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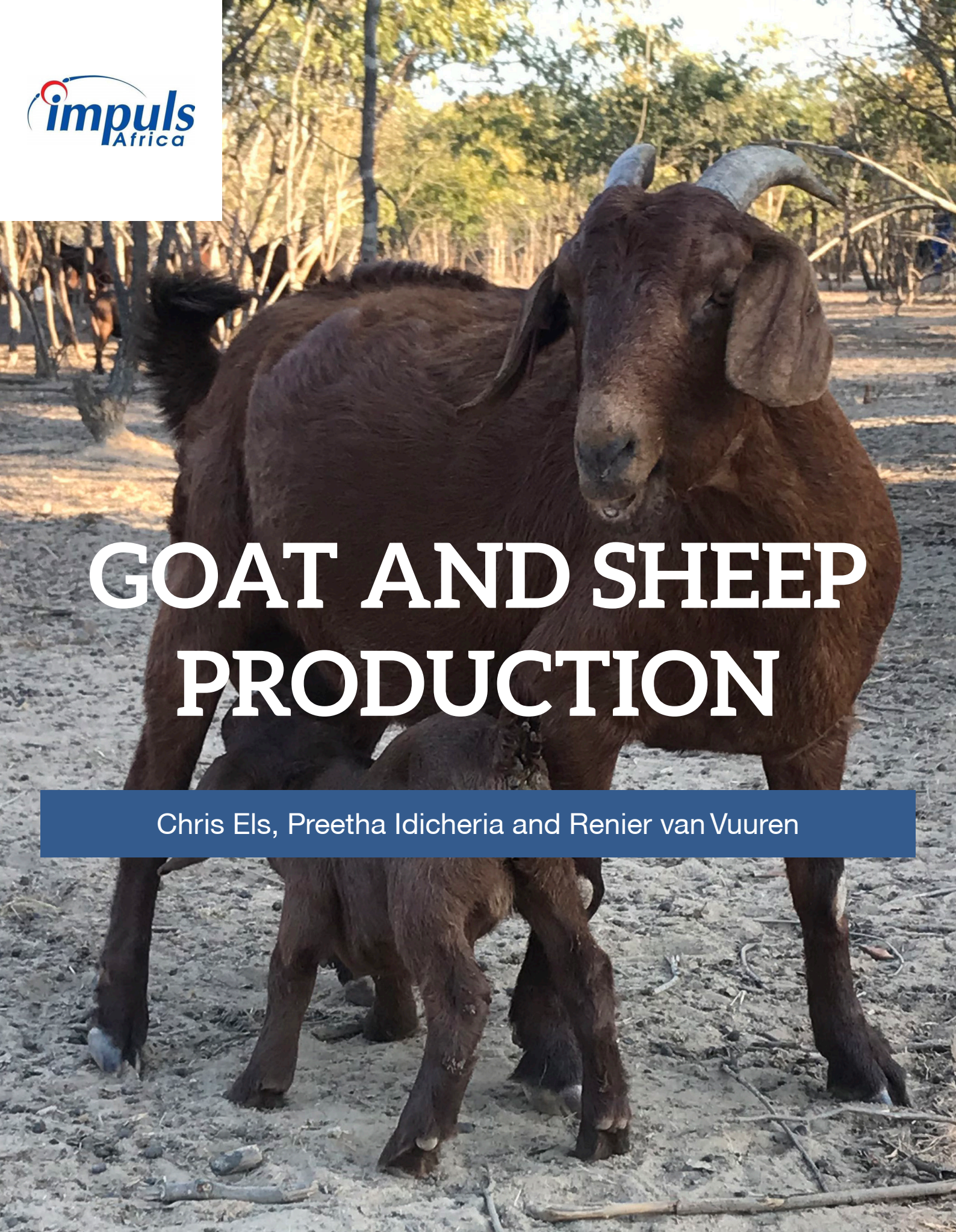

GOAT AND SHEEP PRODUCTION

Chris Els, Preetha Idicheria and Renier van Vuuren

PROSPERO
ZAMBIA

Goat and sheep production

Developed by

Chris Els and Preetha Idicheria

Sparrow Consulting

Renier van Vuuren

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Overview of the book

Purpose of this book

The main purpose of this book is to guide and assist owners of domesticated goats and sheep with a practical approach to the correct ways to enhance the profitability and sustainability of their goat and sheep herds.

EVERYTHING STARTS WITH THE MARKET FIRST!

Farmers have to start by understanding the needs of their target market (volumes and quality standards) and find the practices listed in this book that would best assist them in achieving the market requirements, including breeding genetics and producing meat or milk. Farmers who apply good stockman and husbandry practises explained in this book will find more success to access and deliver good quality and increased quantity to new and diverse markets. Farmers should constantly engage industry role players, including input suppliers, extension service providers, commercial breeders, government institutions, off-takers and agents to familiarise themselves with changes that take place in the market and opportunities that might arise.

The book is written so that readers can easily understand the explanations of the basic steps of goat and sheep rearing.

The book is divided into three parts.

- Chapter 1 is an introduction to goats and sheep. You will learn about the different types of goat and sheep breeds, including indigenous goats and sheep, and how to identify and handle these livestock. This chapter also focuses on housing and shelter facilities for goats and sheep and the typical equipment needed to supply water and feed. Nutrition and feeding basics are covered, including supplementary feeding. Reproduction and kidding/lambing, which includes breeding seasons and management of the does/ewes and bucks/rams, are covered. The section on kid/lamb rearing includes ways to reduce kid/lamb mortalities, castration, weaning and rearing orphans. The proper way to do creep feeding of kids/lambs will also be discussed, as well as how to use the existing grassland available to manage your goats and sheep.
- Chapter 2 covers the wellbeing and health of the goat/sheep herd. You will learn about basic diseases and conditions, including internal and external diseases and parasites. This chapter includes a section on basic vet kits and essential equipment used to take care of goat's/sheep's health, including consumable medicines and equipment. You will learn how to treat goats/sheep correctly, administer medicine, measure correct dosages, take temperatures, give injections and trim hooves. This chapter discusses how to score the herd and how to do ear tagging, keep a record of your livestock,

establish the age of goats/sheep, and make a calendar for the goats'/sheep's treatments.

- Chapter 3 gives basic information on how marketing and value-adding works and discusses the economics of goats and sheep. You will look at different production systems and how to compose a herd for the best commercial returns. This chapter also discusses the costs, income from and profitability of goat and sheep farming, and the marketing and sale of live goats and sheep and their skins or fibre (wool). Finally, the transporting of goats and sheep is discussed.

Chapter 1

Goat and sheep rearing basics

1.1 Introduction to goats and sheep

Zambia is a landlocked country, covering an area of about 752,614 km^2. It has a tropical climate defined by a dry and rainy season and is divided into three main agro-ecological regions based on climatic characteristics with an annual rainfall between 700 and 1 400 mm.

In Zambia, sheep rearing is not as popular among livestock farmers as goat rearing. The total number of sheep was estimated to be approximately 3% of the total number of goats according to the 2017 census. However, there has been an increase in sheep rearing over the last three years. The demand for goat farming in Zambia has grown significantly over the past couple of years. An example of this would be countries like Saudi Arabia are interested in importing one million Zambian goats a year.

In this section, the various breeds of goats and sheep commonly found in Zambia and the main purposes of each breed will be described. As the identification and characterisation of the different breeds are important for any livestock farming, development or improvement work, you will learn how to identify each individual goat and sheep in your herd.

You will also study the basics of keeping goats or sheep and handling them correctly. This includes the best ways to house and feed them, controlling and managing their breeding and kidding/lambing, rearing kids/lambs and using veld or grazing areas effectively.

Goat breeds

The most common goat breeds in Zambia can be divided into three different groups:

- Natural occurring or indigenous breeds.
- Meat breeds.
- Dairy breeds.

These breed types have individual characteristics, but they share some common features. All the goat breeds common in Zambia have the following characteristics:

- The gestation period is 5 months (or 150 days).
- Female goats (does) are ready for breeding at 9 months of age.
- Goats' main birthing seasons are July to September.
- One male goat (buck) can serve 30 does. The common ratio for breeding is 1 buck to 30 does.
- Goats' normal lifespan is 5 - 10 years.

Indigenous goats

Indigenous goats are naturally adapted to live in a specific area or region and have shorter coats. For example, Zambia is harsh, hot and dry in a lengthy winter and very wet in a short raining season. These goats are culturally important and are typically used for meat production. The handling and production norms for goats vary from area to area and can be quite different.

Indigenous goats are usually referred to as Indigenous Veld Goats (or IVGs). They are uniquely adapted to the southern African climate and can recover more quickly and with minimal care from diseases native to the area, like heartwater.

Figure 1.1: Indigenous goats

Indigenous goats have the following unique characteristics:

- Their weight at birth is about 2,5 kg.
- Their weight when weaning (when kids stop suckling) is 12 - 15 kg.
- Females weigh 35 - 40 kg when fully mature.
- Males weigh 45 - 50 kg when fully mature.

The meat breeds

The Boer and the Kalahari goats are typically raised for meat production. A typical goat meat meal (michoppo) is popular in large parts of Zambia. In general, these goats are more likely to catch diseases than the indigenous types. Boer and Kalahari goats are bigger than other goats and an adult male can weigh up to 150 kg, while female adults can weigh up to 110 kg. The meat of these goats is very nutritious and tasty.

Figure 1.2: Typical Boer goat

Meat, Boer and Kalahari red goats have the following unique characteristics:

- Their weight at birth is 3 - 4 kg.
- Their weight when weaning (when kids stop suckling) is 20 - 25 kg.
- Females weigh about 110 kg when fully mature.
- Males weigh about 150 kg when fully mature.

Dairy or milk goats

Many different types of dairy goats are bred around the world. Their products are primarily used to produce milk, and secondarily used to produce cheese, yoghurt, butter and even powdered milk products. In Zambia, milk goats are Saanen goats and Toggenburg goats, which are almost all imported. These goats are specifically selected to produce milk from which processed milk products like cheese and yoghurts are made.

Figure 1.3: Saanen goat

Milk goats have the following unique characteristics:

- Their weight at birth is 3 - 4 kg.
- Their weight when weaning (when kids stop suckling) is 13 kg.
- Females weigh about 60 kg when fully mature.
- Males weigh about 85 kg when fully mature.

