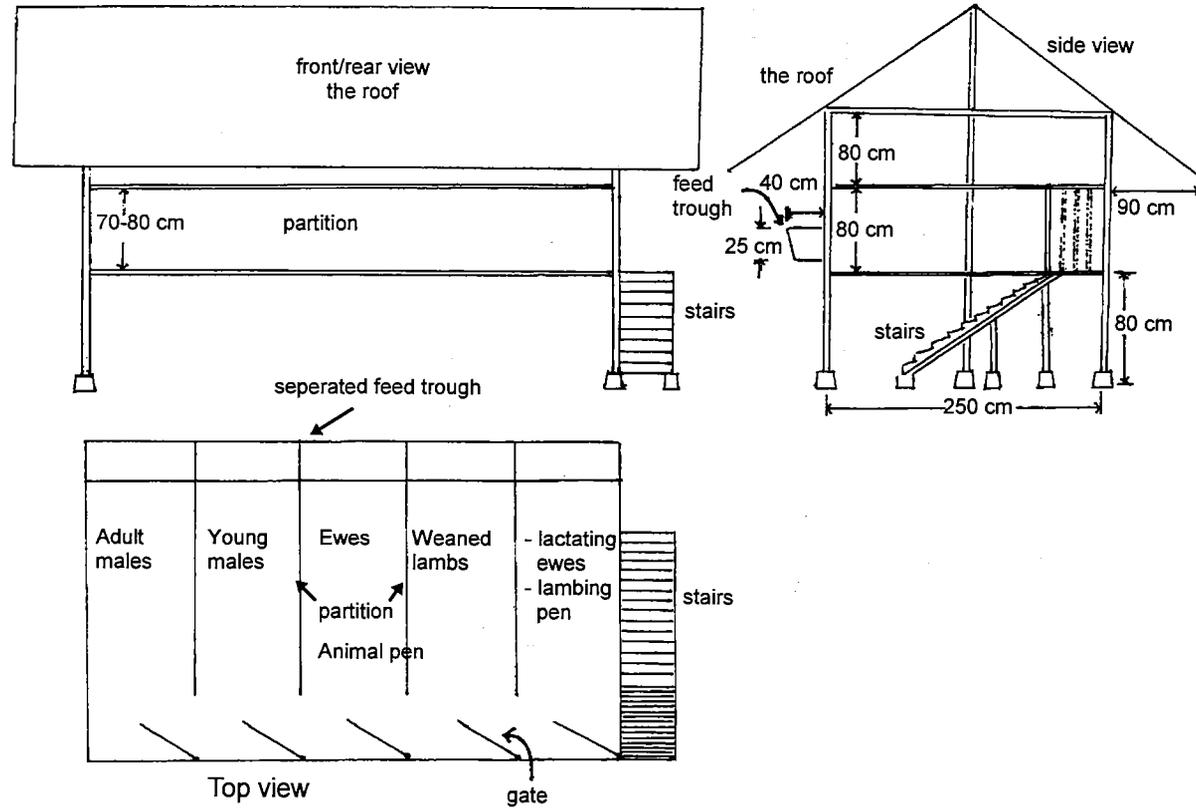
**Note:** If space is limited, there should be at a minimum separate pens for adult males, young males, pregnant ewes and young weaned lambs. If more space is available, separate those ewes close to lambing from ewes with lambs and younger ewes that need to be bred. To change size of pens, partitions can be added by nailing in boards or poles as needed or removing existing partitions to increase pen size.

### C. Aisles in barns

In small barns there is no need for an aisle in the center or along the side. In larger barns housing many more animals, a center aisle makes it easier to separate animals and monitor breeding. The inner walls along the center aisle must be tall enough so that a ram cannot jump over. This prevents unintended matings and matings with sisters or daughters.

## 6. PARTITIONS FOR ANIMAL BARN

### THE CROSS SECTION OF AN ANIMAL BARN



## **7. MANAGEMENT OF THE BARN**

- A. The barn must be well maintained.
- B. The barn must be kept clean and dry.
- C. The damaged areas must be repaired immediately to prevent injury to the animal. Any injury to the animal increases the chance for infection and disease.

### **Areas that need constant attention include:**

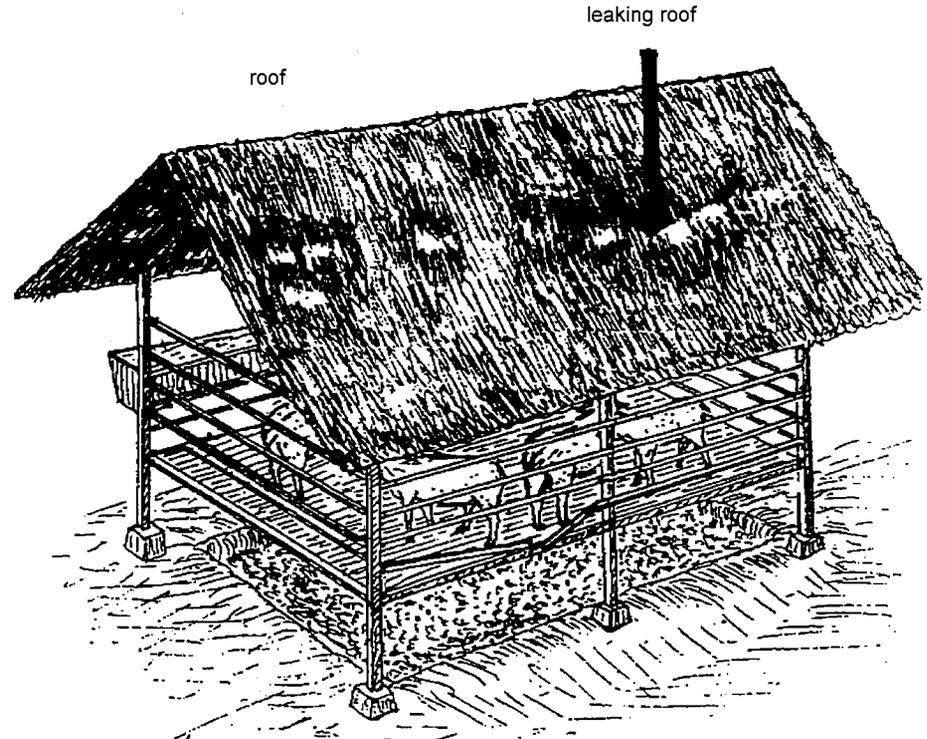
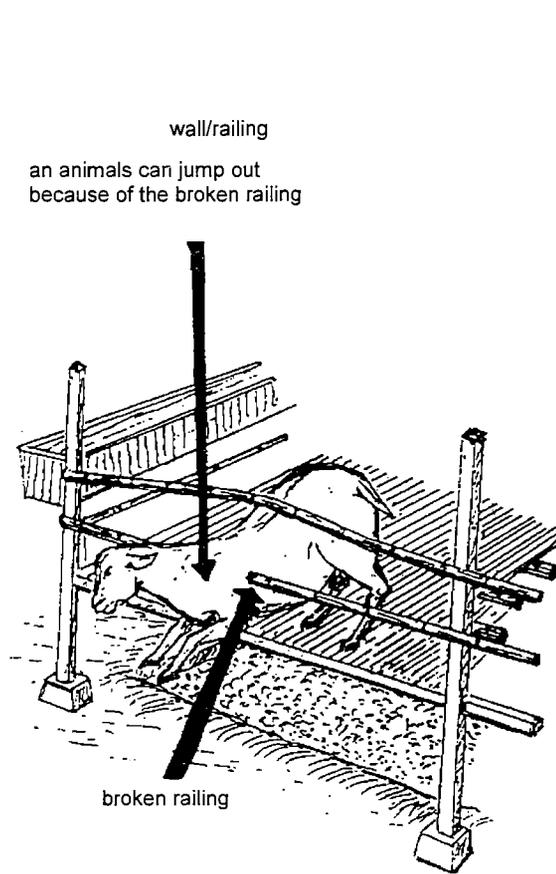
#### **1. Roof**

- ⇒ if the roof is made from palm leaves/grass it will need to be repaired every 1 ½ - 2 years.
- ⇒ a leaking roof can cause other areas to be gradually damaged
- ⇒ a leaking roof has to be repaired as soon as possible
- ⇒ a roof made from palm leaves/grass has to be replaced every 3 years, depending on rainfall

#### **2. Walls**

- ⇒ the walls can be easily broken if animals hit them
- ⇒ repair broken walls immediately to prevent animals from escaping or being injured
- ⇒ the males are usually more active and stronger and may butt the walls with head and horns, thus the walls in ram pens must be strong

## 7. MANAGEMENT OF THE BARN (continued)



Leaking roof can cause:

1. other parts to be damaged especially the floor
2. animals will get wet and cold increasing risk of disease

## **7. MANAGEMENT OF THE BARN (continued)**

### **3. Floors**

- ⇒ these parts are easily broken because:
  - the materials gradually rot due to manure and urine from the animals. Leaks in the roof will speed up the rotting.
  - they support the animal load
- ⇒ prevention of damage:
  - cleaning the floor regularly to keep it clean and dry
  - immediately repair any leaks in the roof
  - if bamboo is used for flooring, it should be thick and mature

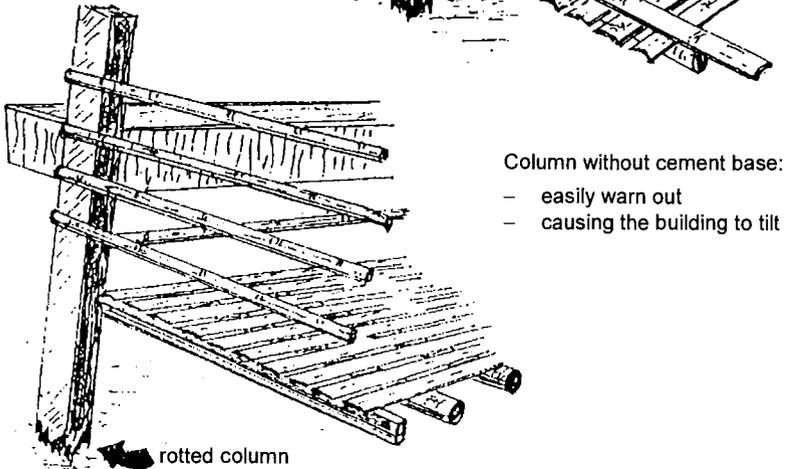
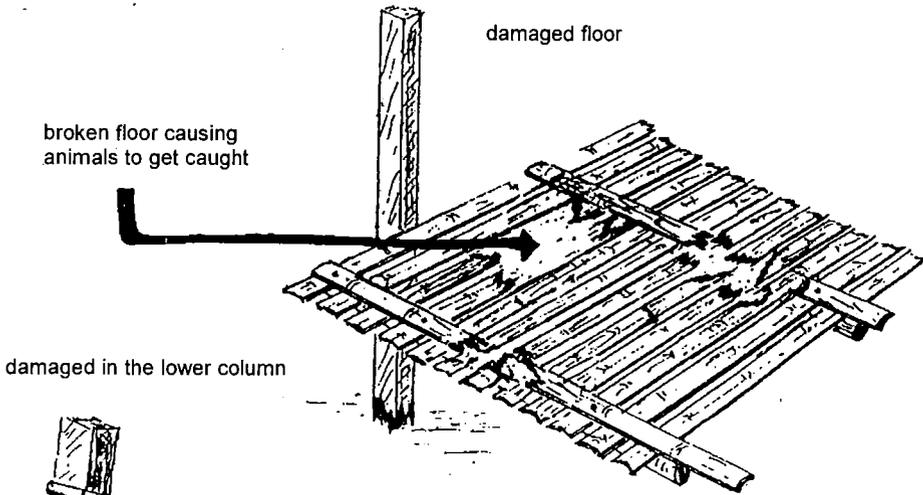
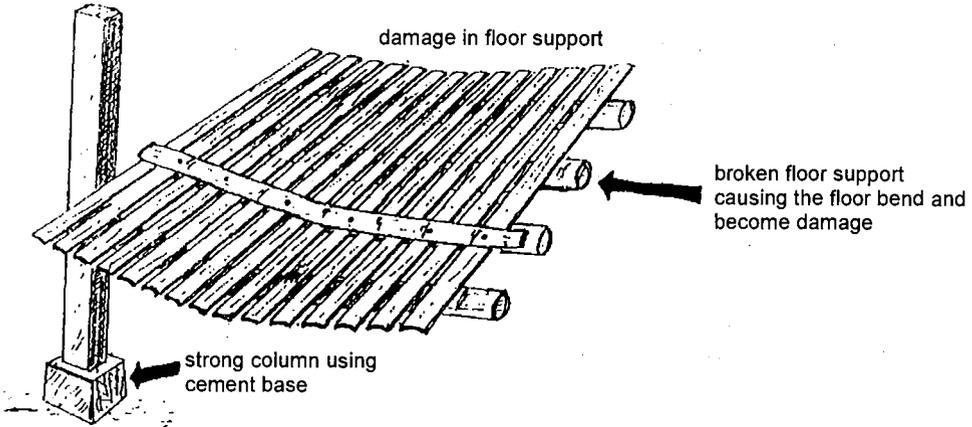
### **4. Main support frames**

- ⇒ the main columns should be strong as they support the whole barn
- ⇒ preventing damage
  - a base of cement or large stones should be used to support the main frame. This keeps the wood out of manure, urine and water that may collect on the ground and cause the wood to rot.
  - if the main supports are rotten, the barn may lean to one side or fall down.

### **5. General**

- ⇒ there should be no nails or other sharp points in the barn where animals can suffer injury as this can lead to sick animals.

## 7. MANAGEMENT OF THE BARN (continued)



## **8. MAINTAINING CLEANLINESS OF THE ANIMAL BARN**

**The cleanliness of the barn and health of the animals is based on the following:**

### **1. The floor:**

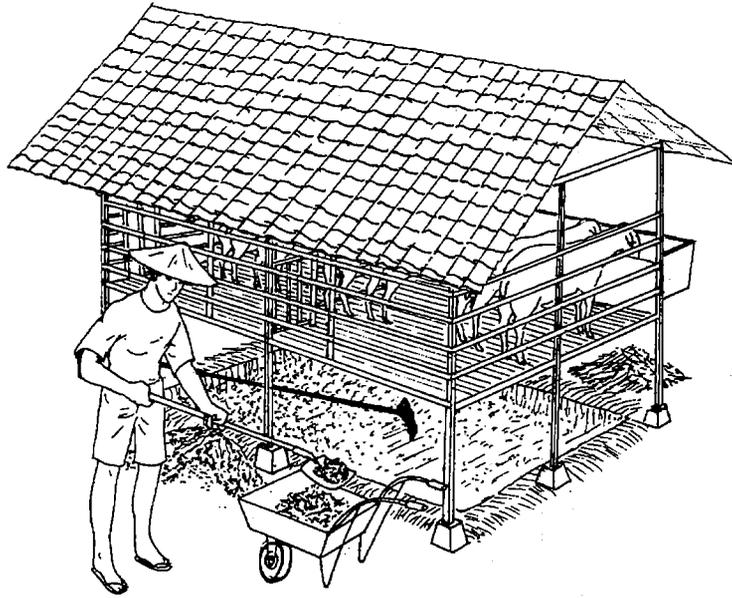
- ⇒ the floor may be broken or rotten
- ⇒ germs that cause disease can grow well in a dirty area
- ⇒ the animals can be easily infected from a dirty floor and cause:
  - unhealthy animals
  - high death rate, especially among lambs
  - slow growth rate
  - low productivity
- ⇒ to help prevent these unhealthy conditions, clean the floor each day by sweeping any dirt or feces to the ground when the animals are grazing or resting.

### **2. Underneath the barn:**

- ⇒ a pit, concrete slab or plastic sheet underneath the barn collects all rubbish and manure.
- ⇒ this area can be a source of disease and parasites that can affect the animal's health
- ⇒ this area also can be a breeding place for flies that carry diseases to animals and humans
- ⇒ to help prevent disease this area needs regular cleaning. Clean manure pits every 1-2 weeks, concrete slabs weekly and buckets under plastic sheets every 2-4 days at a maximum.
- ⇒ remove the manure to a special area for composting
- ⇒ some areas have vegetable producers who may purchase sheep/goat manure

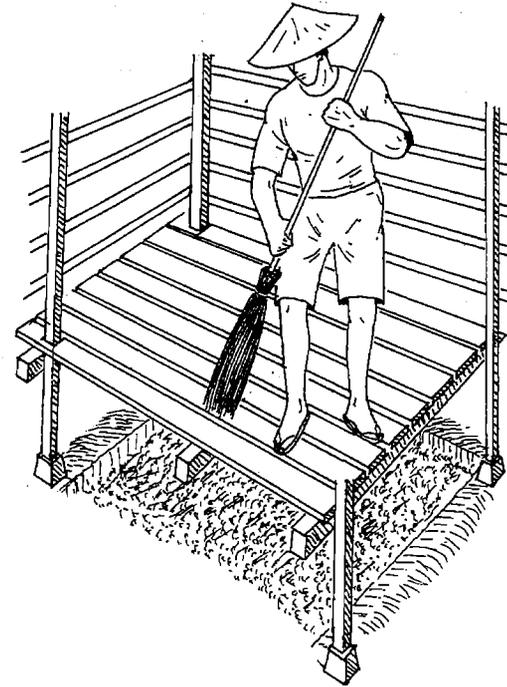
## 8. MAINTAINING CLEANLINESS OF THE ANIMAL BARN

### CLEANLINESS HEALTHINESS OF THE ANIMAL BARN



- Collected wastes in the pit
- should be removed
  - can be composted and used on crops or sold

- Floor should be swept dily
- to remove feces and uneaten feed
  - to keep clean
  - to keep dry



## 9. MAKING MANURE COMPOST

- A. A mixture of manure and urine from the pit, concrete slab or bucket and uneaten grass from the feed trough is a good source of compost to make a fertiliser.
- B. Usually a fresh mixture of manure gives off too much heat so it should be composted first.
- C. Compost can be mixed with soil and used on all types of crops.

### **Composting process:**

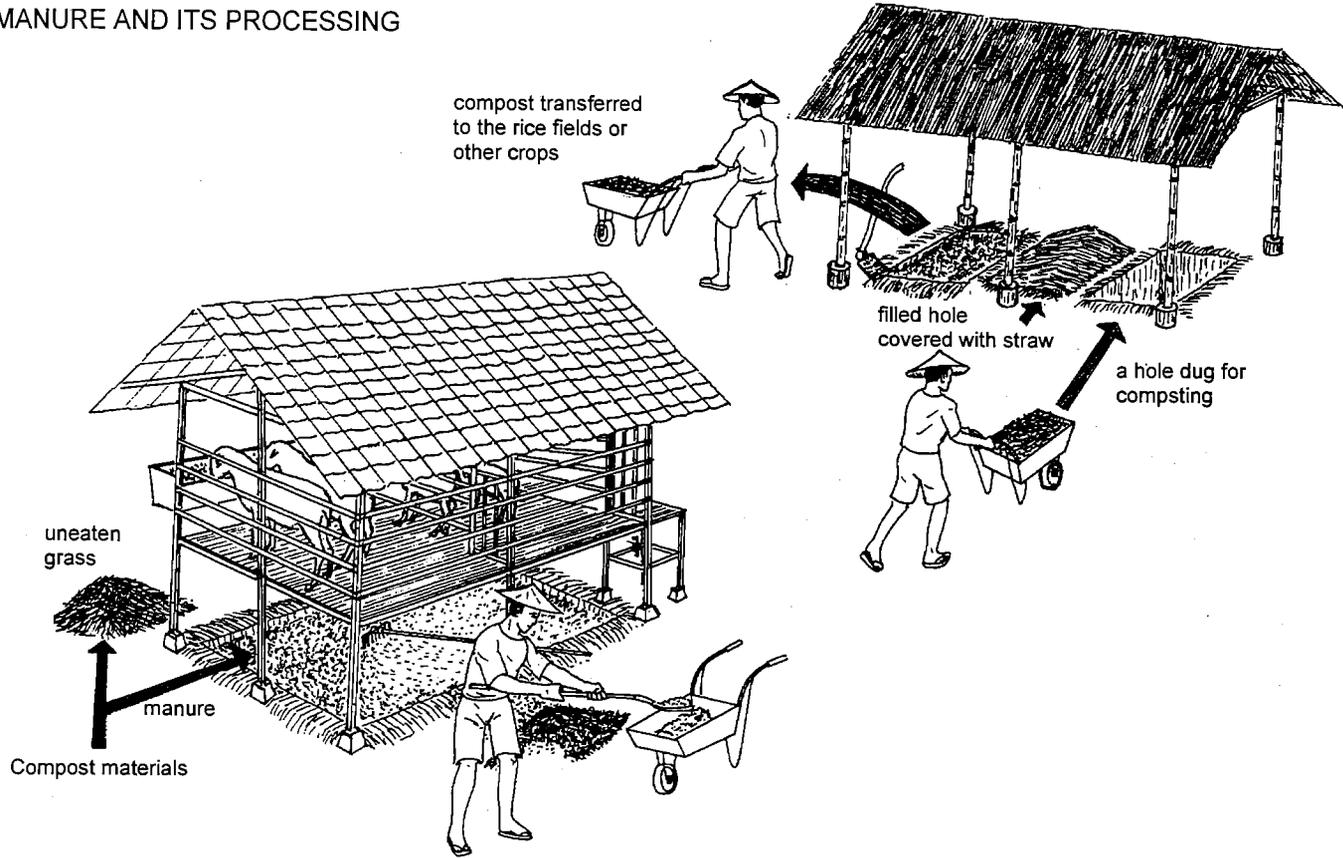
- ⇒ the fresh mixture from the pit should not be thrown away or burnt, but be transferred to a composting pit.
- ⇒ the pit should be 1 meter deep with width and length dependent upon the number of animals raised
- ⇒ the pit should be in an area that does not flood and is well drained
- ⇒ the pit should have a ridge around it to prevent rainwater from running in
- ⇒ after the pit is full with the fresh mixture, cover it with some soil, plastic, straw or banana leaves so flies will not gather on top of it
- ⇒ check the compost regularly, adding water if it is too dry and mixing the manure and grass so that the composting process continues
- ⇒ after one pit is full, another pit may be started
- ⇒ the pit should have a roof to prevent the compost from becoming too wet from rain and to prevent it from becoming too dry
- ⇒ let the mixture compost for 3 months.

### **The advantages of the composting process:**

- ⇒ the compost does not give off heat that can harm the plants
- ⇒ the compost is beneficial to the soil and provides plants with a continuous supply of nutrients

## 9. MAKING MANURE COMPOST

### MANURE AND ITS PROCESSING



## 10. ANIMAL HEALTH CARE

Sheep and goats require basic health care. One of the main activities is hoof trimming. In certain cases animals may need to be sheared or washed.

### 1. Washing the animal

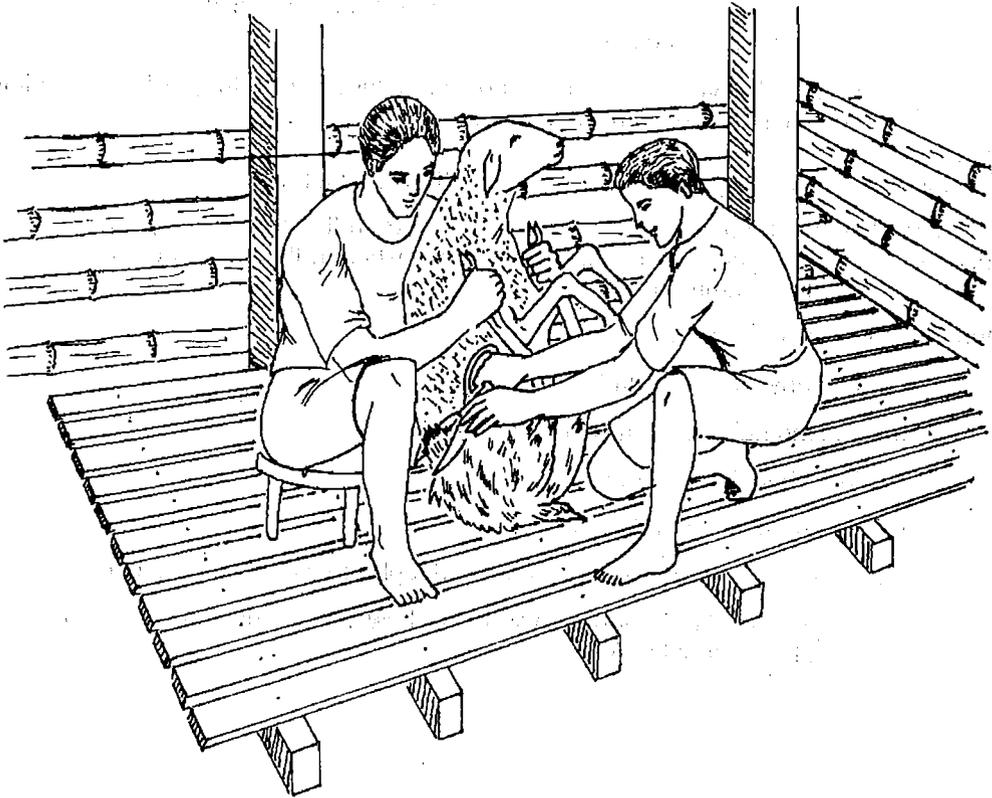
- ⇒ animals need to be washed only if they get very dirty or are infected with certain external parasites (see the **HEALTH AND DISEASE TREATMENT AND PREVENTION SECTION**).
- ⇒ bacteria and fungi living in the coat can be killed by washing with clean water and soap, then letting sheep dry in the sun
- ⇒ the sheep will look better and may get a higher price at market
- ⇒ is not needed for sheep that do not have wool unless they are very dirty.

### 2. Shearing the animal, sheep with wool only

- ⇒ shearing can be done to sheep with very dirty, matted wool that is causing health problems for the animals
- ⇒ dirty wool can harbor external parasites
- ⇒ shearing can be done with ordinary scissors or hair scissors
- ⇒ the animal may be washed first to make shearing easier
- ⇒ sheep with hair coats, not wool, will not need shearing
- ⇒ unless there are health problems or for enhancing appearance, shearing is not necessary. Farmers should select stock with little to no wool for breeding.

10. ANIMAL HEALTH CARE

SHEARING SHEEP



a sheep being sheared using scissors

## 10. ANIMAL HEALTH CARE (continued)

### 3. Trimming sheep and goat hooves

- ⇒ sheep and goats occasionally need to have their hooves trimmed. Sheep and goats that are continuously inside a pen will have longer nails than those that graze
- ⇒ it is not a good practice to let the hooves grow long because:
  - it can cause difficulty in walking and lead to leg and foot problems
  - the males may have difficulty when mating
  - the hooves may break and cause injury and infection
  - the space under the long hooves usually becomes full of dirt and germs that can cause the disease foot rot (see **9. Foot Rot** in the **HEALTH AND DISEASE TREATMENT AND PREVENTION SECTION** section)
- ⇒ trim the hooves of sheep and goats regularly or else they will be difficult to cut when they become long and hard.

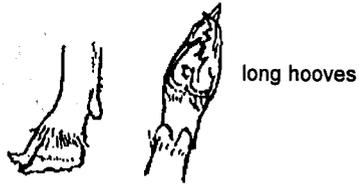
#### Methods of cutting the hooves with hoof-cutters and a knife

The animal should be held in a sitting position between the person's legs or held by a second person. The animal finds it hard to move when in the sitting position and the hooves can easily be trimmed.

During the trimming process:

- ⇒ remove any dirt found under the hooves
- ⇒ cut off long nails and any curled portions
- ⇒ the foot should be trimmed flat
- ⇒ remove bumps under the heel
- ⇒ take care when trimming to not cut too deeply or bleeding may occur
- ⇒ with some practice a farmer will know how far to cut and how a properly trimmed foot should look

10. ANIMAL HEALTH CARE (continued)



trimming the hooves  
by using scissor



10. ANIMAL HEALTH CARE (continued)



remove any dirt



trim the entire  
hoof flat



cut any bump  
under the heel



remove any cuttings



smooth the soft tissue  
under the heel

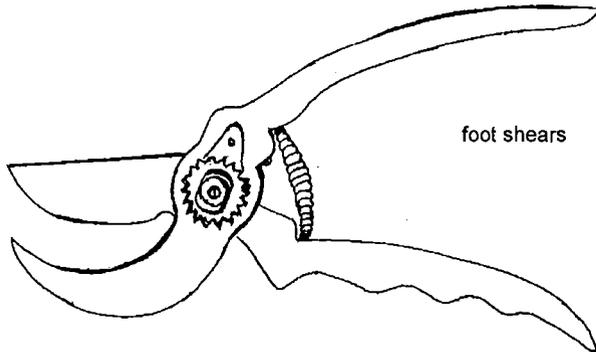
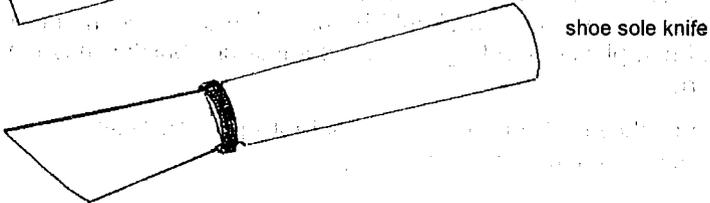
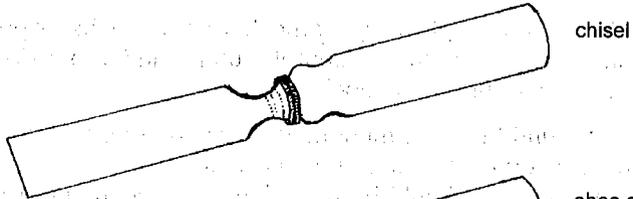
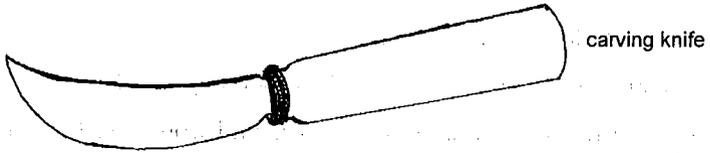
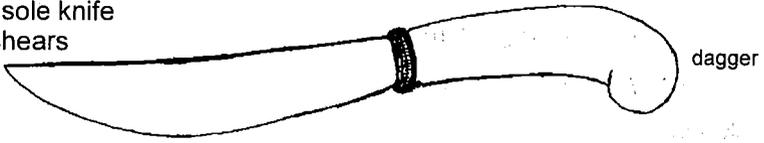


finish

## 10. ANIMAL HEALTH CARE (continued)

### Simple tools to use

1. dagger
2. carving knife
3. chisel
4. shoe sole knife
5. foot shears



## 11. CONSIDERATIONS FOR LARGE FLOCKS

For large commercial flocks of sheep, greater than 100 ewes, a larger more complex barn is required. One barn can hold up to 250 ewes with these broken up into groups for grazing. One shepherd can handle up to roughly 150 ewes. The barn should have a space allowance of at least  $0.7 \text{ m}^2$  per ewe plus  $0.5 \text{ m}^2$  per lamb and have:

- ⇒ pens for lambing and ewes with small lambs
- ⇒ pens for ewes with larger lambs
- ⇒ pens for dry, pregnant ewes
- ⇒ sick pen
- ⇒ ram pen
- ⇒ storage area for supplies and feed
- ⇒ recording table, chair or bench and storage cupboard
- ⇒ be able to move animals out to graze and from pen to pen easily. This is usually accomplished by having a center aisle.
- ⇒ if weaned lambs are kept in the same barn it must be expanded. Ideally, weaned lambs are kept in a separate barn, undergo selection and only replacement ewes return to the flock.

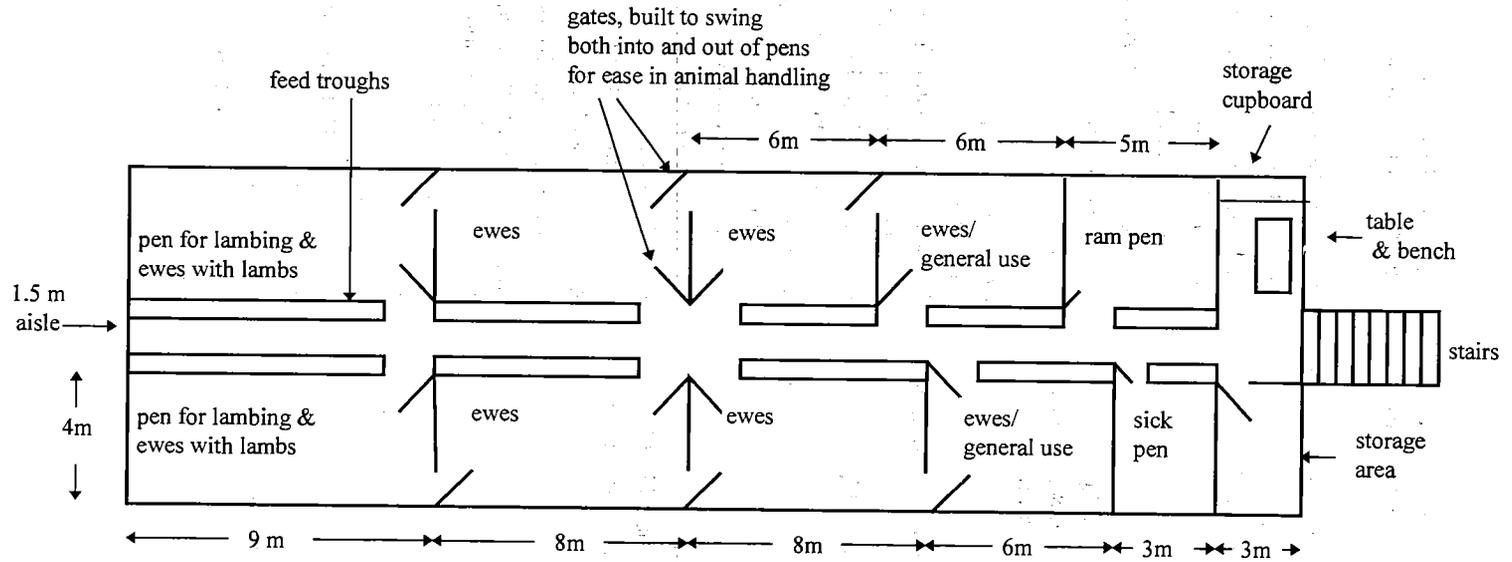
In addition, the area around the barn must have a watering trough and should be in a well-drained area near a source of water and sufficient grazing area. Transportation of forage, feedstuffs and animals should be considered in placement of the barn. With the size and complexity of a large barn a commercial builder may have to be hired to build the barn.

An example is shown of a large barn layout for approximately 180 ewes with weaned lambs removed to a separate barn.

## 11. CONSIDERATIONS FOR LARGE FLOCKS

Example layout for a barn designed to house up to 180 ewes with  $0.7\text{m}^2$  allotted per ewe and space for 80 lambs.

Ewes are moved back to original pen approximately two weeks after lambing.



## 12. MATERIALS NEEDED FOR A LARGE SHEEP BARN ESTIMATES FOR 100 EWE FLOCK

Following is a list of materials that may be needed to manage a large flock of sheep. This list will differ according to type of management used, for example if molasses is fed or not.