Sheep breeds

Sheep have the following unique characteristics:

- They have a strong herd instinct and keep together in tight and easily managed flocks.
- They are hardy animals that can survive over a long period of drought and semi-starvation. Because of their hardiness and adaptability to dry conditions, the north-western- and parts of the southern regions of Zambia have a larger concentration of sheep.
- They can produce well developed carcasses on roughage alone and are therefore well adapted to many areas unable to produce grain profitably.
- They can constrict or relax blood vessels in the face, legs and ears to control heat loss and have a unique ever-growing fibre allowing ventilation. It also protects the skin from the hot sun, rain and abrasions. This makes them less prone to extreme weather conditions, ectoparasites as well as other diseases.
- There is great variation in the external characteristics of sheep as can be seen in the number and form of their horns, the shape and size of their ears, the length of their tails and the development of great masses of fat at the base of the tail and other posterior parts of the body. They also vary with regards to the colour of the face and other parts not covered with wool and in the the quality and colour of the fleece.

The most useful way to categorise sheep breeds is according to their primary purpose, which is meat, wool, or dairy. While most sheep breeds are dual-purpose (i.e. they produce both meat and wool) and some are even triple-purpose (dairy, meat, and wool), most

sheep breeds excel in either the production of meat, wool, or dairy. In Zambia, the dairy and wool industries are not well developed, and most sheep are used for their meat.

The following breeds are the most common in Zambia.

Indigenous breeds

Fat-tailed indigenous sheep are widespread throughout the country, especially in the rural parts. They are usually uncategorised, which means they do not have a known ancestry with a documented pedigree.

Blackhead Persian (BHP)

The Blackhead Persian is a domestic sheep that originated from South Africa. It is a fat-tailed breed and raised for the production of meat. They are small to medium sized hardy sheep that are crossbread with local sheep. They are mainly white haired sheep with a black head and neck and long, drooping ears. They do not grow wool and tolerate heat better than wool sheep breeds.

Persian sheep have some unique structural features such as a large flap of skin extending below their throat, called the dewlap and a prominent forward breast bone called the manubrium. They also have a unique tail that is about the size of a human finger and sits on top of the tail fat pad. The first part of the tail is attached to the rump while the second part is pushed upwards and ends in a tassel hanging downward. When they are in a good condition, they store fat in the rump and base of the tail, which can be used as an energy source. Because of this, they are sometimes referred to as fat-bottomed sheep.

Figure 1.4: Blackhead Persian sheep

Both sexes are without horns (polled) and have black hooves. Rams have an average birthweigh of 2,6 kg at birth and 68 kg when matured. The Persian ewe weighs about 2,55 kg at birth and 52 kg matured. The average weaning weight of lambs is 27 kg at 100 days, when they are ready to be slaughtered for their meat.

They are prolific breeders with a lambing interval of seven months. They can reproduce without supplementary feeding as the ewes are good mothers and lactate for approximately 84 days. They produce around 50 kg of milk during their lactation period, and their milk contains around 5,9% fat. They have a lambing interval of seven month.

The Blackhead Persians are well adapted to local climates and quite resilient in arid conditions as they can survive on their own fat reserves in times of food scarcity. They also have a low mortaility and resistance to all diseases.

Dorper

Dorpers are South African bred sheep crossed between the Dorset Horn and BHP breeds. They can have a black head without a dewlap and a white body, or they can be all white. Both sexes are hornless.

Figure 1.5: Dorper

They have a thick skin covered in a mixture of short and loose white hair and wool that sheds without being sheared. The hair is not desirable in a fleece, as it does not accept dye, minimising both the quality and the value of the wool. The skin protects them in harsher climates and is the most sought after sheepskin in the world. It protects them against insect bites, flystrike and parasites. They also have a high degree of disease resistance.

The Dorper is primarily a mutton sheep that can breed throughout the year. The ewes are fertile and the percentage of ewes becoming pregnant in one mating season is quite high. A

Dorper ewe can lamb three times in two years. They are also fast growing sheep, reaching 36 kg between three and four months and gain muscle easily with minimal feed inputs. This makes them good for the production of low-fat meat.

The average birth weight of a Dorper male is 3,48 kg and 3,37 kg for females and the adult live-weight 74 kg for males and 44 kg for females.

Dorpers are strong and non-selective grazers and well adapted to a wide range of climates from hot and dry to humid and cold. This makes them an easy to care breed that requires a minimum of labour.

Dorset

The Dorset is similar to the Dorper, but with a white face, pink nostrils and no markings. They originated from the town Dorset in southwest England and come in a number of variations. The Dorset Horn has large spiral horns on the male and lighter horns on the female, whereas the Poll Dorset is hornless.

Figure 1.5: Poll Dorset ewe

Both Horned and Polled Dorsets have a large, coarse frame, white hooves and skin and very little wool on the face, legs and belly. Their fleece is very white, strong and lightweight. Dorsets are prolific sheep with a slightly shorter gestation period than many other breeds and can be bred out of season with three lambs per ewe every two years. The ewes are good mothers with heavy milk production while Horned Dorset rams make good terminal flock sires, producing lambs with heavy muscled carcasses.

The average live body weight of the mature Dorset rams is between 102 and 125 kg and the average live body weight of the mature ewes vary from 67 to 91 kg. This makes them good for the production of both meat and wool.

Like the Dorper, the Dorset are easy keepers and can be kept on a small farm.

Identification of goats and sheep

The Animal Identification Act No. 28 of 2010 in Zambia states that all livestock must be marked or identified. Goats and sheep are normally tagged on the ear with the owner's registered identification mark. However, most farmers might not have access to tattoo facilities and other methods are also used.

Tattooing equipment includes tattoo letters and numbers, pliers and ink. This equipment can be purchased from a local farm supply shop.

The process for tattooing is described below:

- The inside of the ear is cleaned to allow the ink to fill the holes made by the pliers.
- The ink is then applied to the area where the tattoo will be done on the ear.
  - The goat or sheep's certificate of registration or other identification will have the correct characters that must be tattooed onto the specific animal. Make sure that the tattoo characters in the pliers match the animal's identification.
- The tattoo pliers are pressed to the ear until holes appear in the skin.
- The ink is rubbed into the holes in the skin.
- The rest of the ink is cleaned from the ear and the characters must be clearly visible as black dots.

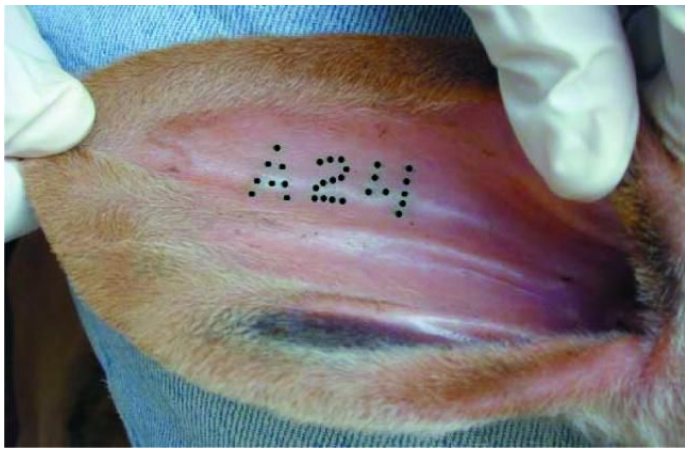


Figure 1.4: Goat with tattooed ear

Ear tags are more commonly used in Zambia. The tag is made from a durable plastic with a unique series of numbers and is available in different colours.

Figure 1.5: Ear tags on a goat

When tagging the ears, decide on a simple system to identify your goats or sheep. For example, you can:

- Use the year and then stroke the number e.g. 18/1 with the mother's numbers on the back.
- Use different coloured tags for male and females – for example, red for males and green for females.
- Decide on a letter for the year the goat or sheep was born – for example, 2017 would be A, 2018 would be B, 2019 would be C, and so on.

Putting all this together, if the first kid or lamb born in 2018 is a male, it can be tagged with a red tag and labelled B1, and the second kid/lamb in 2018 is a female, it gets a green tag labelled B2.

Figure 1.6: A tag applicator

Ear marking or notching is another method that is used to identify goats or sheep. The ear notching process involves the following:

- Punching small holes in the side of the ears of sheep and this is based on a universal coding system.
- You can tailor the system according to the needs of your farm or make use of the universal coding system.

Take note that this is an identification system that is permanent therefore this means that any mistakes made will also be permanent. Another disadvantage is that this method is only suitable for up to 300 sheep, making this system difficult to use for large flocks.

The figure below shows a notched ear sheep.

Figure 1.7: Notched ear identification system (https://commons.wikimedia.org/wiki/File:Notched_ear_sheep.jpg)

Keeping record

Keeping a record of your goats and sheep should be simple and basic but should also still be a complete record of each animal. If you have access to a computer, keep your records on MS Excel where you can fill in all the relevant information. If you do not have a computer, write the information down in an orderly fashion. You must record the following information:

- Number of goats or sheep you own which should be split into age groups.
- Number of kids/lambs born per female and the dates they were born.
- Number of animals that died, their age and cause of death.
- A record of the goats'/sheep's medical treatment, their ages when receiving treatment and the type of treatment.
- The doe/ewe of each individual kid/lamb.
- The buck/ram used to father the kids/lambs.
- The year of birth of each individual goat or sheep.
- The number of goats/sheep sold and whether they were bucks/rams, does/ewes, kids/lambs or castrated goats or sheep. Record the time and date of sale and the price they were sold for.
- The number of goats and sheep bought, the time and date of they were purchased and the purchasing price. Record who sold them and how this person can be contacted.

1.2 Housing and handling facilities

How goats and sheep are handled is very important.

Goat behaviour

Goats can be quite sensitive if not handled correctly. They must be kept calm to prevent injury to themselves or other goats.

Here are a few basic pointers to understanding goat behaviour:

- Goats tend to move to light areas rather than to dark areas.
- Family groups are important to goats, and they tend to stay grouped with their family.
- Goats can become stressed if separated from the rest of the herd.
- When in a confined space or stressed, they can become aggressive towards each other.
- The goats will be less stressed when handled regularly.
- Goats normally have a leader in a herd and the rest tend to follow the leader.
- Moving in a circle is quite common when they are in a pen where the handler is also present.
- Noise can distract goats. Keep outside noise to a minimum.
- Goats will try to find opportunities to escape and can jump over fences and gates.
- A goat can be encouraged to move forward when the handler is standing at the goat's shoulder.
- When trimming the hooves, the goat must be kept upright.
- Try not to hold the goats by the horn tips. Rather hold them by the base of the horn.
- When handling goats, try to be calm and quiet as this will make the task at hand easier. You must not beat animals with sticks or throw them with stones but handle them in a humane manner.