### Examples of some materials needed for managing a large flock of sheep.

1. Notebooks, 5, and pens
2. Table and chair/bench
3. Rulers
4. Correcting fluid
5. Calculator
6. Hanging scale, 50 kg
7. Aluminum sheets & snips for making number tags
8. Number taps
9. Neck rope
10. Larger rope for use with scale
11. Tattoo kit
12. Paint of various colors for identification
13. Soap
14. Syringe, needles
15. Drenching gun
16. Grass scythe, hand held
17. Gasoline powered grass cutter
18. Machete
19. Knife
20. Hoe
21. Shovel
22. Wheelbarrow
23. Fire extinguisher
24. Foot shears
25. Saw
26. Hammer
27. Nails of various sizes
28. Pliers
29. Oil lanterns
30. Metal drum, halved for mixing concentrate
31. Large broom for sweeping pens
32. Dust broom
33. Colored chalk
34. Plywood painted black for chalkboard
35. Whiteboard
36. Markers
37. Large pails, 5
38. Small pails, 20
39. Wire for use in mineral blocks
40. Plastic bags to line pails for mineral blocks
41. Folding gates, 1 m x 1 m used to make lambing pens, general use
42. Large plastic pipe 6" for feeding molasses with holes cut in for feeding
43. Cupboard for books, medicine, etc.
44. Store room for feeds, equipment
45. Water tank
46. Water pump and hose
47. Cement water trough outside barn
48. Molasses tank, 10000 litre, set in ground
49. Wood for barn repair, making feed troughs
50. Gusanex, for wounds
51. Iodine mixture
52. Alcohol
53. Cotton
54. Coccidiosis treatment
55. Anthelmintics
56. Antibiotics
57. Plaster for making casts
58. Asuntol

# HEALTH AND DISEASE TREATMENT AND PREVENTION

1. Occurrence and transmission of diseases in animals
2. Management techniques to decrease occurrence of diseases
3. Animal health care materials and techniques
4. Worms
5. Ticks
6. Scabies
7. Fly-strike or Myiasis
8. Foot infections or Interdigital dermatitis
9. Foot rot
10. Abortion
11. Mastitis
12. Pink eye
13. Pneumonia
14. Orf
15. Lumpy jaw or abscesses
16. Diarrhea
17. Bloat
18. Plant toxins and pesticide poisoning
19. Urinary stones or Urolithiasis
20. Care for pregnant ewes and newborn lambs

## 1. OCCURRENCE AND TRANSMISSION OF DISEASES IN ANIMALS

### Diseases can be classified into infectious and non-infectious.

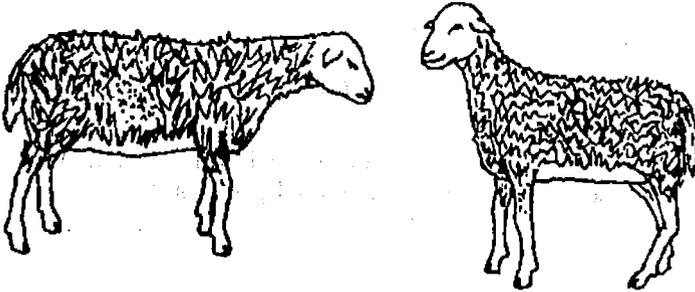
- An infectious disease is one that can be transmitted from a sick animal to other sensitive animals. The agents for infectious diseases are germs such as viruses, bacteria and fungi, and several parasites such as blood parasites, worms, and ticks.
- Non-infectious diseases are mainly related to feed such as mineral deficiencies, toxic plants and poisons. Some diseases may be genetic (received from an animal's parents), diet related (such as a lack of a mineral), due to an injury or an abnormality in the animal itself.

*Animals most likely to get sick are young, weak, underfed or pregnant. If an animal is under stress such as unclean barn conditions or poor feeding, it has a greater chance to get ill than well housed, well fed and well managed animals.*

1. The occurrence of a disease may be due to contact between a sensitive animal and the source of the disease or another sick animal.
  - ⇒ A healthy animal may come into contact or be near a sick animal, such as in the same pen for during mating.
  - ⇒ A healthy animal eats toxic plants. Several local plants contain substances toxic to animals. In small amounts, they may not cause any sickness, however, in large amounts above the toxic level, the toxic effects appear as a disturbance in the animal's condition.
  - ⇒ A healthy animal may accidentally eat or drink poison. Poisons such as insecticides and rodenticides carelessly stored can be consumed by animals and may have a fatal effect. It could also be caused by improper cleaning of a poison container later used as a drinking container.

# 1. OCCURRENCE AND TRANSMISSION OF DISEASES IN ANIMALS

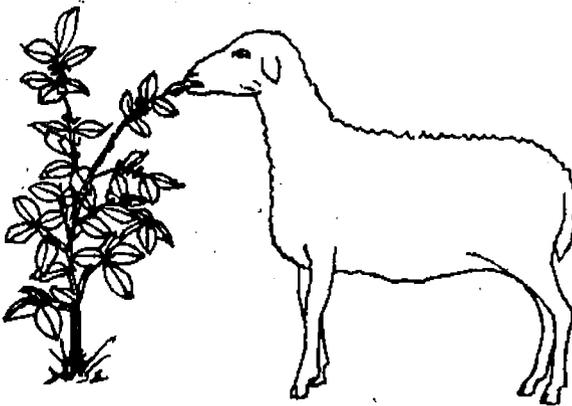
## 1. Direct contact



a sick animal

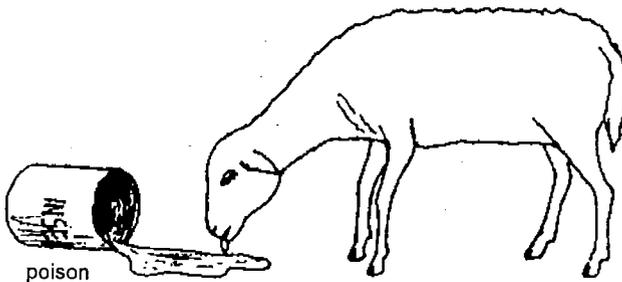
a healthy animal

a. a healthy animal is in direct contact with sick animals in pens or during breeding



toxic plants

b. a healthy animal consumes toxic plants



poison

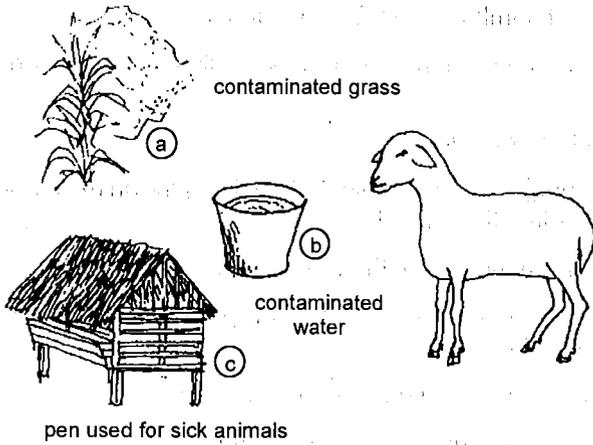
c. animals drinks/licks poison of its empty container (insecticides, rodenticides, ect.) carelessly stored.

## **1. OCCURRENCE AND TRANSMISSION OF DISEASES IN ANIMALS (continued)**

2. The incidence of a disease may be due to contact between an animal with material contaminated by germs or poison.
  - An animal consumes grasses or plants contaminated with germs, parasites or poison.
  - An animal drinks contaminated water.
  - An animal is placed in a pen that was used by a sick animal where the germs are still present in the pen.
3. Transmission of the disease may be caused by germs which are carried by insects, a farmer who just took care of a sick animal or by the wind.

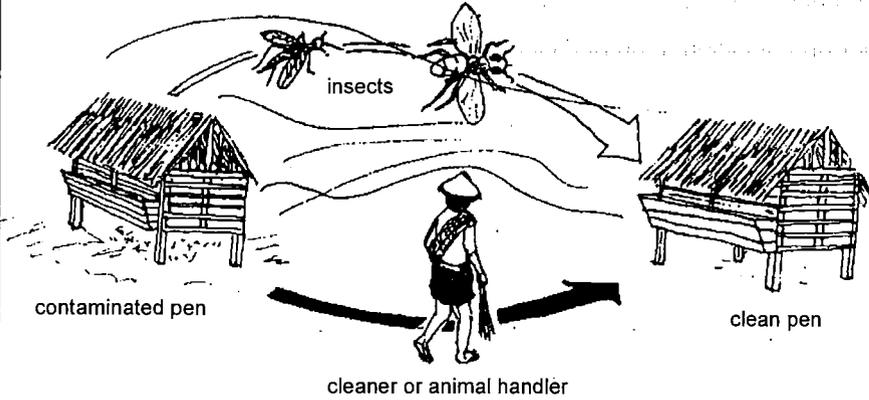
**1. OCCURRENCE AND TRANSMISSION OF DISEASES IN ANIMALS  
(continued)**

2. In contact with contaminated materials,  
germs/posons



- a. an animal eats grasses contaminated by germs
- b. an animal drinks contaminated water
- c. an animal is placed in a pen used for sick animals not yet disinfected
- d. an animal eats concentrate contaminated by infectious diseases or fungus

3. Germs carried by insects, animal handlers, wind



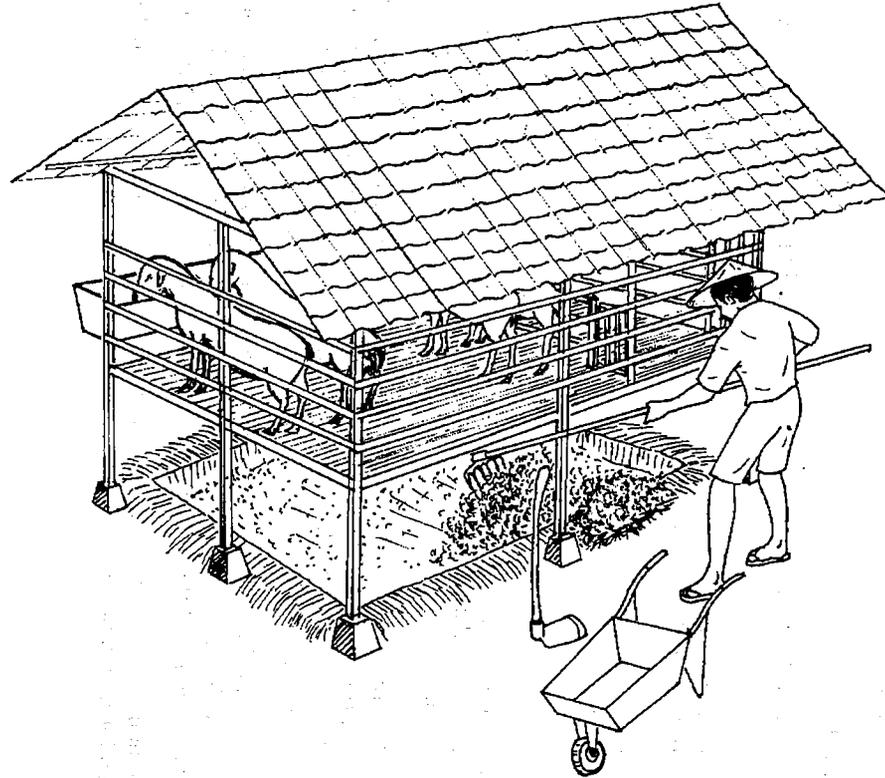
## 2. MANAGEMENT TECHNIQUES TO DECREASE OCCURRENCE OF DISEASE

The most important thing a farmer can do to decrease disease problems is proper management and care of his animals.

These include:

- ⇒ proper barn design, elevated off the ground with slatted floors so manure drops to the ground to decrease worm burden
- ⇒ clean feed troughs in which lambs are unable to defecate
- ⇒ clean, dry barn, with slats free of manure to prevent buildup of germs and flies which carry diseases
- ⇒ area around barn clean from manure
- ⇒ barn with no broken flooring, boards or nails that could injure animals and give disease a chance to enter into the animal
- ⇒ isolate any sick animals from the rest of the flock and treat
- ⇒ deworm any purchased or borrowed animals for parasites and check for disease before putting with flock
- ⇒ proper care of pregnant ewes/does and newborn lambs/kids
- ⇒ proper care of animals, hoof trimming, worm medication
- ⇒ regular monitoring of the flock, check at feeding or while grazing, to notice abnormal behaviour
- ⇒ proper and sufficient feed and clean water

## 2. MANAGEMENT TECHNIQUES TO DECREASE OCCURRENCE OF DISEASE



- proper management (well designed, clean, maintained barn) and good care (adequate feed, water, hoof trimming, etc.) are the most important things to do to reduce disease problems

### 3. ANIMAL HEALTH CARE MATERIALS AND TECHNIQUES

Some materials that are useful in proper health care are:

- iodine solution
- cotton or other material for applying iodine to wounds
- syringe and needle
- knife or clippers for hoof trimming
- gusanex
- antibiotic ointment

#### **Sterilizing equipment**

- ⇒ To sterilize equipment, knives, needles, etc. boil them in clean water for 15-20 minutes.
- ⇒ Equipment should be sterilized after each use and boiled and dried with a clean towel just before using again.
- ⇒ Unclean needles can transmit disease from an infected animal to other animals.

#### **Solutions**

For treating some diseases it is necessary to make solutions. This means that a medicine is mixed or diluted with water. A percentage solution means parts medicine in 100 parts solution.

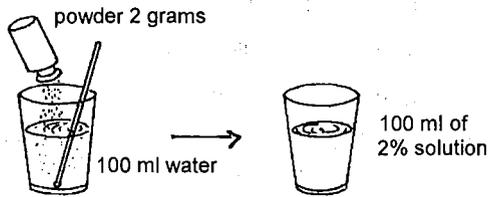
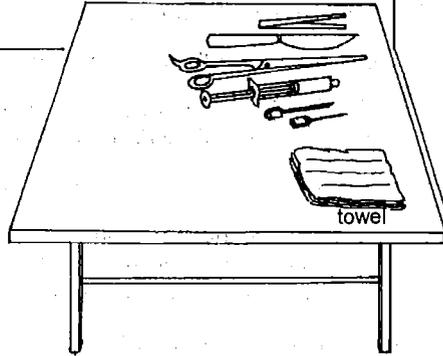
- For example a 2% solution means 2 parts medicine in each 100 parts solution. For a powder, this means 2 grams powder mixed with each 100 ml water. If you use a 750 ml bottle this would mean 15 grams powder mixed with a full bottle (750 ml) of water.
- If the medicine is liquid, the percentage means parts medicine plus water to equal 100. A 5% solution of a liquid medicine would mean 5 ml medicine plus 95 ml water = 100 ml. This equals 5 parts medicine in 100 parts solution.

Follow instructions on any medicine package and ask a livestock extension agent or veterinarian for help if needed.

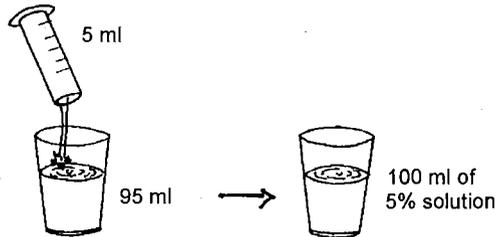
### 3. ANIMAL HEALTH CARE MATERIALS AND TECHNIQUES



- sterilize equipment by boiling in clean water for 15-20 minutes
- dry with a clean towel
- sterilize before and after each use



- for powders, mix the correct amount in 100 ml water



- for liquids, mix the correct amount of liquid with enough water to make 100 ml solution

### 3. ANIMAL HEALTH CARE MATERIALS AND TECHNIQUES (continued)

#### Injections

When needed, injections are either in the muscle, under the skin or in a vein. If you need to give an injection to your animals the following guidelines will help.

⇒ *To give an injection*

- pull the correct amount of medicine into a clean syringe from a clean needle inserted into the medicine bottle
- always expel excess air from the syringe

⇒ *For injections in the muscle*

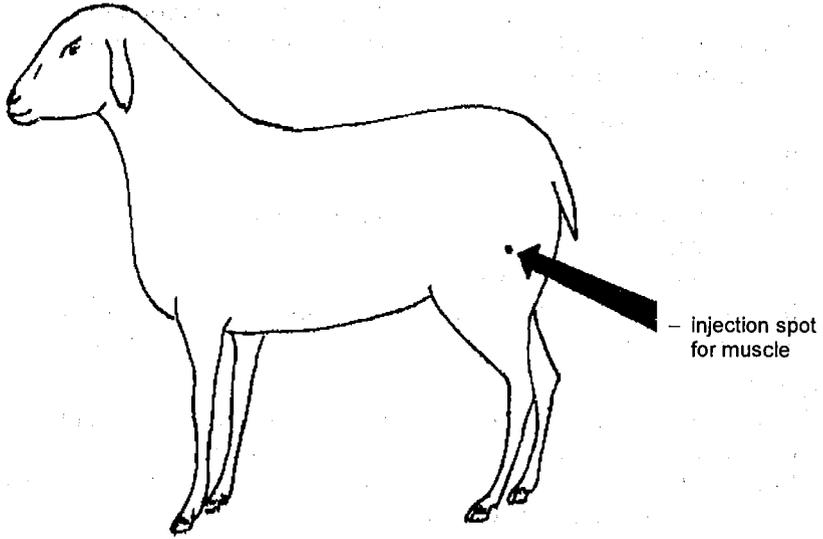
- insert the needle into the muscle of the shoulder or hind leg
- check if you have entered a vein by pulling back slightly on the plunger. If blood enters the syringe, remove the needle from the animal and try again.
- when a correct spot has been entered, gently press the plunger down
- remove the needle from the animal and rub the spot to prevent excess bleeding. There normally will be a little blood. Applying pressure, such as rubbing, will also help the medicine to stay in the muscle.

⇒ *For injections under the skin*

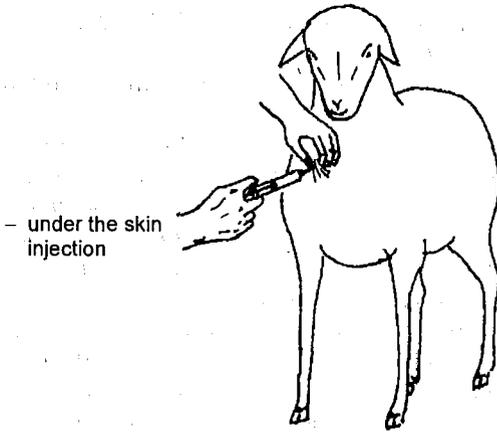
- pull up a pinch of skin on the neck between the shoulder blades
- insert the needle at an angle through the skin away from your fingers
- gently press the plunger down

An *injection in the vein* should only be done by a veterinarian or someone with experience in animal treatment.

### 3. ANIMAL HEALTH CARE MATERIALS AND TECHNIQUES (continued)



- give injections in the muscle in the large muscles of shoulder or hind leg
- check for blood vessels by pulling back slightly on the plunger, if blood is seen move to a new spot
- when in the correct spot, gently press the plunger down
- rub the area to prevent excess bleeding
- sterilize syringe and needle in boiling water



- give injections under the skin by pulling up the skin between the shoulder blades
- insert the needle at an angle and gently press the plunger down
- sterilize syringe and needle in boiling water

## 4. WORMS

### CAUSE

Worms enter animals through contact with contaminated feeds or feces. The most common effect of worms is to make animals thin and slow growing. Some worms do this by sucking blood from the animals making them weak. Worms may also cause some respiratory diseases in animals.

In serious cases the animal will:

- ⇒ have a thin body
- ⇒ have little appetite
- ⇒ be weak and look pale around the mouth and eyes
- ⇒ have dull hair that may stand up
- ⇒ with some worms have swelling under the chin
- ⇒ have worms or pieces of worms seen in the feces. (Worm eggs can be found in the feces by technicians using microscopes in laboratories.)

### TREATMENT

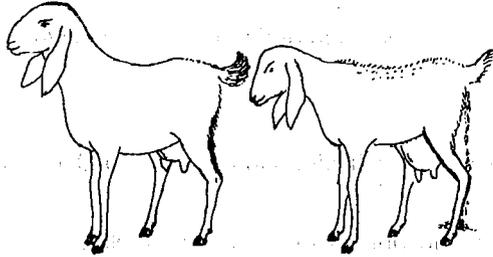
- give anthelmintics (worm medication) following the instructions on the container or recommendations of extension agent
- traditional medicines may also be used to reduce the number of worms
- clean pens all manure and keep dry

### PREVENTION

- ⇒ *give worm medication to all animals every 3 months.* After giving the worm medication, the animals should be moved to a new grazing area the following day after the medicine has time to work.
- ⇒ keep animal pens clean and dry to prevent worms infecting other animals
- ⇒ pens should be raised off the ground and have slatted floors so that manure falls to the ground away from animals
- ⇒ cut forage for animals in areas not recently grazed by animals and in the afternoon to reduce the number of worms and eggs present on the grass
- ⇒ graze animals away from rivers, swamps, rice fields where there are many water snails that can carry worms
- ⇒ change grazing areas often to prevent animals from becoming infected with worms
- ⇒ once an area has been grazed it should be left alone for 8 to 12 weeks before grazing (or cutting) again. This will reduce the amount of worm larvae and eggs that survive to reinfect animals. *However, if another farmers' animals graze that area, those animals will infect it with worms and worm eggs. Try to coordinate grazing with farmers in your area to control worms.*
- ⇒ monitor grazing animals and if an animal shows signs of weakness, loss of breath or pale membranes, it should be treated again. If this happens frequently to a particular animal it should be sold and not used in breeding.
- ⇒ change the type of worm medicine used every 12 months to prevent the worms getting "used" to it and learning how to survive the worm treatment. When changing worm medicine, check the name of the drug in both the old and new medicines so that you are changing the drug that kills the worms and not just the name of the medicine.

## 4. WORMS

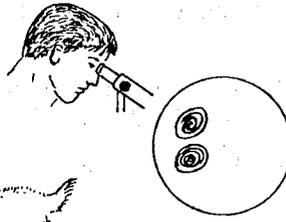
### 1. Clinical signs



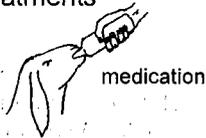
healthy, fat and agile

sick animal: — thin, hair slightly standing up and dull

- constipation or diarrhea
- weak and pale
- jaws appear swollen
- sudden death



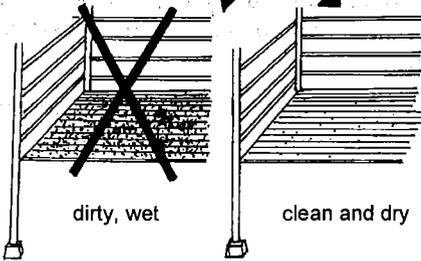
### 2. Treatments



medication

- regular medication against worms or traditional medicines
- change drug used each year

### 3. Prevention



dirty, wet

clean and dry

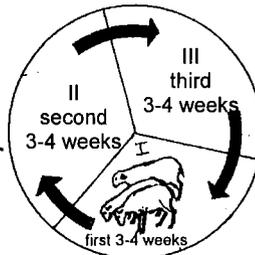
- pen raised above the ground
- clean and dry pens
- animals remain in pens



Cut grass afternoons between 12.00-15.00



cut only the top part of grass



- let animals graze between 12.00-15.00
- more area of grazing often and return after 8-12 weeks

## 5. TICKS

### CAUSE

Ticks are very harmful because they suck blood, transmit disease and cause skin irritations.

- ⇒ in small numbers, animals do not show any problems, but if an animal has a large number of ticks it will look thin, pale and weak
- ⇒ upon observing the coat, the ticks can be seen and appear reddish white

### TREATMENT

- shear the animal's hair, then use an insecticide, such as Asuntol 0.1% (1 ml in 1 liter water).
- the solution can be sprayed on the animal or used for dipping the animal. Apply the solution carefully and avoid getting it in the mouth or eyes.
- place the animal in the sun to dry

### PREVENTION

- ◇ washing susceptible animals every week or two weeks and shearing the hair regularly can help prevent the ticks from multiplying rapidly. Wash the animals with soap while scrubbing the body.
- ◇ check recently purchased or borrowed animals for ticks, especially around the shoulders. Young animals with dark coats should be closely inspected as they are more susceptible to tick infestations.
- ◇ if ticks are seen on an animal, it should be treated immediately to prevent transmission to other animals

## 5. TICKS



small amount : do not cause troubles  
large amount : suck blood  
                  : animal can not rest  
                  : animal becomes skinny  
                  : can transmit diseases

### 1. Signs



- animals appear weak and pale
- coat appears dull
- animal condition declines progressively
- when closely checked, there are many redish sticks



### 2. Treatments



- shear the hair
- spray with insecticides Asuntol 0,1%
- offer good feed and drink
- place in a clean pen

### 3. Prevention



- shear the wool regularly on susceptible animals
- wash susceptible animals regularly with soap and brush
- watch particularly for young and dark coated animals, they are more susceptible
- when purchasing animals, check for the presence of ticks

## 6. SCABIES

### CAUSE

Scabies is a disease caused by infection of skin parasites. It can be a serious problem in goats. Sheep are less likely to be infected.

An animal with scabies:

- ⇒ will have scales on the skin surface
- ⇒ scratch the infected skin on pen walls or trees
- ⇒ hair will fall out and skin will thicken

In a serious case, the whole surface of the body may be infected. In a mild case, scabies can be seen only on certain areas such as legs, udders or ears.

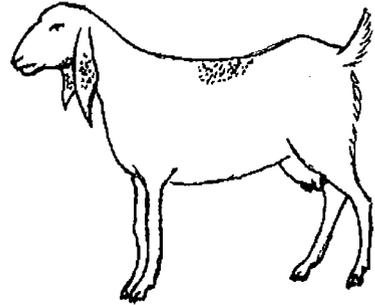
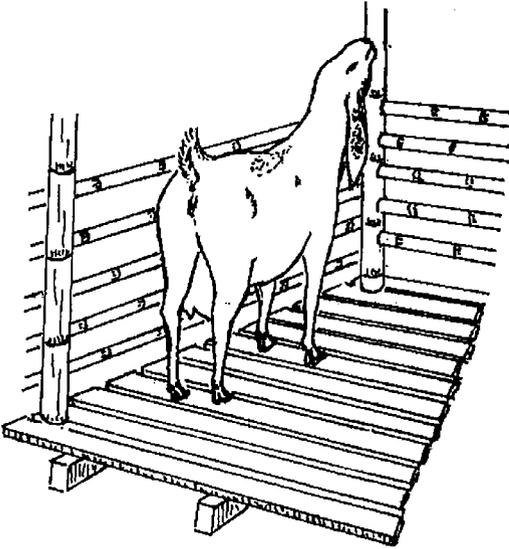
### TREATMENT

- scabies can be treated by giving an injection of Ivomec
  - \* Ivomec is available in an animal medicine supply store
  - \* only one injection of Ivomec is needed. Follow the instructions carefully for all medicines.
- a mixture of sulphur and coconut or peanut oil (3 parts sulphur : 1 part oil) can also be used to treat scabies
  - \* wash the animal thoroughly with soap and let it dry
  - \* apply the mixture on the infected area evenly
  - \* place the animal in a separate pen away from the rest of the flock
  - \* repeat the sulphur/oil treatment every 3 days until it is cured

## 6. SCABIES

### 1. Clinical signs

- depressed appetite
- thickening of skin
- thin
- hair falling
- scaly skin



### 2. Treatments



- Ivomec injection  
injection: IVOMEC under the skin
- Asuntol salve 2% on infected skin
- Sulfur and coconut or peanut oil (3:1)

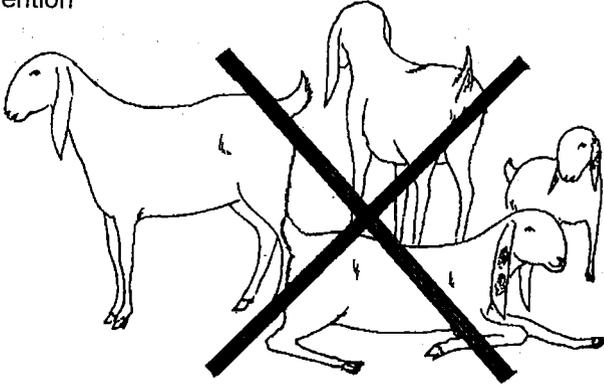
## 6. SCABIES (continued)

### PREVENTION

- ◇ avoid body contact with infected animals in the barn or when grazing
- ◇ when purchasing animals from the market or borrowing rams/bucks for breeding, check ears, legs, scrotum, udder and face. They should be free from scabies.
- ◇ if an animal is infected, isolate it in a separate pen and give treatment immediately, then clean and wash the pen where the animal came from with Asuntol 2% in water

## 6. SCABIES (continued)

### 3. Prevention



- a. - animals with scabies should not be mixed with healthy animals
- animals just purchased or borrowed for mating should be free from scabies
- b. wash with asuntol 2% in water
- c. *Kandang*s which have been occupied by severely infected animals should be burnt
- d. persons who handle infected animals should wash before contacting other animals or persons



## 7. FLY-STRIKE

### CAUSE

Fly-strike is caused by a wound becoming infected by flies that breed and produce larvae. The most important or damaging infestation is that of screw worms.

- ⇒ the clearest sign that an animal is affected is larvae moving in the wound area
- ⇒ if this occurs in the hooves, the animal may limp

### TREATMENT

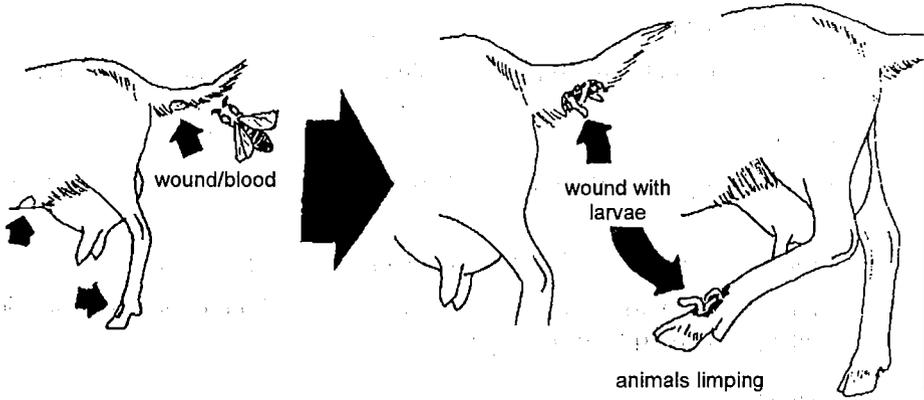
- clean the wound and get rid of the larvae using an insecticide or Gusanex spray (follow medicine instructions)
- mothball powder or tobacco can also be used to get rid of the larvae
- bandage the wound to prevent other flies or dirt from entering
- the following day, reopen the wound, treat and bandage again. Usually 2-3 treatments are needed.
- after getting rid of the larvae, apply an iodine solution to speed up the recovery

### PREVENTION

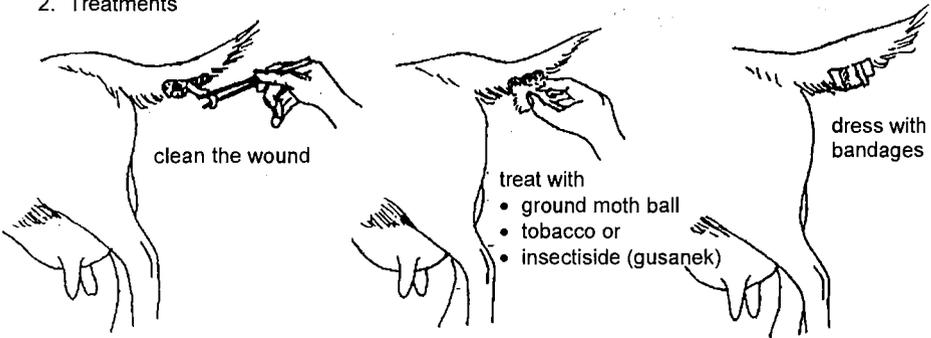
- ◇ keep the barn and surrounding area clean from manure that attracts flies
- ◇ maintain barn to avoid any cause of injuries to the animals
- ◇ when an animal is cut or wounded, immediately treat the wound. The presence of blood attracts flies to come and breed.
- ◇ apply an iodine solution after cutting the placenta of a newborn lamb to prevent this from occurring

## 7. FLY-STRIKE

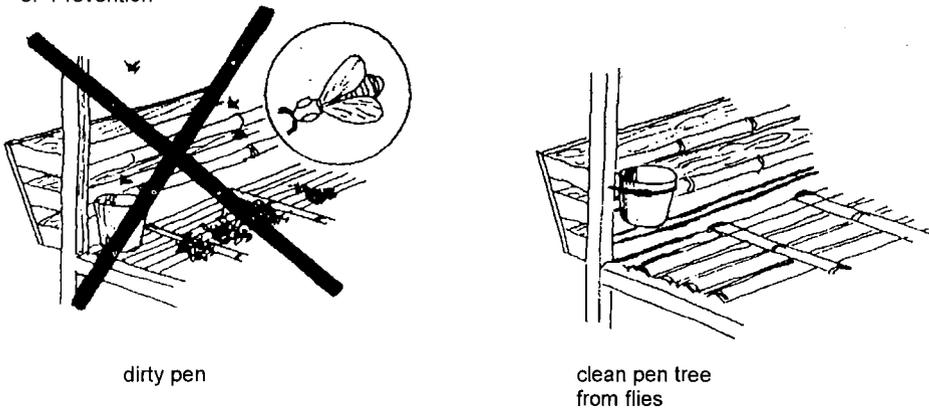
### 1. Clinical signs



### 2. Treatments



### 3. Prevention



## 8. FOOT INFECTIONS OR INTERDIGITAL DERMATITIS

### CAUSE

Foot infections or interdigital dermatitis is a disease caused by several bacteria.

An animal with a foot infection will:

- ⇒ walk with a limp
- ⇒ have lesions in between the toes with or without pus and a bad smell

### TREATMENT

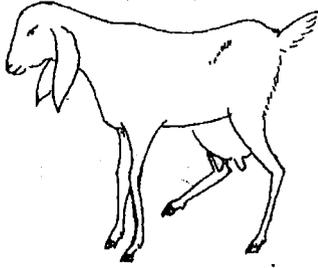
- should be carried out immediately before the infection spreads deeper into the animal
- treatment is carried out by first cleaning the rotting area
- then, the infected area is soaked in a solution containing antibiotics or antiseptics and gusanex spraying

### PREVENTION

- ◇ clean the pens every day

## 8. FOOT INFECTIONS OR INTERDIGITAL DERMATITIS

### 1. Clinical signs

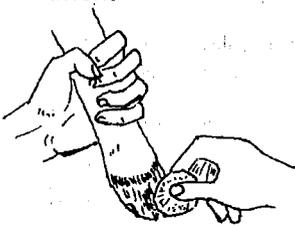


- an infected animal will walk with a limp
- will have a wound between the toes that may have pus



a wound between toes  
that may have pus

### 2. Treatment

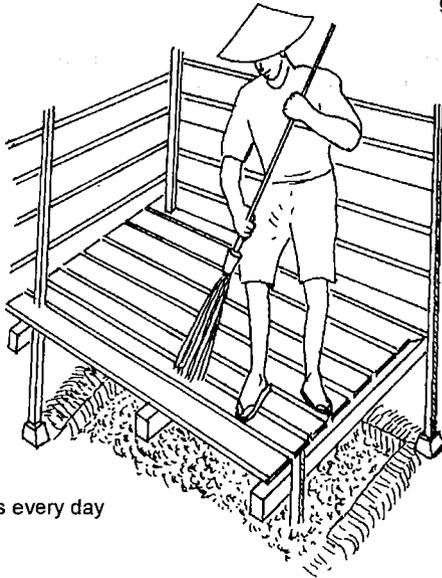


- the area between the toes should be cleaned and treated with antibiotics



spray with  
gusanex

### 3. Prevention



- clean the pens every day

## 9. FOOT ROT

### CAUSE

Foot rot is caused by a bacterial infection in the hooves. It is more common in sheep but can also occur in goats.

An animal with foot rot will:

- ⇒ walk with a limp
- ⇒ have chips on the bottom and sides of the hooves which will appear rotten and have a bad odor

### TREATMENT

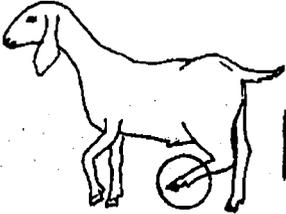
- first, clean the rotting area
- then, clip the hooves until the healthy part is seen. There may be some bleeding.
- soak the infected area in a solution containing antibiotics or antiseptics
- in addition to antibiotics, a solution of 2-3% formalin or 10% copper sulfate may be used. If medicines are purchased make sure to follow the instructions.
- the infected area can be bound with bandages as protection and to restrain movement
- if foot rot is accompanied by maggots, the larvae should be cleaned first
- place the animals in a clean and dry pen

### PREVENTION

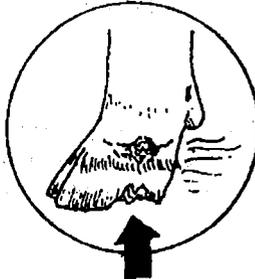
- ◇ keep pens clean and dry. Dirty and wet floors can be a source of infection for the hooves.
- ◇ avoid any causes for injuries to the hooves such as sharp objects (nails, splinters, etc.) and broken slats on the floor
- ◇ trim hooves on a regular basis

# 9. FOOT ROT

## 1. Clinical signs



- walking with a limp



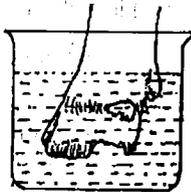
- chips on the bottom and the side of the hooves, bad smell



## 2. Treatments



- the animal should be isolated  
- clean until the healthy tissues are seen



- soak in an antiseptic solution, antibiotics

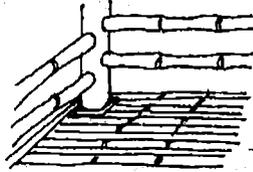


- dress with bandages

## 3. Prevention



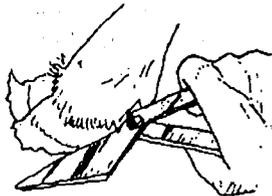
- dirty pen



- pen should be clean, dry, no broken floor boards



- long hooves



- trim the hooves regularly



- trimmed hooves can prevent foot rot

## 10. ABORTION

### CAUSE

Abortion in sheep and goats can be caused by several factors.