Sheep behaviour

Sheep have specific behaviour traits, understanding these traits can help you handle sheep with more ease.

Here are some basic pointers for you to understand the behaviour of sheep:

- Sheep have strong flocking instincts; therefore, they feel safer when they flock together. Never try to separate sheep from the flock as it could result in the sheep feeling scared or frightened.
- Sheep are followers and they usually follow a leader. Leaders are usually the more “dominant” sheep in the flock, so let them follow as you are not required to lead or drive them as you would with cattle.
- By nature, sheep are docile or submissive animals however you should be weary of rams especially during the breeding season. During this season, rams can become aggressive and cause serious injuries to people.

- Sheep can remember people and other sheep for years, hence why sheep are considered to have excellent memories.
- Sheep are animals that like routine, so you should be patient as they do take time to learn something new.
- Sheep are considered to be highly intelligent animals and displays and recognises emotion by using facial expressions.
- Sheep get easily frightened by loud noises such as barking or yelling which could result in them getting nervous or anxious thus more difficult to handle. In cases like this, you should speak in a quiet and calm voice which could minimise the stress of the sheep.
- Sheep are very social animals, during grazing, they need to see other sheep. Making sure that sheep always have visual contact with other sheep will allow them to be more relaxed especially when moving, handling and housing them.
- As a prey animal, sheep depend a lot on their vision. Sheep have eyes which are situated more to the side of their head allowing them to have a much wider field of vision. However, they have poor depth perception which makes it difficult for sheep to identify shadows and wate and fear going to areas where they cannot see.
- Sheep are scared of dark places, so place a chute in a well-lit up area.
- If you need to catch a sheep, it is best to gather them all into a small pen. From there, you can approach the sheep from behind (which is out of their line of vision) thus allowing you to put your arm around their neck without frightening them.
- Sheep prefer moving through long, narrow pens and chutes.
- For sheep to relax, you need to have control over its head. Place your hand under their chin and lift their nose up in the air by a little, this allows them to calm down and relax. Also, by putting your hand on their bum makes them relax as well. These two handling procedures will help you when trimming hooves, shearing or giving them shots.

Figure 1.8: Sheep grazing together in large flocks (https://www.pexels.com/photo/herd-of-sheep-grazing-on-field-4946859/)

Raising goats and sheep together

Goats and sheep can be raised together however requires special care and consideration. Is it important to note that goats should be disbudded and sheep should be polled. Disbudding in goats is a procedure performed on kids so that their horns will not grow. Polled sheep are hornless sheep.

Feeding

Feeding is an important factor when raising goats and sheep. When raising goats and sheep together, you can allow them to graze in the same pasture. They will hardly compete for the same food, however an important aspect to consider when raising goats and sheep together is the amount of different minerals they require. Feeding and nutrition is explained in more detail in Chapter 1.3.

Shelter and fencing

To keep both goats and sheep safe, you have to make a suitable shelter and a strong fence. Sheep are more well behaved than goats, goats tend to explore and escape from their shelters so a much stronger fence needs to be made for goats. Housing needs for goats and sheep is discussed in more detail in the following section.

Shelters for goats and sheep

Housing facilities for goats and sheep differ according to the management system as well as climatic conditions.

Keeping the goats and sheep in smaller enclosures can help improve productivity. Goat and sheep housing is very important, especially with Zambia's intensive and high rain fall. Goats and sheep need to be kept in a dry shelter.

For the wellbeing of the goats and sheep and for confinement at night, you must erect a proper shelter to make sure that the goats and sheep are protected from:

- Bad weather (rain, high temperatures or wind).
- Theft.
- Predators getting access to the animals.

Figure 1.9: Goats in a shelter or goat house

Goats and sheep should be housed separately, and the type of housing differs with the production system used.

Goats and sheep that are kept in an enclosure without any shelter will be exposed to bad weather, theft and predators. You must build proper shelters that are big enough for all the goats and sheep and to provide the necessary protection. The shelter must have the following features:

- A roof to protect the goats and sheep from the rain and sun.
- Walls or side panels to protect the goats and sheep from wind.
- Raised floors for droppings to fall through and good drainage to prevent muddy conditions after rain. Goat droppings make good compost that can be used for crops or fertilizing pastures.
- The space between slats need to big enough for droppings to fall through easily, but small enough so that their feet doesn't get stuck between the slats. For adult sheep, 1,5 cm is ideal and for lambs about 1,3 cm is sufficient. The same is applicable to goats however the spaces are slightly narrower.
- The sheep shelter should be big enough so that is enough space for sheep to lie down, turn around and have the freedom to move around.
- The roof of the shelter must be at least 1,5 m from the floor, roof must either be high pitched or be slated if it is a flat roof, sides of the house must provide adequate airflow to control temperatures in the house and allow ammonium build-up.

Sheep shelters

The housing needs of sheep depends on factors such as:

- Environment: Healthy sheep can handle a wide range of temperatures provided that they have enough feed and water. Shelters for sheep should be able to protect sheep from extreme weather conditions such as hot weather, rain and wind.
- Season: During the rainy seasons, sheep need to be housed in a facility that is more stable. Hair sheep are more likely to seek shelter from rain than wooled sheep.
- Breed: With sheep, protection from heat is more important than protection from rain. For example, wooled sheep are more likely to seek shade during the day because of the heat.
- Type of production: An example of this is, sick and new sheep need to be placed or quarantined in an area away from other sheep, rams also need to have separate housing.

Some important factors that you should consider when choosing housing for your sheep depends on the physical attributes, behavioural patterns and the sheep's ability to adapt to the environment.

The way sheep adapt with its environment depends on factors such as:

- Age: Lambs are more vulnerable than ewes and rams.
- Health: Are your sheep sick or suffering from any illness?
- Access: Access to feed, water and shelter.
- If your sheep has been recently sheared.
- Body condition.

Due to the wet climatic conditions in Zambia, housing needs for sheep vary depending on the climate and the season of lambing. If lambing occurs during extreme weather conditions, stronger housing is usually required. If lambing occurs during periods of mild weather, then simple shelters are sufficient.

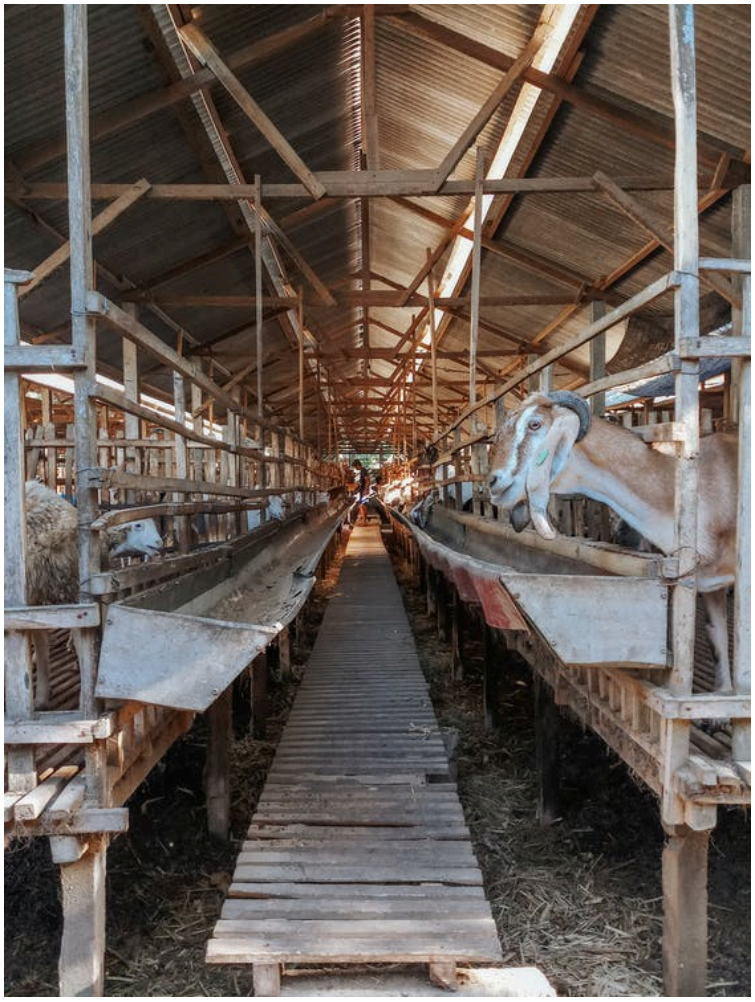


Figure 1.10: Sheep shelter

You must clean the shelter and enclosure often to keep the area hygienic and prevent bacteria and parasites from growing and spreading to the animals.

Figure 1.11: Goats in a camp

Fences for sheep

Fences are not only useful in protecting sheep from predators but also isolating them from other animals. Fences can be made from locally sourced materials but should be resistant against termites but at the same time durable. Using barbed wire is not a good idea as it may cause injury to the skin of sheep that are trying to squeeze in through an opening.

Space requirements for goat and sheep housing

In a country like Zambia with wet climates, the floor design is important. This is because urine and dung on a damp floor can cause an outbreak of disease-causing organisms. In poorly ventilated houses/shelters, lambs are extremely prone to bacterial infections such as pneumonia.

The space requirements for goats and sheep depend on factors such as:

- Size of the animals - for example, smaller animals require a smaller space compared to larger animals.
- Whether the animals are kept individually or as a group.

A suggestion on space requirements for goat and sheep housing is shown in the table below.

Table 1.1: Space requirements for goat and sheep housing

	Space (m^2/animal)			
Type of housing	Breeding female	Breeding male	Young stock	Additional
Permanent confinement (Zero grazing)	1,2	2,0	0,8	Watering trough, feeding racks and exercise yard should be present.
Day time grazing and night housing	0,8	1,5	0,5	

You must make sure that the animals are not overcrowded. There must be at least 1 m^2 available for every goat in the shelter. The shelter must also be cleaned regularly. Droppings and manure must be removed to prevent the animals from getting sick. The shelters must also be sprayed with an insecticide to kill fleas, ticks and other parasitic insects.