- ⇒ physical factors (injuries from the buck, falling)
- ⇒ diseases (caused by salmonella, brucella, trichomoniasis, chlamydia, foot and mouth, listeriosis, toxoplasmosis, nairobi sheep disease, rift valley fever, bluetongue)
- ⇒ eating poisonous plants

A small number of abortions (possibly 2 out of each 100 pregnancies) are normally found in animals. The cause of an abortion can be diagnosed only through laboratory observations. A veterinarian should be called to look at the placenta and aborted fetus.

### TREATMENT

- treatments are given depending on the causes
- abortions due to viral infections cannot be treated
- abortions due to bacterial infections are treated with antibiotics or sulfa tablets
- when an abortion is caused by brucella, the animal must be slaughtered and the meat can be consumed only after boiling
  - \* transfer other animals from the same pen to another pen and vaccinate or give medication to prevent the transmission of the disease
  - \* the dead fetus should be disinfected and burned or buried
  - \* clean the contaminated pen with antiseptics
- be careful in helping sick animals and clean yourself thoroughly afterwards. Brucellosis can be transmitted to humans.

### PREVENTION

- ◇ keep pregnant animals separate from the rest of the flock
- ◇ if the area has a history of an infectious disease causing abortions, the animals should be vaccinated
- ◇ do not purchase or borrow animals which come from a group that often experiences abortions or bloody diarrhea

# 10. ABORTION

## 1. Causes



injured by the buck



falling from the pen



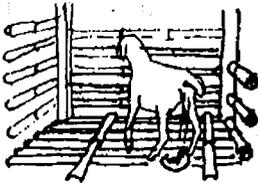
diseases



— caused by germs (brucella, salmonella, chlamydia, foot & moth, listeriosis, toxoplasmosis, Riff valley fever, blue tongue, ect.)

— caused by trichomoniasis.

## 2. Treatments



the aborted animal stay in the pen



the pen used by the sick animal is disinfected



aborted materials must be disinfected, buried or burned

healthy animals are transferred to other pens

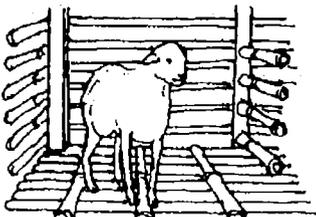


the animal that aborted should be treated or slaughtered



clean-up thoroughly after helping the aborted animal to prevent transmission to humans

## 3. Prevention



pregnant ewe is isolated

(b)



vaccinate against any germs causing abortions, such as brucella vaccine

(c)



- buy healthy animals
- do not buy from a group with the history of abortion or blood from vulva

## 11. MASTITIS

### CAUSE

Mastitis is caused by an infection in the cells of the mammary glands.

An animal with mastitis:

- ⇒ will have swollen udders that are reddish, hot and painful when touched
- ⇒ will have milk that could be pale, dark yellow, greenish or reddish. The milk may be thicker or more dilute.

### TREATMENT

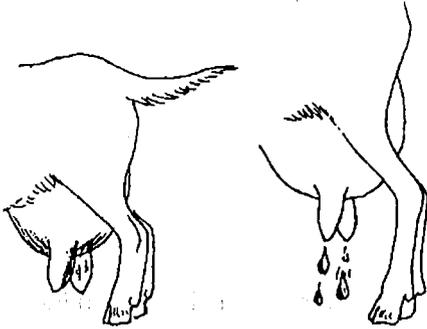
- antibiotic injection into the muscle or mammary glands. In serious cases, the combination of both is recommended.
- use broad spectrum antibiotics following the instructions on the medicine package
- before injecting the antibiotics through the hole in the nipple, the udder should be milked out. Inject the antibiotics carefully. Afterward, squeeze the glands gently and evenly.
- the udder should be milked out at least 3 times daily
- to reduce the pain and swelling wash the udders with warm water 2-3 times a day
- depending on the antibiotics used, treatment can be repeated everyday for 3-4 days

### PREVENTION

- ◇ keep the barn and pens clean and dry. Dirty and wet floors can be a source of infection.
- ◇ for dairy goats, maintain cleanliness before and after milking
  - \* wash hands thoroughly with soap before and after milking
  - \* wash areas around the mammary glands with soap
  - \* after milking, dip the tip of the nipples into a 4% bleach or dilute iodine solution and wipe dry
- ◇ check udders of prospective replacement ewes for evidence of mastitis before purchase
  - \* check the udder for signs of infection as listed above
  - \* feel for hard sections in the udder which indicate previous infection
- ◇ sell ewes that have recurring mastitis problems

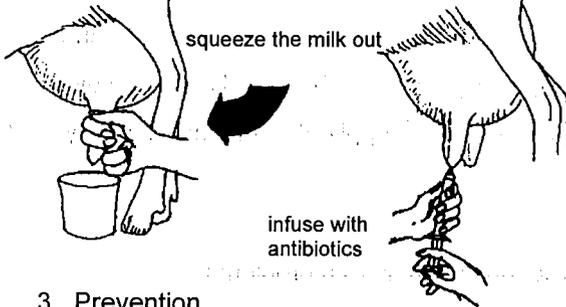
# 11. MASTITIS

## 1. Clinical signs

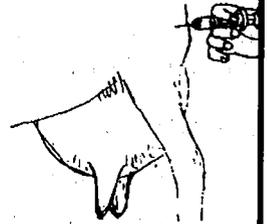


- swollen glands, red, hot and painful when touched
- Milk : reddish/yellow/greenish : very thick or diluted

## 2. Treatments

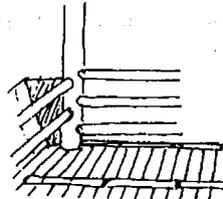
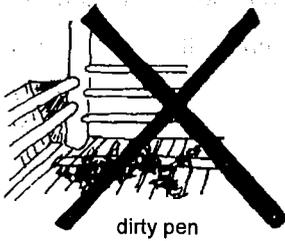


or



combination of injections:  
through nipples and muscles  
in a serious case

## 3. Prevention



clean and dry pen



after milking, dip nipples  
into an antibiotic solution  
to prevent infection

## 12. PINK EYE

### CAUSE

Pink eye is an infection of the mucous membrane in the eye. The causes can be physical (sharp objects such as thorns, dust, grass tips) or germ (virus, bacteria or others).

An animal with pink eye will:

- ⇒ have watery eyes
- ⇒ have difficulty in opening the eyes
- ⇒ blink frequently to avoid light
- ⇒ have swollen eyelids and red eyes

In serious cases, the eyes can be cloudy and there may be an abscess on the eye that can cause blindness.

### TREATMENT

- check the eyes carefully and observe closely for the presence of sharp objects
- if it is caused by a sharp object, remove the object and clean the eyes
- apply an eye ointment (antibiotic). Apply the ointment evenly, following instructions on the label.

### PREVENTION

- ◇ immediately isolate and treat any animals with problems
- ◇ keep the pens clean to keep away flies which may carry and spread germs
- ◇ protect the animals from sharp objects such as nails, thorns and sharp grasses in the field

## 12. PINK EYE

### 1. Clinical signs



watery eyes, redness, always closing and swelling

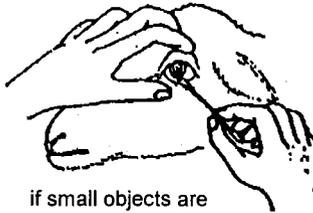
#### Causes :

- small sharp objects (grass tip, splinters, thorn, dust)
- germs (virus, bacteria, rickettsia, chlamydia)

### 2. Treatments



check the affected eye closely



if small objects are found, remove and clean them carefully

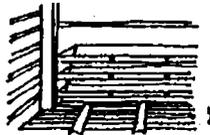


apply eye ointment, antibiotic 0.1%, evenly following the instructions

### 3. Prevention



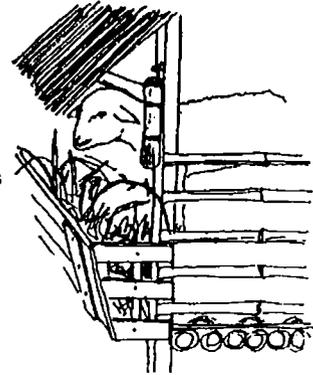
dirty pen attract flies/mosquitoes



a clean pen is free flies/mosquitoes



a sick animal should be isolated from the rest



avoid small sharp objects (thorns, grass tips) in the feed trough

### 13. PNEUMONIA

#### CAUSE

Pneumonia is a disease that can be caused by bacteria or virus.

An animal with pneumonia will:

- ⇒ have depressed appetite
- ⇒ cough frequently
- ⇒ have a fever
- ⇒ difficulty breathing
- ⇒ nasal discharge
- ⇒ depression

#### TREATMENT

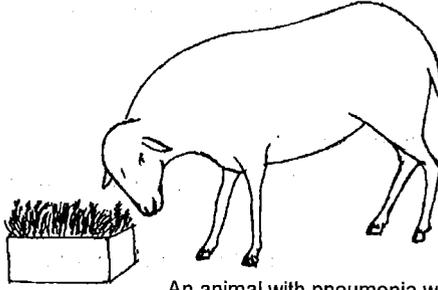
- give an antibiotic injection into the muscle following the instructions on the medicine package

#### PREVENTION

- ◇ avoid the stress factors that can cause pneumonia such as barn overcrowding, exposure to low temperatures and high humidity and bad transportation
- ◇ keep the barn clean and dry

### 13. PNEUMONIA

#### 1. Clinical signs



An animal with pneumonia will

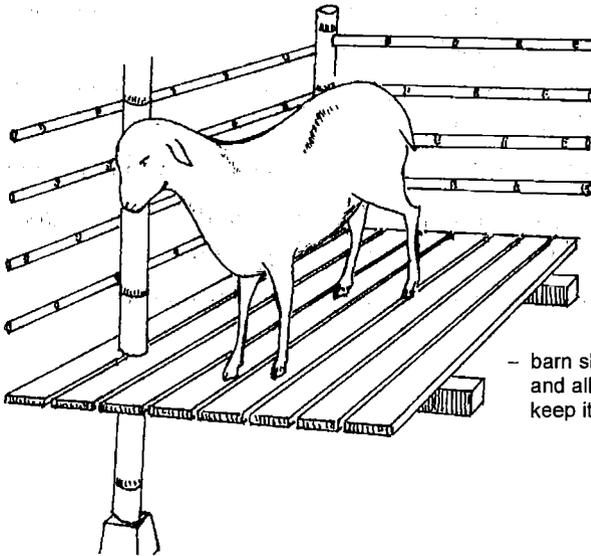
- cough frequently
- have depressed appetite
- have a fever
- difficulty breathing
- nasal discharge

#### 2. Treatment

- antibiotic injection into the muscle following instructions on medicine package



#### 3. Prevention



- barn should keep out rain and allow air movement to keep it dry

## 14. ORF

### CAUSE

Orf is an infectious skin disease causing lesions (scabs) in the mouth area. It is caused by a virus.

An animal with orf will:

- ⇒ have lesions in the mouth area (lips and nostrils)
- ⇒ have lesions that are usually first seen at the corner of the mouth, then spread to the nose area
- ⇒ have a mouth area that may be large and swollen and have a bad odor
- ⇒ possibly have lesions that may occur on the eyelids, legs, udders and scrotum

### TREATMENT

- treatment is by provided by treating the secondary infections caused by the germs, reducing the pain and increasing the appetite. Medicine to kill the virus is still not known.
- an ointment containing antibiotics can also be applied evenly to the lesions
- feed the sick animals with soft feed or grasses
- the disease generally lasts 1-4 weeks

### PREVENTION

- ◇ prevention is by giving immunity to healthy animals through vaccination
- ◇ give vaccinations only in areas where Orf is a major problem
  - \* the Orf vaccine is usually given at 1 month of age and repeated at 2-3 months of age for better results
  - \* separate vaccinated animals from uninjected animals until the scabs formed after vaccination fall off
- ◇ once an animal recovers from Orf and Orf is present in the flock, that animal will likely not be reinfected
- ◇ purchased or borrowed animals should be healthy and free of Orf
- ◇ Orf can be transmitted to humans. After working with or treating animals with Orf a farmer should wash his hands thoroughly.
- ◇ the Orf virus can live in the environment for a long time

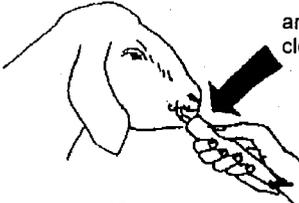
## 14. ORF

### 1. Clinical signs



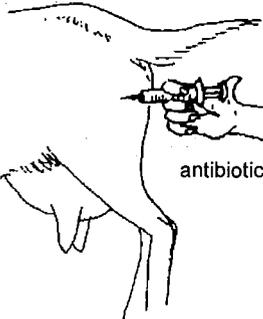
scaly bumps (black scales)  
especially around the mouth

### 2. Treatments



antibiotic salve or iodine solutions (7%) after  
cleaning the lesions around the mouth.

or



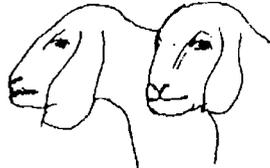
antibiotic injection



give soft feed/grass

### 3. Prevention

- vaccination
- animals from outside must be free from ORF
- keep animals in pen



## 15. LUMPY JAW AND ABSCESSSES

### CAUSE

Abscesses can be caused by bacteria and form under the jaw (lumpy jaw) or in front of the shoulder, on the flank or by the udder or scrotum. The bacteria enters the animal through a wound.

An animal with an abscess will:

- ⇒ have a lump filled with pus under the jaw or on the shoulder, flank or near the udder or scrotum

### TREATMENT

- the abscess, if soft or slightly raised in the center, may be lanced to drain the pus by inserting a sterile needle in the enlarged area. If blood is seen stop as a blood vessel is in the area.
- if pus is seen, use a sharp sterile knife to cut low in the center of the abscess making sure the cut will allow pus to drain out to the ground
- collect the pus on cotton or cloth and burn
- clean and flush the wound and treat with iodine solution
- sterilize the needle and knife used
- treatment may have to be repeated and the affected animal isolated from the rest of the animals

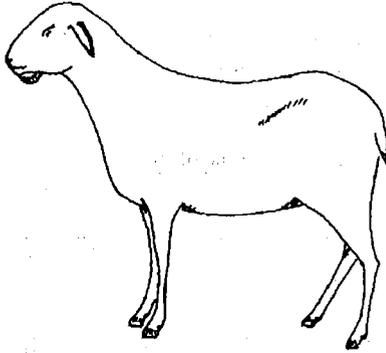
### PREVENTION

- ◇ prevent animals from coming in contact with nails, broken boards or other materials which may cause injury
- ◇ treat all wounds immediately
- ◇ keep the barn and surrounding area clean

## 15. LUMPY JAW AND ABSCESSSES

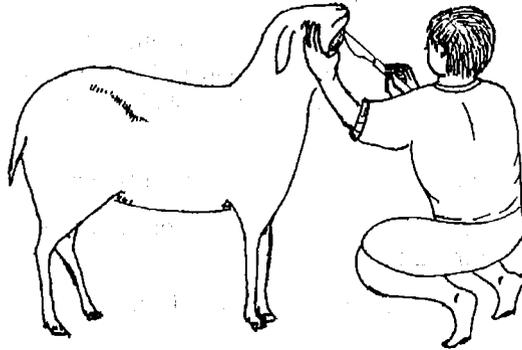
### 1. Clinical signs

- a pus filled lump under the jaw, on the shoulder or hind leg, udder or scrotum



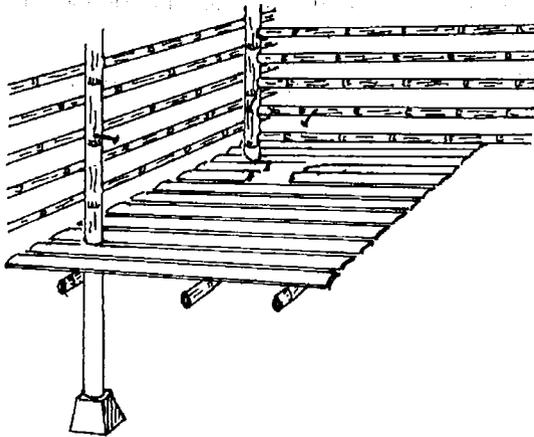
### 2. Treatment

- use a sterilized needle to check for blood vessels in the lump
- use a sterilized knife to cut low in the center of the lump for the pus to drain
- collect the pus on cotton or cloth and burn
- clean the would with iodine solution



### 3. Prevention

- keep barn area clean from sharp objects



## 16. DIARRHEA

### CAUSES

Diarrhea is an indicator of an ailment in the alimentary tract. The causes can be feed, germs or a combination of both.

An animal with diarrhea will:

- have feces that look light green, dark green, shiny green, reddish green or yellowish green
- be weak and may die if not given proper treatment

### TREATMENT

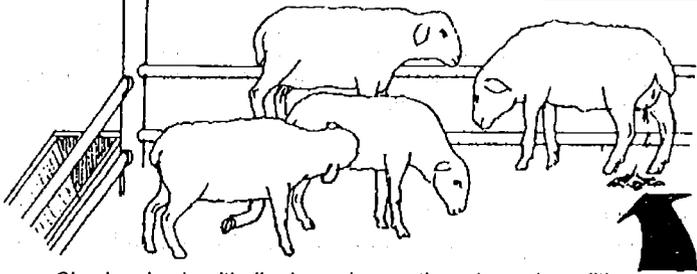
- isolate sick animals immediately and check the condition of the feces for color, thickness, frequency of defecation. By recognizing changes in fecal condition, other animals in the flock that may have the same problem can be identified.
- if the diarrhea is serious and the condition worsens, the animal must be treated immediately. It is very important to get fluids into the animal.
- force the animal to consume a solution of salt and sugar prepared by dissolving a tablespoon (10 grams) of salt and a tablespoon (10 grams) of sugar in 2.5 liters of cooled, boiled water. Oralit can also be used in the solution.
- give the animal as much as 1/6 of its body weight
- the animal can also be given active charcoal tablets, such as Norit (2-3 tablets)
- report the case to the local veterinarian for further tests and treatment

### PREVENTION

- isolating the sick animal will prevent the transmission to other animals in the flock. Move the healthy animals to a clean pen.
- do not buy a sick animal or animals coming from a group with a history of serious diarrhea problems
- reduce or do not give any feed/grass which may cause diarrhea. Mix them with other grasses.