It is a good idea to have feeders or feeding troughs and hay racks. This prevents the goats from trampling the food. Make sure that the feeders are spaced so that the animals do not crowd each other when they are eating. Also, make sure that the animals are given clean water every day.

Figure 1.12: Make sure to space your feeding troughs correctly

Separate the male and female goats as they may bully each other, which can cause injury. This is especially important in meat breeds as the males are significantly larger and more aggressive. Does with kids that are still suckling must also be kept separate to prevent the herd from trampling the kids.

Make sure that the goats and sheep are given enough time to graze. The animals should not be kept in the enclosures for extremely long periods of time or for longer than necessary. Also, consider placing a foot bath with copper sulphate and water mixture at the entry or exit of the goat pen to control foot rot in the raining season.

Feed and water provision equipment

Take note that the feeding behaviour of goats and sheep are different, and a barrier needs to be used to prevent animals from jumping into the trough. The size of racks and troughs depends on the size of the goats or sheep. These racks can be made from wood or easily available raw materials such as bamboo.

It is important to provide water troughs and feeders to supply the herd with enough water and food. These units should be mounted in such a way that dirt and sand do not get into the water and food. The feeder should also be high enough to prevent adult goats and sheep from putting their heads into it or jumping into the feeder. You should also install containers for the supply of supplementary licks.

Figure 1.13: Example of a hay rack

Water troughs are dependent on the size of the flock. For small flocks, buckets, bowls or watertight tins are sufficient. Make sure that these water troughs are easy to clean.

Goat and sheep handling facilities

You need proper handling facilities to efficiently handle goats and sheep and eliminate their stress, especially if you have many goats or a large flock of sheep.

Some of the main components that a handling facility must have are:

- A gathering or crowding pen that feeds into the crush or race passage (a narrowing of the unit that only allows one animal through at a time).
- The crush or race, which is a narrow passage used to vaccinate or dose goats and sheep.
- A footbath or dip vat, so that the goats and sheep can walk through to control foot rot or ticks.

Figure 1.14: A gathering pen that feeds into the crush or race passage

Additional components you can add to a handling facility include:

- A sorting gate at the end of the facility, which you can use to select certain animals and divide them from the rest.
- A loading ramp for loading animals on vehicles for transportation.
- Weighing equipment to weigh the animals.
- A restraint or clamp to hold an animal.

1.3 Feeding and nutrition

Feeding and nutrition plays a critical role in performance. Poor nutrition will result in low production, and it impacts the animal's ability to fight of diseases and viruses. Zambia is considered to have a vast feed resource base for animal production purposes, but this is not fully utilised due to the low goat and sheep production in Zambia

Feeding and nutrition in goats

The minimum amount of food that a fully-grown goat that is not lactating or pregnant needs to maintain its body weight is called the maintenance requirement.

Any changes in the physiology of the animal increase their feed requirements. This means that young and growing animals, and animals who are pregnant or lactating need more

food than others. Does who are raising twins or triplets also need more food than does who only have one kid.

The goats' physical activity also determines how much food they need. Goats that graze or browse on hilly pastures eat more than goats who graze or browse on flat pastures of the same quality because they spend more energy while out browsing. Goats who have to travel long distances to browse require more food as they burn more energy than goats on developed fodder fields.

Figure 1.15: Goats in a pasture

Extra feed requirements are also linked to the goats' weight and the season. Underweight animals or animals living in cold conditions need more food.

Feed components

Goats need a variety of components to grow properly and maintain a good condition. They need enough water, energy, proteins and a proper range of minerals and vitamins.

WATER REQUIREMENTS

The animals must have a good source of clean water, especially when there are kids in the herd. Water makes sure that animals are healthy and productive. A lactating goat, depending on the stage of lactation, can drink anything from 3 - 20 litres of water a day. Hot weather increases the need for water.

PROTEIN REQUIREMENTS

A healthy and productive goat herd requires proteins to ensure growth, reproduction, lactation, good hair growth and strong animals.

Protein is required for production and plays a role in the blood, antibodies, milk and muscle of an animal. Shortages of protein can make the animals weak and more likely to get sick. Typical proteins can be found in food such as beans, lucerne, cowpeas, acacia pods, green pasture and supplements like high protein concentrates (HPCs).

Figure 1.16: (From top left) Acacia pods, cow peas, Lucerne and high protein concentrate

ENERGY REQUIREMENTS

A goat also needs a diet that gives it enough energy to grow, reproduce and produce milk. In Chapter 2, we will discuss body scoring. You can use body scoring to determine what type of energy is required. Sorghum, molasses (from sugarcane refining), maize and maize bran are foods with high energy content.

Figure 1.17: Oats, molasses, sorghum and maize

MINERAL REQUIREMENTS

Different minerals supply different nutrients to improve the overall condition of a goat. Typical mineral supplements in a diet are calcium, phosphorous and salt. The

requirements depend on a variety of things, like age and whether the animal is pregnant or suckling. Table 1.1 shows mineral requirements for goats at different stages.

Table 1.2: Mineral requirements for goats at different stages

Nutrient	*Young goats*		*Doe (40 kg)*		
	Weanling	Yearling	Dry	Lactating	
	15 kg	30 kg	Pregnant	Avg. milk	High milk
Daily feed (kg)	1,0	1,5	2,2	2,2	2,5
Energy (MJ/kg) dry matter	10,2	9,7	9,0	9,0	9,7
Protein, % dry matter	14	12	10	11	14
Calcium, % dry matter	0,6	0,4	0,4	0,4	0,6
Phosphorous, % dry matter	0,3	0,2	0,2	0,2	0,3

Additional or special feeding

Apart from normal feeding, there are times when additional or special feeding is required. This can be very important depending on the condition of the goat and can be summarised as follows:

- Does and bucks need extra feeding before mating.
- To avoid weak kids in late pregnancy, does need additional nutrients in the last six to eight weeks of pregnancy. Do not to overfeed at this stage, as this can lead to the unborn kids becoming very large and making the birthing process difficult.
- To make sure that the doe has enough milk, it will need more nutritious food and more water in early lactation.

Goat supplementary feeding

You must be aware of the different types of supplementary feed available and the correct way to use supplementary feed. Supplements come in a variety of forms. They can be hard, compressed powder licks. When the veld does not supply enough natural supplements, you might have to supply the goats with additional mineral feeds.

Although supplements are good for goats, you must still make sure that there is enough grass, browse or hay available for them because supplements cannot provide all the nutrients that a goat needs. Many supplements also contain urea, which can be poisonous. You must make sure that you protect supplements that contain urea from the rain because urea dissolves in water and can be lost or poison the animals, if they drink the water.

WARNING: Urea is toxic in large amounts, and even small amounts can be poisonous to horses, donkeys, chickens and goat kids. Always make sure that you use the correct dosage and precautions as stated on the container.

Mineral supplement for summer

The southern African veld can be low in phosphate during summer. Therefore, you may need to give your goats a phosphate supplement if they graze in a veld. The following are examples of how you can do this:

- Mix 50 kg of P12 phosphate lick concentrate with 50 kg of salt to produce a P6 supplement and supply at a rate of 18 g for non-lactating and 36 g for lactating animals per day.
- Supply a P6 phosphate concentrate with salt included at a rate of 18 g for non-lactating animals and 36 g for lactating animals per day.

A phosphate summer block typically contains the following:

- Calcium – 180 g/kg maximum.
- Magnesium – 10 g/kg minimum.
- Phosphorous – 90 g/kg minimum.
- Sulphur – 15 g/kg minimum.
- Copper – 360 g/kg maximum.
- Manganese – 1 200 g/kg maximum.
- Cobalt – 6 g/kg maximum.
- Selenium – 8 g/kg maximum.

These elements can vary depending on the manufacturer or requirements for a specific area.

Protein energy mineral supplement

There are different grazing or veld conditions in every country. Normally in sourveld (veld that is mostly covered with rough seasonal grass, supplying inferior grazing in winter) a definite supply of protein rich supplements is required. One of the main reasons for this is that the protein energy encourages microbe growth. A limited amount of energy is needed (molasses, maize or maize bran) to help use the protein and digest the poor-quality grazing.

The following are some examples of which supplements to use when the grass is not adequate or of poor quality in the drier seasons:

- Winter blocks (commercial protein) comes in 25 kg blocks. One block per 25 goats at 100 – 140 g per goat per day can supply the animals' needs for about eight days.
- Molasses enriched with minerals and protein comes in 40 kg bags. The goats can receive about 200 – 300 g a day. One bag can feed about 160 goats for a day.

Instead of buying the supplements, you can make them yourself by mixing the different ingredients in the correct ratios.

TAKE NOTE

For correct and safe application, goats must be adapted to any supplementary feeding, especially in lick blocks. The blocks are supplementary feed and must never be used as the

only source of food. Kids can safely eat up to 300 g per day once they have adapted to blocks, while does can eat up to 500 g a day. To adapt kids to eating blocks, feed them 100 g a day for 10 days. Let 13 kids eat at each block. Does can be adapted by feeding them 200 g per day for 10 days. Let seven goats eat at each block. Table 1.2 shows nutritional values of supplement blocks.

Table 1.2: Nutritional values of supplement blocks

	Dry matter (DM)	*Crude protein (CP)*	*Energy (ME)*	*Calcium (Ca)*	*Phosphorous (P)*
Units	%	g	MJ	g	g
1 kg block	83	152	8,6	16	7
100 grams	8,3	15,2	0,86	1,6	10,7
200 grams	16,6	30,4	1,72	3,2	1,4
300 grams	24,9	45,6	2,58	4,8	2,1
400 grams	33,2	60,8	3,44	6,4	2,8
500 grams	41,5	76	4,3	8	3,5

Recipe

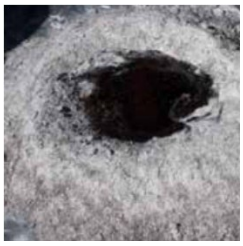
Figure 1.18 shows the ingredients used to make your own mineral supplementary feed.

Figure 1.18: From left to right: salt, molasses, HPC, lime and maize meal

Table 1.3 shows the procedure to mix all the ingredients together.

Table 1.3: Mixing procedure

Procedure	*Photo*
1. Weigh out the dry ingredients according to the recipe.	

Procedure	*Photo*
2. Mix the dry ingredients and add the molasses.	
3. Mix well.	
4. Break up any clots by hand.	
5. Form blocks using a mould or brickmaker. Allow blocks to harden for three days in the sun.	

Homemade feeds

If you have enough different components and the ability to mix, you can produce some homemade feeds by mixing a few simple ingredients together.

Chocolate maize

Chocolate maize can be made by mixing the right ingredients together. Maize grain normally used to fatten animals forms the basis of the recipe. To make chocolate maize, you will need:

- 25 L hot water.
- 11,5 kg of urea.
- 3 kg of salt.
- 700 kg of whole maize grain.
- 8 kg of P12 phosphorous concentrate.
- 4 kg of limestone.

- 10 kg of molasses liquid.

MIXING PROCEDURE

1. Spread the maize grain in a container at a depth of between 150 mm and 250 mm.
2. Dissolve the salt and urea mixture in hot water.
3. Sprinkle it over the maize.
4. Mix the rest of the ingredients separately and spread over the wet grain.
5. Mix everything together. Make sure that all the products are well mixed.
6. Dry the mixture, put it in bags and store in a dry place.


TAKE NOTE

Keep in mind that the bagged mixtures can only be stored for short periods of time to prevent the loss of urea. Chocolate maize cannot be used in humid areas because it will not dry properly.

7. Add the chocolate maize to the coarse roughage when required.
8. Start slowly at about 100 g per goat on the first day.
9. Increase it slowly up to the fourteenth day to give the rumen microbes a chance to adapt to the mixture and to avoid acid in the rumen.


TAKE NOTE

If you are going to feed male goats this chocolate maize for more than four weeks, you should add 7,5 kg of ammonia chloride to the mixture. This will prevent kidney stones (urinary calculi) in the goats.

HOME MIXES

Local materials can also be used to produce feeds. A typical example of this is chopped up maize stover with a liquid supplement, such as Voermol LS33, added. You must not feed kids this mixture.

Milled bean residue can also be used as feed. When feeding lactating does and kids, add Lucerne to the mixture to increase the protein content.

HOME GROWN GREEN FODDER FOR GOATS

Different feeds that can be grown at home, for example perennial pastures, can be used as goat feed. Typically, these would be Napier grass planted in rows between existing fields like Lespedeza (cowpea), lucerne or tick clover (Desmodium). Annual pastures such as oats, peanuts or soybeans can also be used in summer. The leaves and stalks can be used as a protein supplement for winter consumption.

Other types of plants high in protein and energy that can be used as feed are root types such as radish, fodder beet and chicory. These crops are normally planted at the end of summer. They are an early winter-feeding option when harvested and fed to the animals.


TAKE NOTE

It is important to give this feed at night in secure feeding troughs to avoid picking up worms from the dirt.

FEED CONSERVATION

You should also consider harvesting leaves and cutting grass to supply the goats during winter, when natural feeds are scarce. The grass and leaves must be dry before you store them to prevent mould from forming because goats become sick, if they eat mouldy material.

If the harvested material is too rough to eat, you must process or cut it into smaller chunks for consumption. You can also add an additive like Voermol LS33 to improve the quality of the feed.

Problems around feeding

Some feed stuffs used to feed goats can cause problems. There are certain steps you can take to assist or even prevent these problems:

- Concentrates must be increased slowly to allow goats to adapt. The dosage must be about 50 grams a day per goat and increased gradually over a week.
- Legume pastures can cause bloating in goats. Therefore, you must be careful when the goats access a legume pasture.
- Letting goats in a new pasture might make them to eat poisonous plants (refer to the section on poisonous plants).
- You must avoid oversupplying goats with concentrated feed and grains. This includes rice and sorghum beer rests. An oversupply of concentrated feed and grain can cause overeating disease (also called enterotoxaemia), ruminal acidosis, urinary calculi, bloat, laminitis-founder and other rumen-based diseases, which can be life-threatening.
- The overeating diseases (enterotoxaemia) is caused by clostridial organisms (clostridium perfringens, types C & D). These pathogens are normally not harmful. However, unnatural conditions, like stress from the environment, psychological causes or physiological causes, can cause increase the number of pathogens rapidly, which will in turn release a toxin that can be fatal to the goat. This can be prevented through vaccination, typically One-Shot Ultra 7.

Feeding and nutrition in sheep

Sheep are ruminants. Ruminants have the ability to consume and digest foods such as course and fibrous feedstuffs. Sheep are not like human beings where they require specific types of feeds, sheep require energy, protein, vitamins, minerals, fibre, and water.

Improving nutrition in sheep depends on three factors:

- The availability of nutrients.
- Type of feeding system.
- The type of feeding management system.

The section below shows the different types of nutritional requirements sheep need.

Energy

Energy makes up the largest portion of a sheep's diet. Carbohydrates, fat, and excess protein in the diet all contribute towards fulfilling the energy requirements of sheep. One of the biggest challenges farmers have, is meeting the energy requirements of sheep without over or underfeeding the animal. The most common nutritional deficiency in sheep is a lack of energy or energy deficiency.

You can detect energy deficiencies early on in growing animals, examples of these are:

- Reduced growth.
- Weight loss.

In ewes, a drop in milk production, reduced conception rates and reduced multiple births are all examples of an energy deficiency.

EXAMPLES

Examples of feedstuffs high in energy are:

Concentrates (grains) contain starch, which is a rich source of energy.

- Forages contain fibre or cellulose.
- Sileage.
- Pasture.
- Hay.

Proteins

Proteins are considered to be the most expensive part of a sheep's diet. Young, growing lambs who are building muscle and lactating ewes who are producing milk proteins have higher protein requirements. It is not wise to overfeed animals with protein as excess protein is converted into blood urea and ammonia.

EXAMPLES

Protein supplement examples include:

- Soybeans.
- Peanuts.
- Legume hays.

Minerals

There are 16 minerals that have been identified as essential in a sheep's diet. Examples of these minerals are:

- Sodium (Na).
- Chloride (Cl).
- Calcium (Ca).
- Magnesium (Mg).

- Potassium (K).
- Sulfur (S).
- Other trace minerals required in small amounts: Iodine (I), copper (Cu), iron (Fe), manganese (Mn), zinc (Zn), molybdenum (Mo), cobalt (Co), selenium (Se), and fluoride (Fl).

The table below shows symptoms of mineral deficiencies and supplement sources.

Table 1.3: Mineral deficiencies

Mineral	*Deficiency symptom*	*Class of animal affected*	*Feed source*
Calcium	Deformed bones.	Newly lambed ewes. Sheep on high grain diets.	Milk, grain feed and ground limestone.
Phosphorous	Deformed bone, retarded growth, poor fertility and soil eating.	Young sheep.	Milk and cereals.
Sodium	Chewing on wood and/or licking dirt, loss of appetite and slow growth.	Sheep of all ages.	Common salt.
Magnesium	Weight loss, frothing and excessive salivation.	Young sheep but can also occur in adults.	Bran and oilseed cakes.
Copper	Dull coat, young sheep have difficulty walking.	Young lambs.	Seeds and trace mineralised salt containing copper sulfate at 0.5%.
Zinc	Stiff joints, high rates of abortions, salivation and reduced conception rates.	Lambs and adults.	Cereal grains, corn gluten feed and meal added to trace mineralised salt.
Manganese	Poor fertility, difficulty in walking.	Lambs and adults.	Bran

Salts

Salt which is a combination of sodium (Na) and chloride (Cl) forms an important part of the regulatory function in the body. If the salt intake is inadequate, this can result in a decrease in feed and water intake, growth deficiency in lambs and a reduced milk production in ewes. Chewing on wood or licking dirt are signs that the animal needs salt.

Calcium and Phosphorous

Calcium (Ca) and phosphorus (P) are nutrients required for the development and maintenance of the skeleton. Deficiencies may result in rickets. In male sheep, deficiencies can cause urinary calculi. The calcium in most forages is usually adequate to meet the nutritional needs of sheep. High-grain diets contain high levels of phosphorous and low levels of calcium, which causes a deficiency of calcium. The ratio of calcium to phosphorus in the sheep's diet should be at least 2:1.

Vitamins

Sheep require a few vitamins such as vitamins A, D, and E.

Fibre

The bulk of a sheep's diet is the fibre, and this is what keeps the sheep's rumen functioning properly by increasing rumination and salivation. Sheep that are desiring more fibre may chew on wood or wool.

Water

Water forms an important part in a sheep's diet and it is often overlooked. Depending on the environmental conditions, a sheep will consume about 2 -15ℓ of water a day.

Feedstuffs

Feeds are classified according to the amount of specific nutrients they supply. Two main categories of feedstuff are:

- Roughages: Bulky feeds that contain high amounts of poorly digestible materials.
- Concentrates: These feedstuffs are rich in proteins or energy and contains high amounts of fats and carbohydrates.

The nutritional requirement of sheep depends on the size of the animal and the physiological state (i.e., if the ewe is pregnant). The larger the animal, the more feed it requires. Also, the amount of water supplied to sheep should be at least four times the amount of feed dry matter (1:4). At higher temperatures, sheep may need more water.

Figure 1.19: Herd of sheep eating feed

Types of sheep feed

In Zambia, there are three types of feed as per the age and when a specific type of feed should be fed.

MEAT PRODUCTIVE SHEEP FEED

This includes:

- Dried molasses.
- Wheat roughage.
- Maize powder.
- Dried grasses.
- Soybean cake.

PREGNANT SHEEP FEED

This includes:

- Dried grasses.
- Barley.
- Maize.
- Soybean cake.
- Dried molasses.

MOTHER SHEEP FEED

This includes:

- Dried grasses.
- Barley.
- Maize.
- Wheat roughage.

Sheep feed timings

The table below shows the suggested feeding of lambs from birth to 3 months.

Table 1.4: Feeding of lambs

Age	*Feeding time*
Just born	Should be fed with colostrums once after they are born.
Newborn	Should be fed with milk frequently for three days.
Three days	Feed the sheep milk 2 -3 times in a day.
Two weeks	Should be trained to eat roughages.
One month	Feed the sheep with concentrated mixture.

Lambs should suck the dam of the ewe for the first few days to get a sufficient amount of colostrum. The rate at which colostrums are given is 100ml per kg.