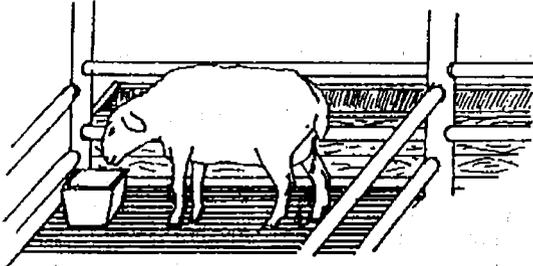
## 16. DIARRHEA

1.



Check animals with diarrhoea, observe the color and condition of the feces.

2.

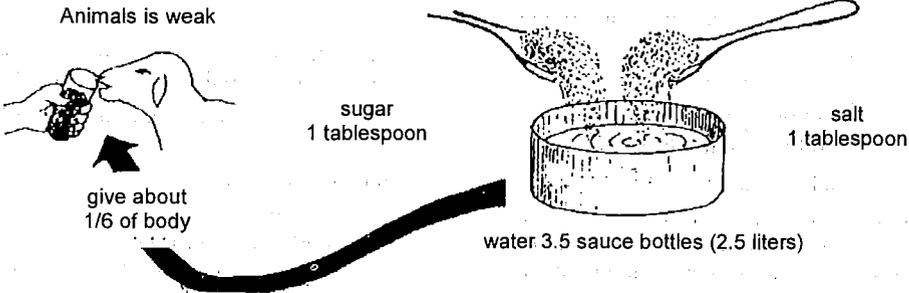


animals with diarrhoea isolated and give fresh feed

- + water
- + salt

3.

Animals is weak



force feed with the mixture

sugar  
1 tablespoon

salt  
1 tablespoon

water 3.5 sauce bottles (2.5 liters)

give about 1/6 of body

(if body weight is 10 kg, 7 give glasses of the

4. Pens must remain clean

5. REPORT



Report to the group leader, then he will report to the animal extension service

## 17. BLOAT

### CAUSE

Bloat is the result of a failure in expelling stomach gas normally, caused by the rapid production of gas by feed in the stomach. If not treated, it will be fatal. Animals may bloat that are fed on lush legumes. An animal with something preventing gas from leaving the stomach will also bloat. This may be due to an animal eating a plastic bag.

A bloated animal:

- ⇒ will be restless
- ⇒ have difficulty breathing
- ⇒ the upper left side of the stomach will appear bigger than normal and when tapped will sound hollow

### TREATMENT

- keep the animal in a standing position
- use a piece of wood to keep the mouth open
- force-feed the animal with cooking, coconut or peanut oil, ½ to 1 glass full (100-200 ml)
- apply side or lifting pressure to the stomach to help expel the gas by lifting the animal from below the stomach
- walking may also help in getting rid of the gas
- if the condition does not improve, a small diameter rubber tube (1/2 - 1 cm opening) should be forced down the throat and into the stomach to release the gas
  - \* to make certain the tube is in the stomach, smell the gas released. It should smell like stomach contents.
  - \* another method is to place an ear next to the stomach on the left side of the animal and blow into the tube. A bubbly sound should be heard. This also helps to clear the opening of the tube.
- if it is a gas bloat, gas may be immediately expelled once the tube enters the stomach. In some cases it may be necessary to move the tube and try to find the gas pocket.
- if it is a bubbly bloat, pouring a small amount of coconut, peanut or vegetable oil (100 - 200 ml) through the tube will help
- for best results, use a tube within the first few hours of bloat occurring

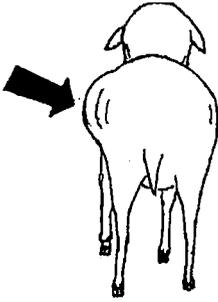
If all other attempts fail and as a last resort, a small tube can be inserted into the stomach through the side of the animal. This method is dangerous and over one half of the animals treated in this manner develop infections and die. First, a small area on the top left area of the stomach is shorn and dabbed with iodine solution. Determine the area to stab, about 3-4 fingers from the back bone in between the ribs and hip bone. Stab the area with a short piece of narrow (5 mm in diameter) metal tube which has been dipped in iodine solution. Before stabbing, pull the skin slightly so that after the tube is pulled out, the wound will close again. The gas coming out through the tube will have a bad smell. After the gas is released entirely, pull the tube out and the wound should be dabbed with iodine solution.

### PREVENTION

- ◇ do not offer animals too much wet lush legumes, grass, and grains that may cause bloating
- ◇ if there are no other choices, mix the feed with mature forage or with coconut or peanut oil before feeding it to the animals. Or, the animals can be force-fed with oil first before eating the grass.

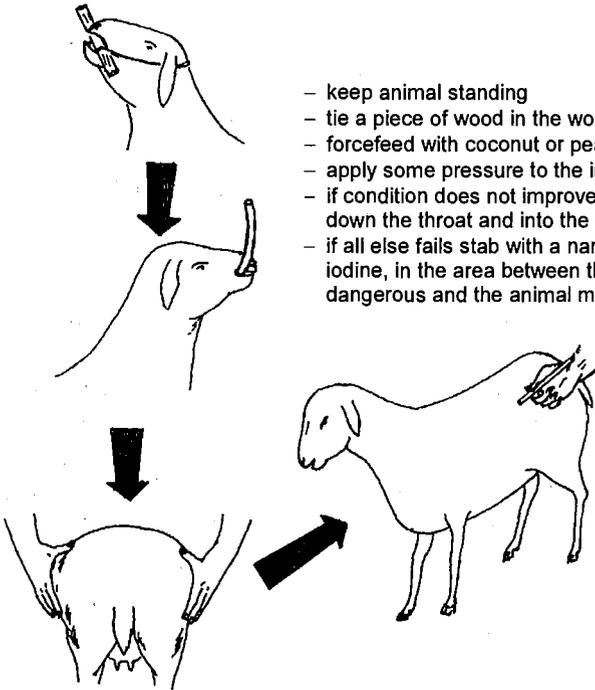
## 17. BLOAT

### 1. Signs



- restlessness, difficulty in breathing
- the left side of stomach is inflated
- when tapped, it sounds hollow

### 2. Treatments



- keep animal standing
- tie a piece of wood in the mouth
- forcefeed with coconut or peanut oil, ½ glass
- apply some pressure to the inflated stomach
- if condition does not improve a small tube can be forced down the throat and into the stomach to clean the gas
- if all else fails stab with a narrow metal tube, dipped in iodine, in the area between the ribs and hip bone. This dangerous and the animal may die

### 3. Prevention



- do not give too much young grass
- do not give much wet grass and grain in pods

## 18. PLANT TOXINS AND PESTICIDE POISONING

### CAUSE

Several plants, including grasses and legumes, contain toxic substances. When they are consumed by animals, the animals may suffer from the toxin.

An animal that has consumed a toxic plant or poison may:

- ⇒ foam at the mouth
- ⇒ have muscle spasms
- ⇒ have blue spots on mucus glands
- ⇒ have peeling skin
- ⇒ bloody feces/anus
- ⇒ have lesions on the face (from some types of toxic plants)

### TREATMENT

- treatment is rarely successful, especially when the toxin is already in the blood system
- at an early stage, the animal can be treated by force feeding the animal 2-3 tablets of Norit or the juice from a young coconut
- if a toxic plant is suspected, do not let the animal graze the area where the plant is present and feed non-toxic forage

### PREVENTION

- ◇ do not allow animals access to toxic plants, remove any toxic plants from grazing areas
- ◇ toxic plants vary with different areas. Veterinarians, livestock extension agents and other farmers are all good sources of information about toxic plants in your area.
- ◇ if grazing animals in plantation or cropping areas, be aware of when and where pesticides or herbicides are used and do not graze those areas after spraying

Note: Sometimes *Brachiaria decumbens* may cause hair to fall out and facial swelling in animals grazing Brachiaria dominated pastures or fed too much brachiaria unmixed with other forages.

Rubber seed also contains cyanide and must be processed by boiling for 30 minutes or soaking for 24 hours or combination of both before feeding.

Cooked rice should never be fed to sheep or goats. It can cause bloat.

# 18. PLANT TOXINS AND PESTICIDE POISONING

## 1. Clinical signs

- sudden death
- spasms



foaming at the mouth

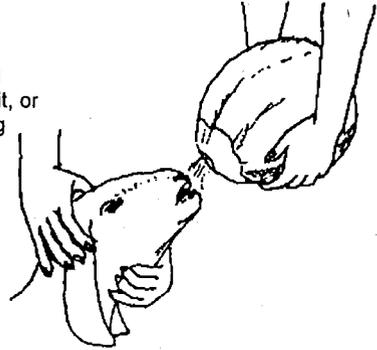


bloody faeces

## 2. Treatments

- early stage

give active charcoal tablets such as Norit, or the juice from young coconuts

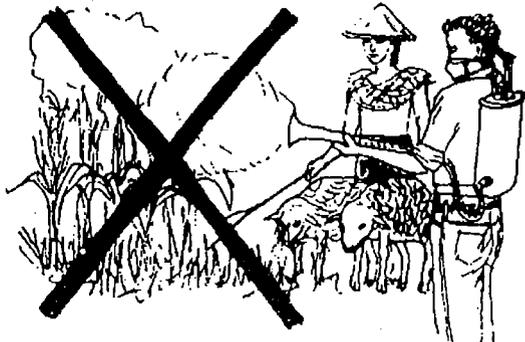


- late stage : difficult

## 3. Prevention



toxic plants



do not graze the animals around pasture/rice fields/crop estates which have just been sprayed with insecticides/poisons

## 19. URINARY STONES OR UROLIATHISIS

### CAUSE

Urolithiasis (called urinary or bladder stones) is caused by improper mineral balance in the feed. This usually occurs in rams fed a high concentrate diet. "Stones" are formed in the bladder that can block the flow of urine. As the animal cannot urinate, the bladder swells and will eventually burst and the animal will die from internal infection.

An animal with urinary stones:

- ⇒ will be unable to urinate or have small amounts of urine mixed with blood
- ⇒ may kick the belly area in early stages, later will lie down and strain to urinate with hind legs fully extended

### TREATMENT

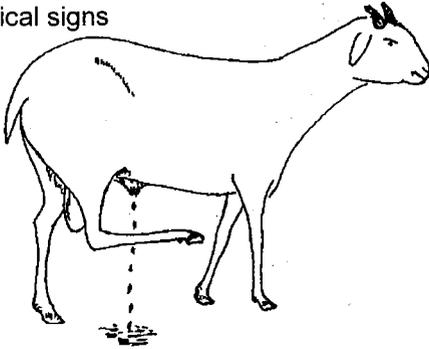
- initial cases can be treated with "keji beling"
- in some minor cases, the animal will pass the stone with some blood
- in more serious cases treatment is unsuccessful and if an animal shows signs of being unable to urinate and pass the stone it should be slaughtered for its meat value

### PREVENTION

- ◇ concentrate feeds should maintain a calcium to phosphorus ratio of at least 2:1
- ◇ additional salt may be included in the concentrate to increase water consumption to keep the system flushed
- ◇ offer a limestone and salt mixture to the animals to increase calcium consumption and stimulate water consumption.
- ◇ fresh water should be available at all times
- ◇ on high forage diets, bladder stones are usually not a problem

## 19. URINARY STONES OR UROLIATHISIS

### 1. Clinical signs

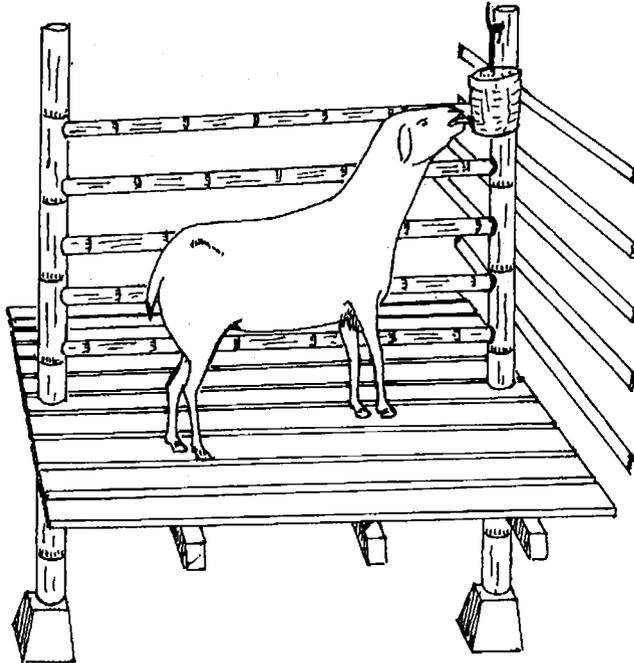


- a lamb with bladder stones will be unable to urinate or have small amounts of urine mixed with blood
- may kick belly and, later, lie and strain to urinate

### 2. Treatment

- traditional drugs may be tried
- in minor cases the stone may pass
- in severe cases there is no treatment and the animal should be slaughtered for its meat

### 3. Prevention



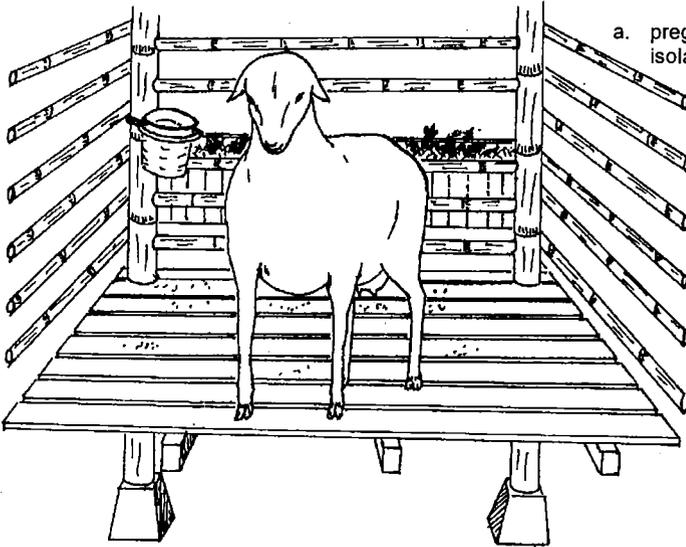
- provide a mineral block, salt or salt:limestone (1:1) mixture to increase calcium intake and stimulate water consumption
- always provide plenty of clean water

## **20. CARE FOR PREGNANT EWES/DOES AND NEWBORN LAMBS/KIDS**

- 1. Care for pregnant females close to lambing/kidding is undertaken to keep them healthy before and after giving birth in order to produce healthy offspring.**
  - ⇒ separate pregnant females close to giving birth from animals in early pregnancy, adult males and other young animals. This can prevent injury to the female.
  
- 2. Pregnant females require extra care, feed and water at all times.**
  - ⇒ feed them fresh grass and legume leaves in adequate amounts. Do not give grass that is too young.
  - ⇒ concentrates such as rice bran can be given
  - ⇒ provide clean drinking water and salt at all times
  - ⇒ pens should be kept clean and in good order so that the animals cannot be trapped in a broken floor
  
- 3. After giving birth, the ewe/doe is cared for and cleaned of any blood. Dab the newborn's navel with iodine solution.**
  - ⇒ the offspring should be able to suckle within the first few hours
  - ⇒ if there is a problem, such as the mother refusing to allow the newborn to suckle, hold the mother to allow the lamb/kid to suckle
  - ⇒ it is important that the newborn suckle soon after birth (within a maximum of 12 hours), because the milk contains substances to provide immunities to diseases
  
- 4. Place the ewe/doe and its newborn in a safe, clean and comfortable pen where the animals will not suffer from heat or cold stress.**
  - ⇒ a jute bag may be placed on the floor to keep the area warmer and also to prevent the newborn's legs from falling through the slatted floor

## 20. CARE FOR PREGNANT EWES/DOES AND NEWBORN LAMBS/KIDS

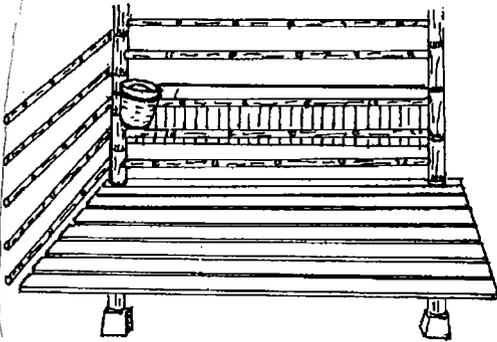
1.



a. pregnant ewe is isolated in a clean pen

2.

Raise the water bucket 300-350 mm above the floor, to prevent lambs from falling in and drowning



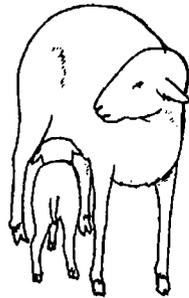
legume leaves



young grass

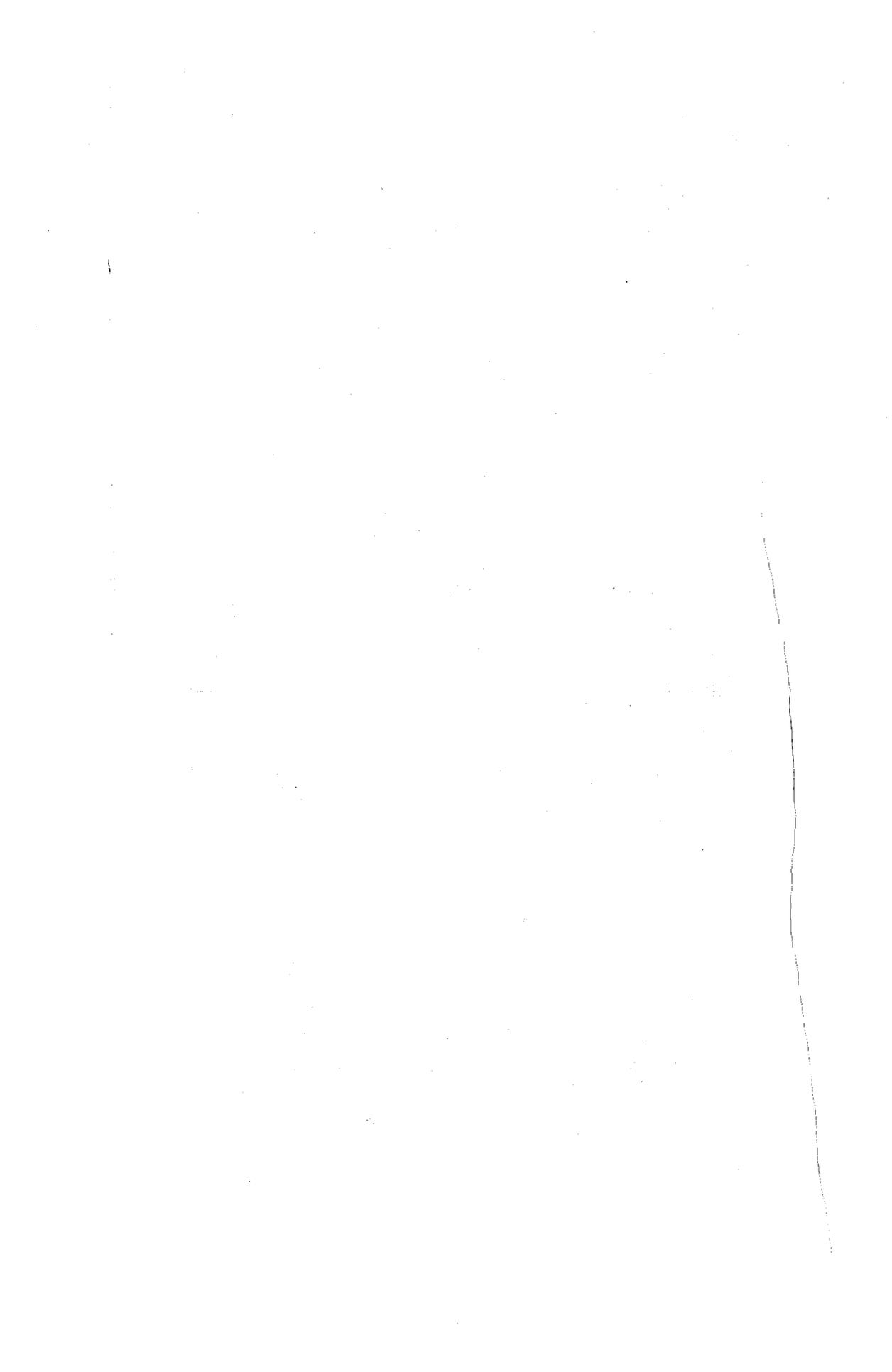


3.



4. Keep the pen clean

the lamb should suckle as early as possible (within 12 hours)



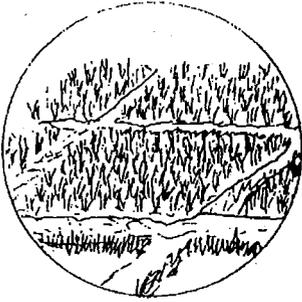
## **ECONOMICS AND MARKETING**

- 1. Reducing the risk of a decline in income**
- 2. Increasing business profits**
- 3. Regulating sales based on production planning**
- 4. The appropriate time to sell animals**
- 5. Some methods of selling animals**
- 6. Estimating the price of sheep and goats**
- 7. Increasing the selling price of animals**
- 8. The appropriate time to buy animals**
- 9. Calculating the benefits of new production methods compared to old methods**
- 10. Calculating the minimum price**

## 1. REDUCING THE RISK OF A DECLINE IN INCOME

- Farm enterprises in the villages are usually based on a small area of land, limited capital and seasonal family labor availability. Family income must be provided according to the needs of the household through mixed farming practices.
- Mixed farming can reduce the risk of income loss due to a failure in the harvest of one crop or farm enterprise with other sources of income from the other farm activities.
- Mixed farming also spreads out the risks of losing sources of income by allocating farming activities that correspond to the availability of land, capital and labor.
- Raising animals has proven to be beneficial to crop farming. Apart from using the manure for the plants, animals can also utilise crop residues as forages.
- Sheep and goats are one of the most appropriate commodities in a farming system based on a small piece of land. The risk of investment loss in the death of an animal is smaller for sheep and goats than for larger animals, and with the same capital the farmer can own more sheep and goats, compared with larger animals.
- Sheep and goats can adapt to various environments are easy to raise, can be sold anytime, are faster in reproducing, can utilize almost any forages and agricultural residues and the cost for pens and maintenance are usually lower.

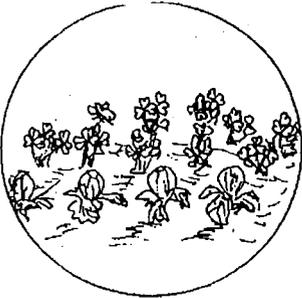
1. REDUCING THE RISK OF A DECLINE IN INCOME



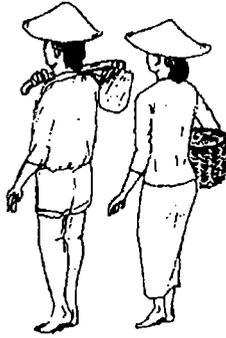
rice



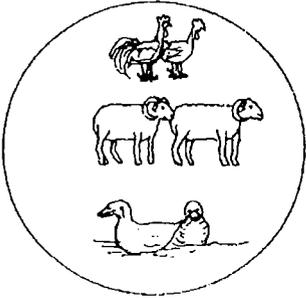
cassava



food crops



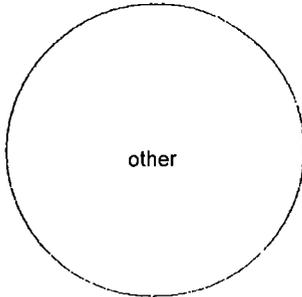
fish pond



animals



industrial labor



other

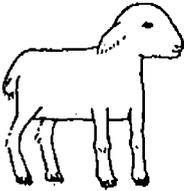
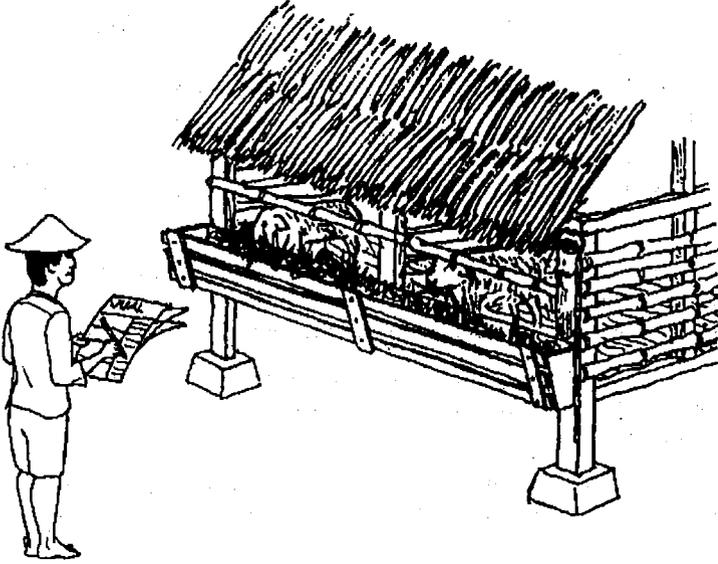
## 2. INCREASING BUSINESS PROFITS

Mastering the art of farming may increase profits, because the running costs and the expected sales can be well planned.

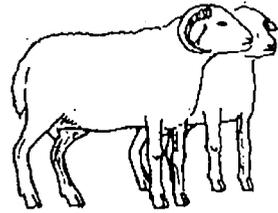
- Try to find alternatives for combinations of feed resources for various ages of animals so that the feed costs can be minimised. For example, a combination of feed resources for every planting season and the utilisation of agricultural residues at harvest is the best way to reduce the feed costs and make feed available all year.
- Try to keep records on simple methods of animal care with maximum output. The most important record in this program is the birth date, to determine when to wean and when to sell the animals. The date of mating is used to predict the lambing period, and the amount of cash required for the fixed and operational costs. (see **17. Production Record Cards** in the **BREEDING STRATEGIES AND RECORD KEEPING SECTION**.)
- It is preferable to have records on the additions and reductions in the number of animals at any given time. For instance, the additional animals may come from newborn lambs, purchases, profits from lending animals, gifts, etc. Reduction in numbers may be caused by death, sales, payment of debts and slaughtering for family consumption.
- The use of production records remove any doubt in making decisions. A good management plan helps to make important decisions and is usually very beneficial.

## 2. INCREASING BUSINESS PROFITS

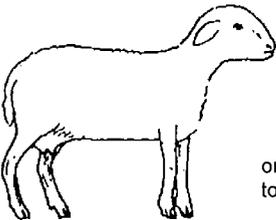
production records can help to increase profits



buy weaned lambs  
for fattening



age at selling: 1½ years



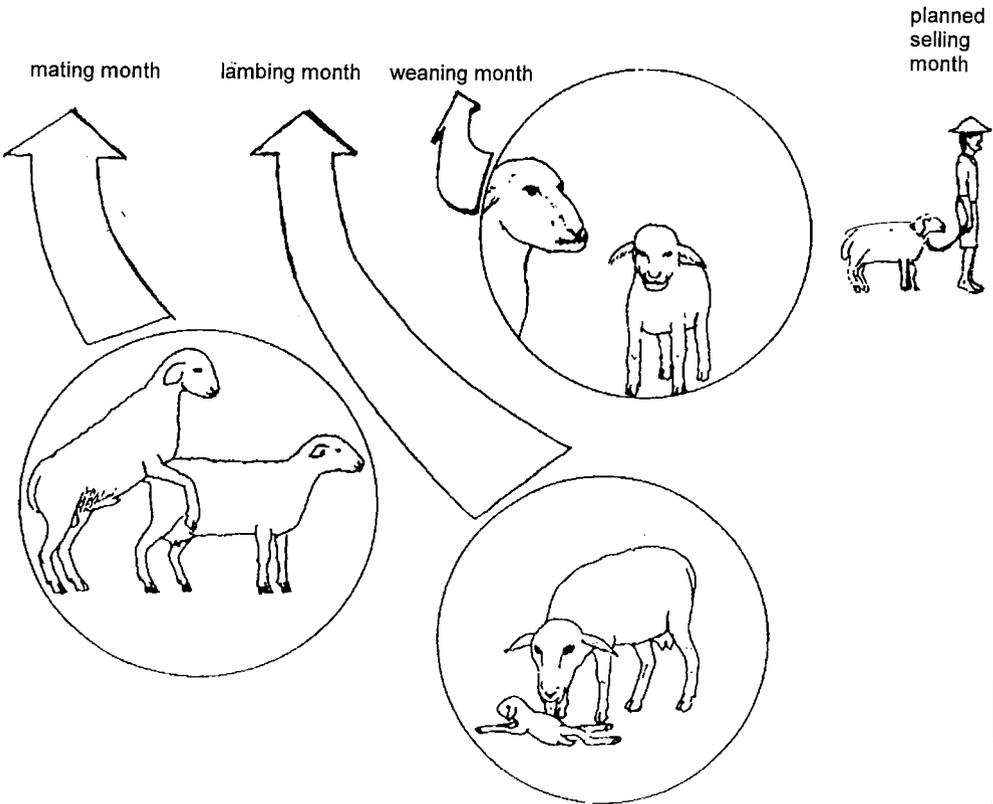
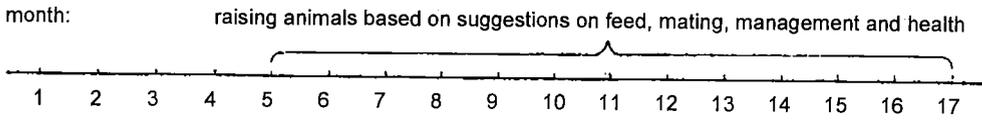
or good female breeding stock  
to replace the old ones

### 3. REGULATING SALES BASED ON PRODUCTION PLANNING

- Careful planning for regular sales is one way of increasing income from raising sheep and goats.
- Planning the production cycle can help plan the buying and selling of animals, estimating the requirements for capital and labor and estimating income.
- Production can be arranged by taking into account the gestation period, weight at weaning, age at marketing, age for replacing dams, age for replacing bucks, choices of rams/bucks and stocks, and the market demand which is seasonal or for special demand periods such as during Idul Adha.
- The gestation period is 5 months and the age at weaning is 3 months, so the production calculation can be based on the number 8 as the unit of production for the offspring.
- If a farmer has 8 ewes to be mated in consecutive months, then 18 months later, which is 8 months after mating plus 9-10 months for growth, the farmer can start selling animals monthly, for the next 5 years until it is time to replace the ewes.
- If a farmer has only 4 ewes, sales can be carried out every 2 months. Likewise, if there are only 2 ewes, the farmer can sell only every 4 months. In other words, the selling interval is the number of ewes divided by 8.
- Planning the production and marketing may increase family income because the selling rate depends on production level, age at selling and market demands.

### 3. REGULATING SALES BASED ON PRODUCTION PLANNING

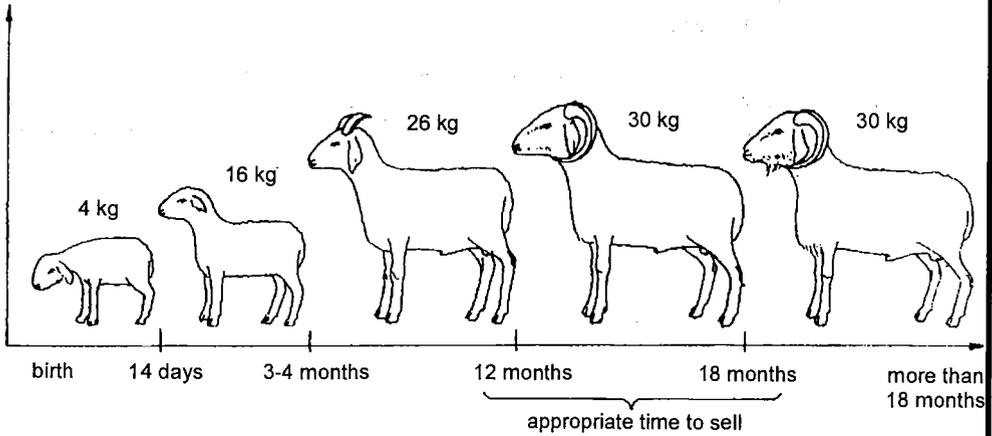
- Plans for regular selling are closely related to mating plans
- Suggested to sell animals at the age of 1 1/2 years depending on their condition
- Sell animals according to carcass calculation and the shortest market channel possible



#### **4. THE APPROPRIATE TIME TO SELL ANIMALS**

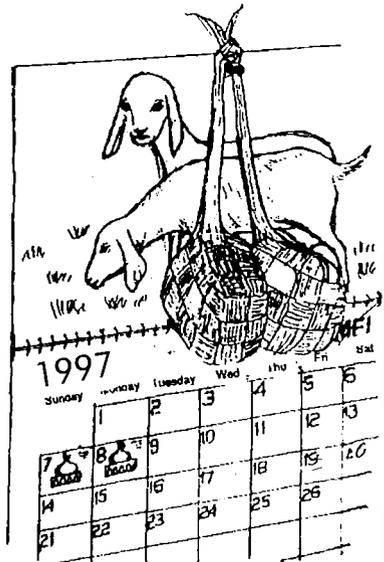
- Sheep and goats will gain body weight daily depending on the feed given and the breed used. However, at one stage the body weight will not increase anymore because the animals have reached their mature sizes.
- Animals can be sold when the body weight does not increase anymore, which is about 1 - 1 ½ years of age.
- Try not to sell younger animals because the price is usually low and the chance for rapid growth will be lost.
- Selling the animals can be postponed if a festival is approaching. However, the extra maintenance cost should be calculated as not to exceed the expected price increase during the festival periods.
- Postponing the sale of animals too long will result in a loss, because there is no more increase in body weight to cover the extra maintenance cost.

#### 4. THE APPROPRIATE TIME TO SELL ANIMALS



Selling price is high on:

1. Idul Fitri, for males and females
2. Idul Adha (festival of sacrifice for males)

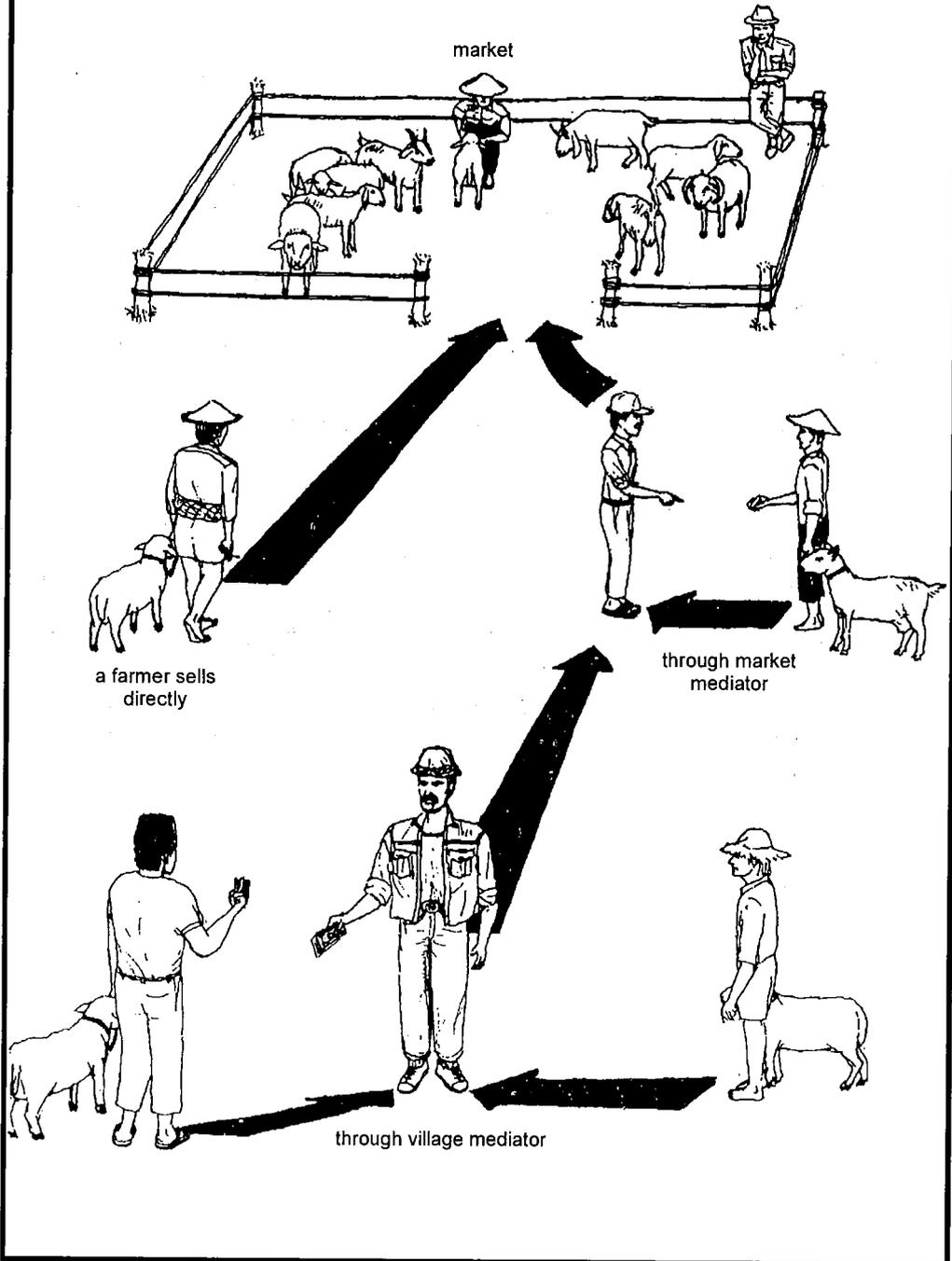


## 5. SOME METHODS OF SELLING ANIMALS

Sheep and goats can be sold by farmers in several ways. Each method of selling gives different profit levels depending on the number of parties involved in the selling process.