FEEDING OF SHEEP (3 - 12 MONTHS)

- During the rainy and summer seasons, you need to feed the sheep with dry fodder.
- Sheep this age need to pasture in grazing for about 8 hours.
- A supplement concentrate mixture of 100g to 200g which contains at least 16% protein should be fed to the sheep.

ADULT SHEEP

- If the pasture availability in the sheep shelter is good, then a concentrate mixture needs to be supplied.
- With poor grazing conditions: A concentrate mixture of 150 – 300g needs to be supplied to the sheep per day, however this depends on factors such as:
  - Lactation.
  - Pregnancy.
  - Age.
- Adults need to be supplied with a digestible crude protein level of a concentrate of 12%.

NON-PREGNANT SHEEP

- If the pasture availability in the sheep shelter is good, then a concentrate mixture needs to be supplied.

- With poor grazing conditions: A concentrate mixture of 150 – 200g needs to be supplied to the sheep per day.

PREGNANT SHEEP

Into four months of pregnancy:

- Sheep needs to be fed at least 4 – 5 hours a day with good quality pasture.

Last month of pregnancy:

- A concentrate mixture of 250 – 350g needs to be supplied to the ewe per day.

RAMS DURING THE BREEDING SEASON

- Rams and ewes should eat together.
- In this condition, rams and ewes will get the same feed ratios.

FEEDING OF EWES FROM LAMB-WEANING TILL FLUSHING

This is a critical period for ewes and they should be maintained completely on pastures.

1.4 Reproduction in goats and kidding

In goat reproduction, the correct control and management has a direct effect on the reproductive performance of a herd. To reap the benefits of the efficient reproduction of the goats, you must consider the following:

- Consecutive kidding of the doe. Specifically, the interval between each kid must be less than 250 days.
- The number of kids per doe.
- The total number of kids born and weaned in the herd.

Studies have shown that well-managed flocks have higher birth rates than those in communal areas. The low productivity of communal flocks is a result of kids dying early. If more kids dye early, there will be fewer does growing up to eventually replace the adult does in the flock. As the goats get older and unproductive, they are culled. Poor management, unhygienic facilities, theft, flock hygiene, poor nutrition and predators all contribute to kids dying early.

Another problem caused by poor flock management is that kids born late winter or early spring will have a shortage of food, especially when they are born after late pregnancies. The growing foetus puts a great demand on the doe when it does not get proper food. The doe experiences the same strain when it is lactating while not getting the proper food.

Breeding season

Free-ranging goats mate throughout the year. However, even when mating is not regulated, most kids will still be born between March and August. When the animals have freedom to graze and live together throughout the year, the does and bucks will be able to

mate as soon as they are ready. The disadvantage of this is that the kids will be born throughout the year. This makes managing strategic feeding more difficult and it will be the owner's responsibility to keep the buck in good condition throughout the year.

Managing and improving a breeding system

To run and manage a successful breeding system, you must address management factors. You must choose a specific breeding season. This allows you to control and improve management of the herd and will only be successful if you prevent the bucks from mating during certain periods of time. It is difficult to implement an effective flock health programme if kidding takes place throughout the year because many treatments must be applied at a specific age of the goat. A controlled breeding season also prevents inbreeding between the buck and its doe offspring.

If this can be achieved, it would be ideal to limit the breeding season to a specific timeframe, specifically to plan for all the kids to arrive during a six-week period. You must consider the following when implementing a breeding system:

- The high season for parasites is.
- The reduced feed is available.
- The bad weather that may affect the young goats.

An advantage of the goats kidding at the same time is that you will be able identify does that did not kid and are not raising any young goat.

The best time for kidding is between April and September as rainfall will be low and the parasites will be less. Parasite infestations can cause high mortality rates during the wetter periods. You should allow the goats to mate in November and December. This way, the grazing will still be good when the kids are born around April or May, and the kids can also be weaned on maize leftovers. This may differ from region to region and some areas have found that births in November are better because there is a lot of forage available and the chances of growth and survival for the kids are much better. For November births, mating will have to take place in June and July.

Kidding in spring

When the breeding takes place in autumn, the spring kidding depends a lot on the quality of the grazing and fodder available.

The advantages of spring kidding are:

- High fertility.
- Good pasture when weaning.
- Mating of the 18-month does for the first time in the following autumn.

The following are disadvantages of spring kidding:

- September and October are usually dryer months with less dry matter.
- Spring and summer are high seasons for parasite infestations, and it is difficult to rear kids in a high rainfall.

Kidding in autumn

The following are advantages of kidding in autumn:

- Abundant dry matter while kidding takes place in April and May.
- Parasite infestation rates are much lower, and the kids will be healthier.
- The weaned kids can eat maize crop residues supplemented with protein and nitrogen licks, which will ensure that they are ready for the market.

The following are disadvantages of kidding in autumn:

- Kidding rates are lower.
- Replacement females will be introduced 18 months later to be mated during a reduced sexual activity period.

Managing the buck

The most important purpose of a buck is to mate effectively during mating season. This means that buck must be managed and fed properly during the mating season. Good management means that one buck can cover 30 - 40 does, and bucks must be replaced frequently to prevent interbreeding.

Choosing a buck

You must choose the buck carefully to make sure that the buck you put with the does has the correct genes to be introduced to the herd.

Each kid gets about half of its characteristics from the buck, you must therefore choose only the best buck for breeding purposes. You must also make sure that the buck is fertile because it would be a waste of quality feed and supplements, if you put an infertile buck with the doe. A buck should also have strong legs and feet to be able to mate effectively throughout the breeding season.

To make sure that you have a buck that will successfully breed, look out for the following:

- The buck's reproductive organs (sheath and penis) must not have any wounds, swellings or abnormalities.
- The testicles must be well formed, about the same shape and size, and move freely in the scrotum.
- The testicles must have a cool and firm feel.
- From 18 months of age the scrotum must be about 34 cm in circumference.

Managing doe

When purchasing a new doe, make sure that:

- The doe kids every year.
- The doe has a well-shaped and firm udder.
- The teats do not hang too low to the ground and they are evenly sized without any damage.

- The doe does not show signs of pain when the udder is handled.
- The underbelly and the udder have the same temperature.
- The doe's milk is creamy and smooth with no clots or blood.
- There is no abnormal discharge or blood in or around the vulva.

HOW TO MANAGE DOES BEFORE MATING

Does must have access to good browsing and feed (good nutrition) for about three weeks before mating and up to two weeks after mating. Supplements may be needed over the winter period to keep the body in good condition. The doe must reach a body condition score of 3 to be ready for mating. Body condition scoring will be discussed later in this manual. Avoid handling the does too much during the mating season and keep handling to a minimum for two weeks after the mating season has ended. Avoid deworming and vaccinations during the breeding season as these treatments would place pressure on the immune system of the doe and effect the fertility.

HOW TO MANAGE DOES DURING PREGNANCY

The pregnancy or gestation period of goats is about five months or 150 days. You must make sure that there is enough good quality feed. This will prevent reabsorption of the foetus during the early stage of pregnancy. The does must also have access to enough good quality food during the last 6 - 8 weeks of pregnancy because the foetus is growing fast during that time. Do not overfeed pregnant does as this can cause birthing problems.

KIDDING MANAGEMENT PRACTISES

The following is an important part of the system:

- Do not move, handle or disturb the doe during kidding.
- Separate does giving birth from the rest of the herd, if possible.
- Earmark the kids so that they are matched with the mother.
- Adequately feed the doe with good quality food because the doe will have an increased need for feed during kidding.

DOE CULLING

Doe culling can be a difficult decision, but it is necessary. After the kids are weaned, look for the does that might have udder or mouth problems. These does might not be able to raise another kid.

DECIDE ON RAISING DOES AS REPLACEMENTS

If does have been well managed and fed, they will reach sexual maturing at an age of about 5 - 9 months. They should also have grown adequately and be in good condition. Young does must not be introduced to a buck for mating before they are at least 12 months old or have reached 70% of mature body weight, this can have a negative influence on their growth.

This means that the weaned female kids must not encounter bucks as mating might take place, which is not recommended. In rural areas, this might be difficult or impractical. A

good guideline is to not breed does until they have reached about 60 - 70% of their mature body weight. An indigenous adult doe will weigh about 35 kg when fully mature. Therefore, a doe must not be mated when her weight has not reached 22 kg.

You should only keep animals that are in a good condition and that have good characteristics to replace the dry or older does. The other animals that are not in a good condition must not be used for breeding and should rather be sold.

1.5 Reproduction in sheep and lambing

There are several factors known to influence the age of puberty in sheep such as nutrition, breed, body weight, season of birth and the growth rate. Nutrition is considered to be the most important factor that influences the onset of puberty and the reproductive development in sheep.

■ Breeding season

Once males and females are sexually mature, they will reach out to eachother and mate unless restrained. Females ovulate and exhibit estrus almost the whole year round. In most cases, conception occurs during March to May after the short rainfall. The gestation period in ewes is about 150 days (5 months).

When the animals have freedom to graze and live together throughout the year, the rams and ewes will be able to mate as soon as they are ready. The disadvantage of this is that the lambs will be born throughout the year. This makes managing strategic feeding more difficult and it will be the owner's responsibility to keep the ram in good condition throughout the year.

Figure 1.20: Pregnant ewe

Three types of mating can be practiced depending on the type of production system used:

- Flock-mating: Fertile rams or bucks are allowed to remain continuously with a group of females.

- Pen-mating: Involves introducing a ram into a group of females.
- Hand-mating: Involves detecting females in estrus and bringing them to breeding males.

The Estrus cycle in Ewes

After ewes reach puberty, they show a repeated pattern of reproductive activity. The estrus (heat) cycle is defined as the number of days between two consecutive periods of estrus. In ewes, this is usually a period of 17 days.

Reproductive phases of an ewe

An ewe's reproductive timeline is made up of various phases, i.e.:

- The first and last months of pregnancy.
- First month after lambing.
- The periods where reproductive wastage occurs is between ovulation and implantation.

Failures in reproduction for sheep

Reproductive failures in sheep can occur in both rams and ewes. The reasons behind these failures are not always obvious but can cause extreme production losses for farmers if not dealt with properly.

Failure in reproduction could be due to:

- Failure to mate.
- Failure of fertilisation in mated animals.
- Abortion during any stage of the gestation cycle.
- Neonatal mortality.
- Reproductive disorders can also occur due to structural defects which can affect the genitals of sheep. In males, the following can be easily identified:
  - Testicular hypoplasia: This is characterised by testicles that are undersized and produces very low semen.
  - Cryptorchidism: Failure of one or both testicles to stem from the abdominal cavity into the scrotum.