- **Selling directly to buyers** is the best way because the full selling price is received entirely by the farmer.
- **Selling animals in the market** usually creates extra cost for marketing and also may waste time that can be used to work in the field.
- **Selling through village traders** will reduce the farmer's income because he has to pay for the trader, and also the actual returns will be lower to cover the cost of transportation to the market.
- **Selling animals to pay debts** often results in the highest losses because the farmers are forced to sell, the price received often is very low and may have been predetermined as the cost of the debt rather than the true value of the animal.

5. SOME METHODS OF SELLING ANIMALS

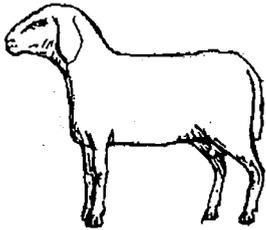


## 6. ESTIMATING THE PRICE OF SHEEP AND GOATS

- Sheep and goats can be marketed easily because the need for meat is always increasing.
- Selling animals through someone other than the final buyer will reduce profits because the cost of transaction increases.
- A mediator usually makes profits from the sale of the skin, the head, the offal and the lower legs. Therefore, a farmer should try to adjust the selling price up to the level of the retail price of meat.
- To estimate the selling price based on the meat retail price and the liveweight at the time of selling use the following formula:  $\text{liveweight} \times (45/100) \times \text{meat retail price}$ . Example: 20 kg lamb, liveweight price Rp 5,500/kg, meat retail price Rp 12,500/kg.
  - if animal is sold solely based upon liveweight the selling price is:  $20 \text{ kg} \times \text{Rp } 5,500/\text{kg} = \text{Rp } 110,000$
  - if the animal is sold based upon meat retail price the selling price is:  $20 \times (45/100) \times 12,500 = \text{Rp } 112,500$
  - the animal's actual value is higher due to the value of hide, offal, head and lower legs
- The number 45 in the above formula is called the "dressing percentage" and represents the percentage of liveweight that can be sold for meat in the market. Dressing percentage usually ranges from 45 - 50 for small ruminants. Using 45 in the formula gives the lowest estimate of the selling price for an animal. Using 50 would give a higher estimate. Calculate these estimates before selling and keep them in mind when bargaining to receive a fair price. Also, consider the additional value of hide, offal, head and lower legs when selling animals.
- The absolute minimum price received for an animal must at least cover all costs associated with raising that animal. (see **10. Calculating the Minimum Price** later in this chapter.)

## 6. AN EXAMPLE OF ESTIMATING THE PRICE OF SHEEP/GOATS PER HEAD

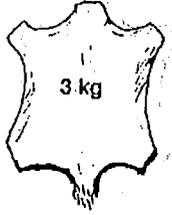
### I. Estimate live weight



20 kg × Rp 5,500.00/kg

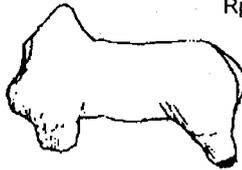
### II. Estimate carcass

skin



15% (3kg) value = Rp 10,000.00

carcass



9 kg (45%)  
Rp 12,500/kg = Rp 112,500.00

head



1½ kg (7½%)  
Rp 2,500/kg = Rp 3,750.00

legs



2 kg (7½%)  
Rp 2,500.00/kg = Rp 5,000.00

offal



1½ kg  
Rp 6,500 = Rp 9,750.00

manure



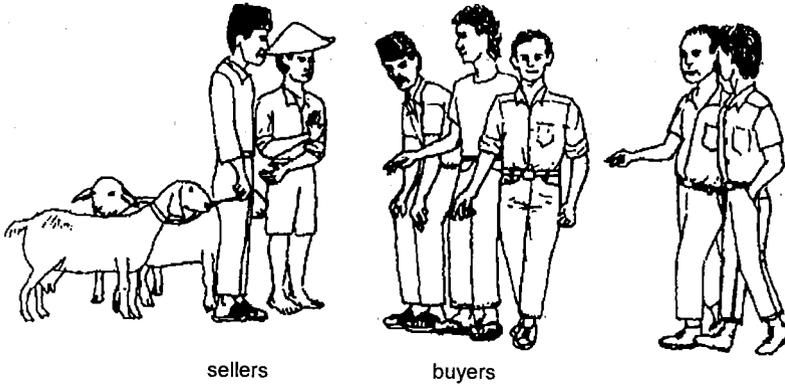
value Rp 110,000.00

Total value = Rp 141,000.00

## 7. INCREASING THE SELLING PRICE OF ANIMALS

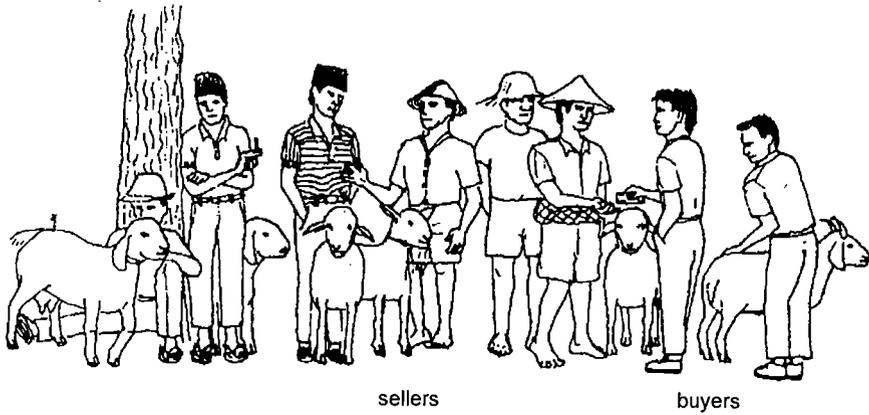
- Another aspect of increasing the selling price of animals is to observe the levels of supply and demand.
- Demand is the amount of sheep and goat meat sought by buyers in the market. Demand is usually higher during festivals because more meat is required.
- Supply is the amount of meat produced from slaughtered animals which depends on the number of animals in the market.
- If the demand for meat is larger than the meat supply (there is not enough meat in the market for everyone to buy), the price will go up, such as during festivals. On the contrary, if demand is lower than supply the price will go down.
- Likewise, if the supply of meat is larger than the demand for meat (too much meat in the market), the price will go down. If supply is lower than demand, usually the price will go up.
- The demand for sheep and goats is high during festivals, especially at Idul Adha, and also when many farmers want to buy animals. For example, at the beginning of the dry season, farmers in areas relying on rainfall cannot produce crops. To increase their income, many farmers want to buy sheep or goats to raise. This increases the demand for animals and raises the price of sheep and goats.
- Supply will be very high when many farmers want to sell their animals. For example, at the beginning of the wet season many farmers sell animals for cash to purchase seed, fertiliser and other things needed to work the land. Also, at the beginning of the dry season, forage availability in crop estates is limited and many farmers may sell some of their animals.
- Considering this information, try not to sell animals when many other farmers also want to sell. In this situation, it is possibly the best time to buy animals because supply is high and prices are low. Also, do not buy animals during festival periods or during other high demand periods when many people want to buy animals. Try to wait until the demand is lower when the price of animals will be lower also.
- Try to sell animals in their best condition, healthy, high body weight and ready for market.

## 7. INCREASING THE SELLING PRICE OF ANIMALS



The appropriate time to sell

- there are less sellers than there are buyers



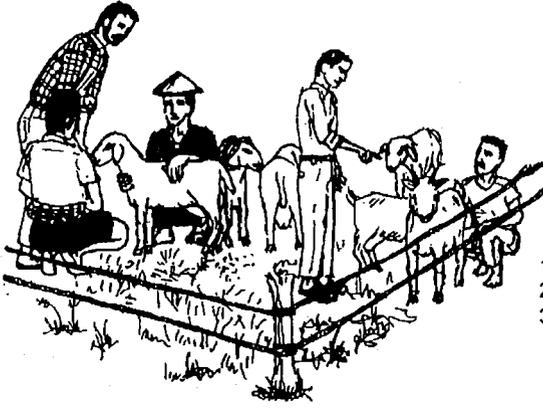
Inappropriate time to sell

- there are more sellers than there are buyers

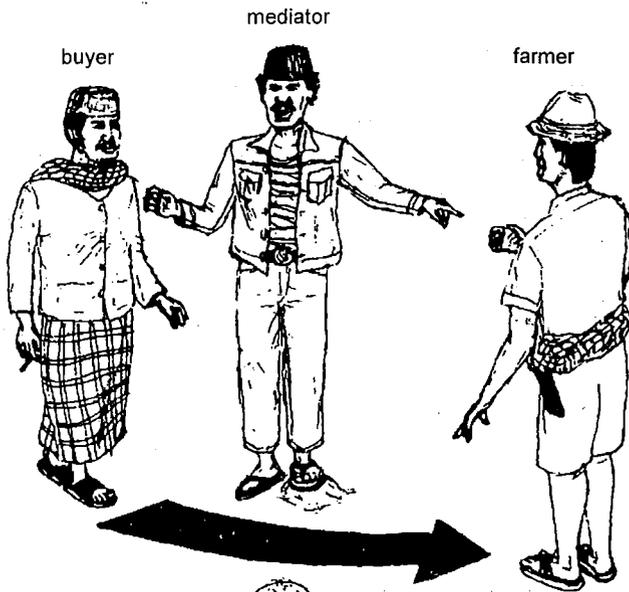
## 8. THE APPROPRIATE TIME TO BUY ANIMALS

- Sheep and goat production is profitable when started at the appropriate time in purchasing the animals. Preferably do not buy animals during the time when many other farmers also want to buy, because the price will be high. Try to buy when there are only a few buyers, so that the price will be low because there are many animals in the market.
- The purpose of buying animals is not only for breeding stock, but also to replace old animals or for fattening. Use proper judgement in selecting animals for breeding stock and for fattening by choosing animals that are less than one year old.
- Try to buy animals directly from the owners. This will not only cut the marketing channels to get a lower price, but the farmer can also find out background information on the animals such as whether they come from singles, twins or triplets.

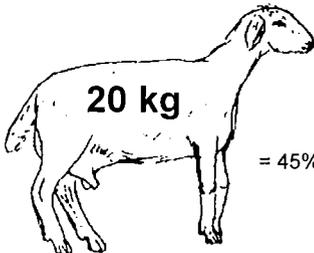
## 8. THE APPROPRIATE TIME TO BUY ANIMALS



1. buy when the buyers are few
2. select good stock
3. fattening  $\longrightarrow$  select animals less than 1 year old



4. buy animal directly from owner/farmer or by shortening the market channels



= 45% meat - bones

5. use the calculation of production cost and an estimate of selling value, based on the initial condition (body weight) of the animals

## 9. CALCULATING THE BENEFITS OF NEW PRODUCTION METHODS COMPARED TO OLD METHODS

- Sheep and goat production has long been practised by farmers in the villages. However, various new methods can be applied to improve or expand the business.
- Farmers would certainly consider adopting new production methods if they were more beneficial than the old methods. Therefore, it is necessary to compare the advantages and disadvantages of each method.
- Farmers desire a method which is the most profitable, so that either the new or old method can be adopted or even upgraded.
- An example for this comparison is in handling the lambing process.

The old method : no help provided at lambing, no additional milk for more than 2 lambs in the litter and no additional feed or care given to the ewes

Advantages : no extra cost, time or materials used to help in the lambing process and reducing the deaths of offspring

Disadvantages : high lamb mortality, low weaning rate and production level, consequently a low price is received when selling the lambs

The new method : assisted lambing, extra milk provided when required, extra care and feeds provided to milking ewes

Advantages : low mortality rate, high weaning rate, heavier lambs at weaning, higher price received when selling lambs

Disadvantages : extra handling and care are required, additional cost for extra milk, additional labor required for gathering extra feed

- The choice of the new or old method is based on the difference of (advantages - disadvantages of the new method) - (advantages - disadvantages of the old method).

$$\begin{array}{ccc} \textit{New method} & & \textit{Old method} \\ (\text{advantages} - \text{disadvantages}) & - & (\text{advantages} - \text{disadvantages}) = ? \end{array}$$

- **Conclusion:**

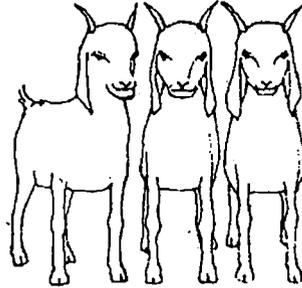
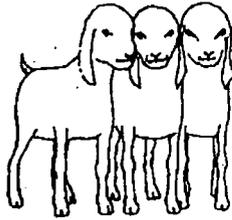
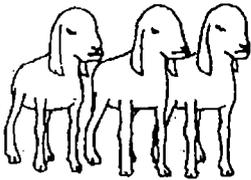
- ⇒ if the value is larger than zero, the new method is more profitable
- ⇒ if the value is equal to zero, both methods are equal
- ⇒ if the value is less than zero, the old method is more profitable

## 9. COMPARING BENEFITS OF 2 DIFFERENT METHODS (an example of lambing procedure)

(a) new method:

additional cost:

labor, time,  
milk for more  
than 2 lambs

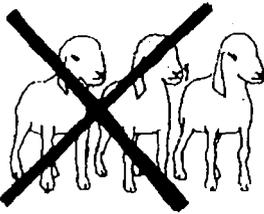


advantages: - low mortality  
- more lambs weaned  
- more animals to sell

Difference - A: advantages minus additional cost

(b) Old method:

Cost savings: labor, time  
extra milk



production level: - high mortality  
- few lambs weaned  
- few animals to sell

Difference - B: production level minus cost savings

- If difference A minus difference B is large than zero, then the new method is more profitable than the old method.
- If equal zero, both methods are equal.
- If smaller than zero, than the old method is more profitable than the new method.

## 10. CALCULATING THE MINIMUM PRICE

- The minimum price or the lowest price that can be accepted by a farmer is the price level which covers the entire cost of production until the animals are ready to sell.
- The production cost generally consists of the initial capital, fixed cost for pens and other equipment with long duration, and the running costs such as labor, feed, medications and marketing. A selling price lower than the minimum price means a loss for the business.
- The minimum price can be calculated in 2 ways:
  1. The minimum price for the entire farming period, by taking into account the initial capital, fixed cost and the cost of raising the animals.

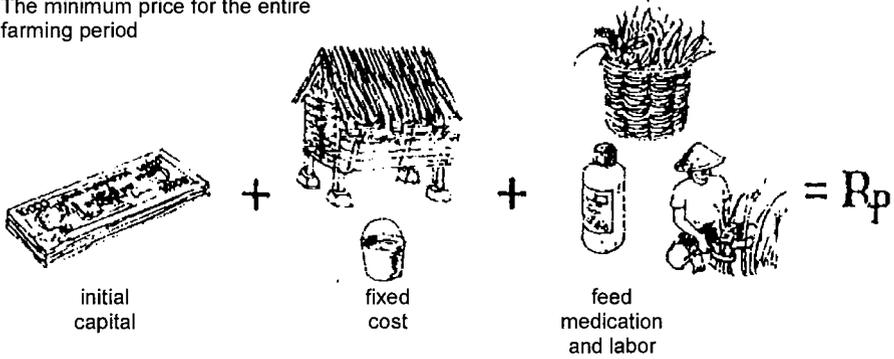
$$\text{Minimum price per animal} = \frac{\text{initial capital (Rp)} + \text{fixed cost (Rp)} + \text{production cost (Rp)}}{\text{total number of animals for sale}}$$

2. The minimum price for one production process, for instance in the case of fattening, one production process includes all costs from buying the animals to selling them.

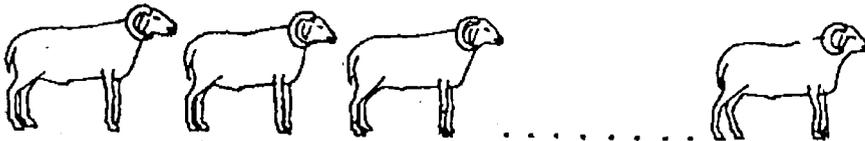
$$\text{Minimum price per animal} = \frac{\text{production costs (Rp)}}{\text{total number of animals for sale}}$$

# 10. CALCULATING THE MINIMUM PRICE

(a) The minimum price for the entire farming period



divided by \_\_\_\_\_ = Rp/head



the number of animals for sale

(a) The minimum price for one production process



divided by \_\_\_\_\_ = Rp/head



the number of animals for sale









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