Lambing

With sheep, proper care already starts before the lamb/s are born. Proper nutrition and care needs to be given to the ewes especially during the last trimester of the gestation period. This will result in healthy lambs. Lambs with a low weight or seem to be weak at birth needs to be given special attention.

There is a clear relationship between the survival of the lamb and the weight of the lamb. Very high or very low lamb weights can result in poor or no survival of the lamb.

Immediately after birth, the umbilical cord should be trimmed if needed using clean scissors and then dipped in tincture of iodine. The recommended concentration is 7% solution of iodine. As much as possible, protect newborn lambs from conditions such as wind, rain and other extreme weather conditions.

Materials needed during lambing time

- Rubber gloves to assist ewes or to handle aborted materials.
- Needles and syringes for the administration of any medicines.

Care of newborns and rejected lambs

- Old towels to clean lambs that are rejected by the ewe.
- Colostrums are required for vulnerable lambs.
- Lamb feeding bottles.
- Teats for artificial rearing of lambs.
- Tincture of iodine to treat umbilical cord.
- Thermometer to detect temperatures in hypothermic lambs.

1.6 Rearing kids and lambs

Reducing kids' and lambs' deaths

Kids and lambs should be born in a quiet and clean place with no other animals nearby. Provide a dry weather-proof shelter for dams and their offspring. To prevent bacterial infections, clean kids' navels with iodine. The kids must be given a drop of iodine on the tongue to help prevent mineral deficiencies. Furthermore, the kids and lambs must be kept dry and given time to bond with their mother. They must drink the colostrum within an hour after birth.

Figure 1.21: Suckling kid

Figure 1.22: Sucking lamb

The doe must be inspected to see if it is healthy and has enough milk for its kid. Any retained placenta and mastitis must be attended to immediately.

Green fodder is important to stimulate milk production, so make sure that the fodder is readily available. The doe and ewe should also get enough feed to support the growth of the kid. Does and ewes that cannot mother the kids properly or does with bad udders must be culled as soon as the kids are weaned.

Kids and lambs should start getting supplemental feed around the age of two weeks to one month. This will ensure that they cope with poor milk production when there is a shortage of proper feed. To prevent newborns from being injured or killed, newborns and their mothers should be kept away from the rest of the herd.

Castration in goats and sheep

In Zambia, the rubber rings are mostly used, and this section gives a bit more information on that. Castration is the removal of testes from bucks or rams, and it is done to control mating.

When rubber rings are used, male kids must be castrated before they are seven days old. After seven days, this method of castration can lead to the death of the kid.

The rubber rings are also called an elastrator and is an expensive, quick and bloodless way of castration. A heavy rubber ring is placed around the scrotum as close to the body as possible. The rubber ring prevents blood circulation to the scrotum and testicles, and they will eventually dry out, shrivel and be discarded from the body in about two weeks. Before castration, you must consider the following:

- The rubber bands must be kept in a refrigerator to prevent them from breaking when used.
- About 30 minutes before castration, give the kid one adult aspirin and on prescription 0,25 cc of Banamine.

The following are steps for castration:

1. Restrain the young goat or sheep by a helper, with the goat or sheep facing away from you.
2. Stretch the rubber band with the elastrator prongs.
3. Place the rubber band as close to the body as possible and release the elastrator prongs.
4. The rubber band will now slip onto the scrotum.
5. The rubber band will now slip onto the scrotum. Cut if off and reapply a new one. If there is doubt about the correctness of the rubber band.
6. Check the scrotum regularly for infection and spray with an anti-infection spray.

When using a Burdizzo, male kids must be castrated at the age of three months.

This large clamp is designed to break the spermatic cord leading into the testicles. Once the blood supply to the testicles is lost, testicular necrosis occurs, and the testicles shrink, soften, and eventually deteriorate completely.

To castrate with a Burdizzo, the spermatic cords of the two testicles are crushed separately and at slightly different distances from the body. This will make sure that the blood flow to the scrotum continues.

Figure 1.23: A Burdizzo

When rubber rings are used, male kids must be castrated before they are seven days old. After seven days, this method of castration can lead to the death of the kid.

- **Raising orphans -**

A very important point to remember is that a kid or lamb needs colostrum from the mother within an hour after birth. The first milk from the doe or ewe contains antibodies that will protect the kid from diseases.

When a dam dies or is dry at the birth of its kid or lamb, the antibodies cannot be supplied and ingested. However, the colostrum from another dam might be used to assist the kid or lamb. If no colostrum is readily available, a make-shift replacement can be made up of 500 ml cow's milk, one egg and one teaspoon of cooking oil. This must be mixed together to form an even consistency. For the first three days after the birth, the kid or lamb must be given four small feeds per day of about 150 - 250 ml each. The milk must be heated up to body temperature before being administered.

Figure 1.24: Bottle feeding a kid

Milk replacement

The above milk mix for right after birth can be changed after the first three days to give the orphan kid normal 150 - 250 ml of cow's milk three times a day (for a total of 400 - 750 ml per day). After this, the feeding can be reduced to twice a day, for a total of 200 - 400 ml of milk with each feeding. You must continue doing this for at least six weeks. Take note of the following:

TAKE NOTE

- Full cream UHT cow's milk can be used as a milk replacement.
- When normal cow's milk is not available, a good quality milk replacer can also be used. A milk replacer containing high amounts of fibre (indicated on the label) must not be given to orphans because the vegetable products in it will not suit them.
- The kids can be become bloated when the milk replacers are mixed incorrectly, and. bloating can be fatal. The correct way when starting to use milk replacers instead of

normal milk is to mix half normal milk and half milk replacer for several days. This will make sure that the kids adapt to the new diet.

- After the kids and lambs are 10–12 days of age. Feed them only 3–4 times per day and provide creep feed (which is explained in the next section).


TAKE NOTE

As always, hygiene is a very important part of rearing kids. Poor hygiene can easily spread diseases between does, and sicknesses such as mastitis can develop when orphan kids are suckling on different does. The same applies to using the same bottle for different kids. Orf virus can spread, if kids are fed from the same bottle.

Creep feeding kids and lambs

Kids and lambs must be fed solid food, or the rumen will not develop properly. If kids and lambs are not properly fed, they can have a poor condition or even die when weaning. Kids and lambs start feeding on solid food when they are about two weeks old but must still be supplemented until they join the rest of the herd. To prevent worms, kids and lambs must be kept in an enclosure separate from the other animals for 1 - 2 months. Their water must always be kept clean and fresh. You should follow the schedule for vaccinating and deworming the kids.

Types of creep feeds

An area should be constructed where the kids can move away from the doe to feed or drink water on their own. This also applies to when the does go out to graze. Supplemental feeds are a way of creep feeding when the kids are still suckling. Generally, it is preferred to kid at the end of raining season in April or May to avoid the intensive raining season. When the doe's milk production becomes low, typically during winter, it will be useful to introduce creep feeding especially when there are lots of twins and triplets.

The different options for supplementing kids and lambs include:

- Specially mixed feed for kids, called goat creep feed.
- Feeding kids meat goat feed or game block, If kid creep feed is not freely available.
- Tree leaves, if commercial feed is not available. Make sure that the tannin levels in the leaves are not too high, and that the leaves are not poisonous.
- Creep rations should be made available to lambs in limited amounts from when they are a week old. At three weeks of age, creep feed should be provided ad lib.
- The intake of milk should be reduced to encourage consumption of dry feed.
- Grass or hay that is freshly cut for roughage. The grass or hay must not be cut where the adults have been grazing, as this can give the kids worms.
- Clean drinking water should be always available.
- After lambs reach a weight of 12kg, and consume more than 200g of creep feed everyday, they can be weaned from the milk replacer. Roughage such as lucerne can be fed to the lamb at this stage.

When the kids and lambs are fed dry feed, the feed should be palatable and fresh. Young kids normally prefer feed that is finely ground as it digests more easily. As they grow, they will start to take coarser feed. They will also digest whole grains more efficiently as they grow older. Commercial feed should have about 18% crude protein (CP) and 12 MJ of energy per kilogram of dry matter (DM) included. The commercial feed you choose must not contain any urea because young goats can get poisoned by urea. The type of feed can be adjusted as the kids and lambs get older. When weaned, the kids can get feed with 15 - 16% crude protein. Feed pellets are usually better because kids cannot be select the feed. When you give kids concentrated creep feed, allow them to also eat high quality roughage. This will improve the development of the rumen function.

The following are other factors you must consider:

- Goats and lambs tend to start nibbling at feed and hay at a young age. A working rumen will let the young goats start chewing the cud at about two weeks old. When the kids and lambs are two - three weeks old, creep should be made available. They will start to consume adequate quantities of creep feed only at about four weeks.
- Stale or contaminated feeds will not be taken by young goats or sheep. Old food must be removed from troughs weekly. Older goats might eat stale food, and therefore waste can be avoided.
- Clean water must be available to the kids and lambs and should be close by the creep feeder.

Design of feeders

The important factor in the design of creep feeders is for the kid or lamb to be able to get in and out of the enclosure to feed while the older goats are kept inside. There are different ways of doing this. A trough can be placed inside a pen to which only the kids have access, as can be shown in Figure 1.25. The spacing between the upright bars or slats must be between 120 mm and 150 mm.

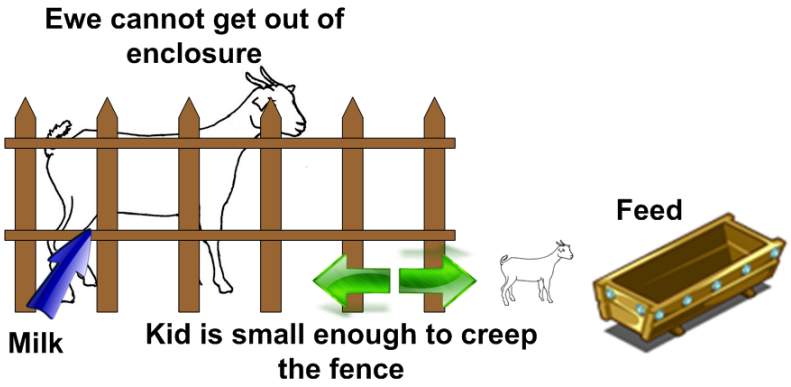


Figure 1.25: Ideal creep feeding enclosure

The feeder space should be about 200 mm per kid and should be built so that the kids can only use it to feed because young goats tend to play and contaminate the feed. Older goats will also try access the feeder, so the pen where the feeder is located must be durable to prevent older goats from entering the pen.

Figure 1.26: Creep feeding area

The creep feeders should be located where fresh water is available and should be close to a shade where the young goats can rest. Young goats and sheep are playful and enjoy climbing and jumping. You should provide rocks, wooden stumps and cable spools for the kids or lambs to use.

The management of the feed area

The control and management of the creep feed area is quite important. There must be fresh dry feed available and the creep feeder must never be completely empty. Keep the feeders covered to keep rain out. Feed can become mouldy; it should be removed if it is mouldy. Be careful with open troughs as they can become contaminated if goats climb into the troughs and urinate or defecate on the feed. Contamination will waste feed and therefore troughs should be built in such a way that that goats or lambs cannot climb in them. Also, the feeder must be cleaned and refilled at least once a day.

TAKE NOTE

Deep troughs with sloping sides may be slippery and can trap the kids, where they could die from suffocation.

Grazing

Creep feeding does not always have to be in a feeder or supplied on the ground from a bag. Creep grazing can be the best alternative to help young weaning goats and lambs gain weight. Creep grazing can be achieved by supplying high quality material like soybeans, clovers, groundnuts or lucerne.

Safety or health precautions

Animals are susceptible to illnesses. You must look after their health. They can contract orf, if the young goats or sheep share the same feed and water source. You should consider vaccination with coccidiostats against orf. To help prevent these illnesses, keep the pens and grazing areas clean. Disinfect these areas regularly to control germs.

■ Time to wean the kid and lambs

Weaning time for kids and lambs can be a stressful time because they are removed from the supply of their mother's milk. This normally happens automatically at the age of about three months, when the kid weighs about 20 kg. At this stage, the kids or lambs should be supplied with supplementary feed while they adapt to not drinking the dam's milk.

During this change, the decline in maternal antibodies and the stress of weaning could expose kids and lambs to respiratory diseases.

1.7 The correct way to use the veld or grazing areas

■ Basic principles of grassland management

The carrying capacity of the veld

You must remember that the veld is only able to carry a certain amount of livestock over a certain period of time because it can only produce a certain amount of food for grazing. Areas that receive a high rainfall normally have a good vegetation cover and higher quality types of grass. These types of environments will be able to supply the most grass for feeding livestock.

Some types of grasses, called unpalatable grasses or grazing, must not be eaten by the animals. These grasses either taste bad or are very tough to bite off, which can wear down the animal's teeth.

Figure 1.27: (From left to right) Ngongoni, rats-tail dropseed and South African lovegrass

Goats are both grazers and browsers whereas sheep prefer to graze, so make sure that there is both grass and edible tree types available. The leaves of the trees should be below 1,5 m high for the goats to be able to reach them. Alternatively, you can cut the branches with the leaves for the goats to eat. You must consider whether the trees lose their leaves in winter or not. If the trees do not have leaves in winter, you will have to provide an alternative for the goats.

You can calculate the number of goats and sheep that can be kept on a specific area of land for grazing and browsing. If the number of animals is more than what the grazing can support, the goats and sheep will not be able to get enough energy and nutrition. This will also cause overgrazing and damage the veld.

Sweetveld compared to sourveld

Sweetveld is generally found in warmer and dryer areas and tends to keep its quality throughout the year, although it produces less grass per year. The carrying capacity of a sweetveld is lower and can be overgrazed and damaged easier because of its lower yield. This will lead to encroaching by different types of bush, which might not be edible.

Sourveld is usually found in high altitude and cooler areas, which means that the rainfall may be higher, but it may become frosty during the winter. The grass quality declines while the nutrients are reabsorbed by the soil during the resting period to survive the colder and harsher weather. This means that the goats will require nutrients or supplements such as a urea lick or block to enhance the feed quality in winter. Although these areas supply new and highly nutritious leaves in spring, the veld recovers slowly for use by goats. Typically, the grass found in sourveld is short.

Resting the grazing or veld

Grazing areas and veld must have a rest period for a full season at regular intervals. This gives the grazing time to recover and restock or replenish energy in the root reserves. Nutrients are taken from the root reserves every time grazing happens, which reduces the growth of leaves. When grazing happens over several seasons, the root reserves cannot replenish themselves and will eventually die or get pulled out by the animals.

Trees can also be over-browsed. This can be seen in the height of the trees, which is called a browse line (see Figure 1.28). When this starts happening, the animals have to be withdrawn from the area to allow the trees to regrow branches and leaves that can be used for browsing.

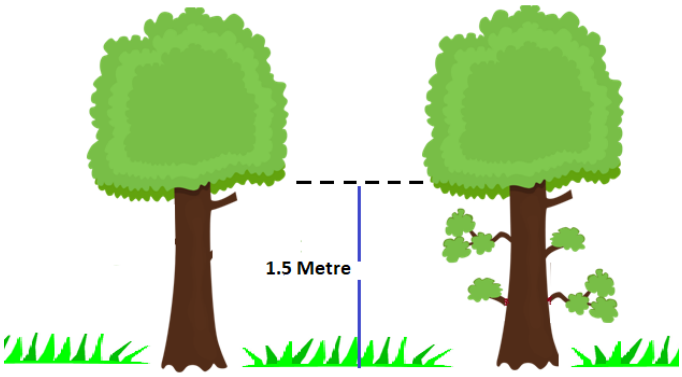


Figure 1.28: The browse line

In some dry countries, where trees and grazing are scarce, the goats will even climb into the tree to get hold of some leaves. This seriously damages the tree and the tree might eventually die.

Figure 1.29: The goats have eaten the leaves from these trees as high as they can reach

Grazing and goat/sheep management

The following can be done to prevent overgrazing:

- Decide on the number of goats and/or sheep allowed to graze, if the piece of land belongs to you. If the grazing is not enough, add supplements as needed.
- When food is scarce, and the goats are fenced in, they will not be able to forage. Goats normally walk long distances to look for food.
- Supply clean water every day.
- Do not overgraze communal areas. When there are different goat or sheep owners using communal grazing areas, everyone should agree on which pastures to rest and which to use.
- Ask permission to cut small amounts of branches with leaves to feed the goats or sheep, when there are tall trees on communal ground that still have some nutritional value.

1.8 Pasture development

With proper pasture control, you will also be able to improve the control of parasites.

Parasites and pastures

The following are various ways to reduce parasites with pasture control:

- Hay crop. This type of pasture will mean that goats will be grazing in one part of a pasture in the early parts of the season and moved to another pasture that was for the purpose of hay cutting.

- Use annual pasture systems. This means planting the pasture first and then using an implement to roughen the stubble.
- Include plants with high tannin levels. Certain shrubs might also contain tannins.
- Use other types of animals to graze the pasture. Certain parasites cannot survive in the stomach of certain grazers.
- Introduce the goats to pastures with high nutritional food at certain times, but they should also graze in a little less nutritional areas.
- Be aware that parasites larvae normally live close to the ground. Therefore, if the goats browse in longer grass, the chances of getting close to the parasites are reduced.
- Put better goats with the highest requirements in the best pasture available.
- Rest pastures for at least a full grazing season if possible. This will give the parasite larvae and eggs time to die off.

Controlled grazing

Controlled grazing is a system of allowing goats or sheep to graze for shorter periods in one paddock before moving them to another paddock. The smaller the paddock the more evenly it is grazed. The animals are moved to the next paddock to allow a little growth in the current paddock. This will allow the paddock to recover quicker.

If the grazing continues for too long, the brush or grass can be damaged, and this will prevent it from growing back in the same season.

Natural grasses appear quicker after controlled grazing.

Strip grazing is done to prevent overgrazing of a certain paddock. Movable electric fences, one in front and one in the back, will force the goats to move forward continuously. In this way, the goats will have 2 - 3 days in a section and then be moved to another section. Therefore, overgrazing will be prevented, and the paddock growth can also recover quicker. Rotation of paddocks must be about 30 days for the best recovery of the fodder, grass and other plants.

More than one pasture will make sure that:

- Goats become used to humans and will be easier to handle
- Plants recover quicker
- Grazing is not wasted by trampling
- Dung and urine are distributed more evenly
- Goats are monitored more closely on a continuous base.

Controlled grazing has the following few disadvantages:

- Costs are higher
- The overall layout of the paddocks should be easy to control
- Pastures can be overstocked, if not careful.

- Rest periods might be too long.
- Quality of the forage can also become low.

Continuous grazing will cause the goats to be kept in one paddock for long periods. The goats will then decide where to graze, what to graze and when to graze.

The number of goats on continuous grazing method must be less than when controlled grazing is done. However, if there is a tendency to overgraze parts, temporary fences can be erected.

Chapter 2

Health of goats and sheep

2.1 Keeping your animals healthy

You must keep your goats and sheep healthy to make sure that they are as productive as possible. If you have a lot of sick animals, the cost of medicine can become high and you will waste a lot of time and money on sick animals.

Early treatment can stop illnesses and lead to quicker recovery of animals. Therefore, you must be able to detect and identify illnesses early, and then treat it correctly. The following are some ideas on how to keep goats and sheep healthy:

- Make sure that enough good quality feed is always available.
- Make sure the goats have access to clean water.
- Follow a vaccination programme. Vaccines are used on a routine basis to prevent diseases and are of two types: dead and living vaccines. It is important to follow the given instructions correctly for the storage and when using the vaccine.
- Keep all internal and external parasites under control.
- Keep sick goats and sheep separate from healthy ones to prevent cross-contamination.
- Make sure that new goats and sheep are free of diseases when introducing them to the flock by creating a small quarantine area in which the new animals can be separated and observed for a number of days before introducing them to the rest of the flock.
- Make sure that the goats and sheep have a good shelter for bad weather.
- Practice proper herd management practices to achieve disease control.

As soon as a goat or sheep becomes sick, it must be isolated and treated. This will help it recover quickly and prevent spreading the illness to the other goats. You must also keep an accurate record of the sick goats and sheep and the treatment they received.

A goat or sheep that becomes sick quite often is weak and does not contribute to the overall production of the herd. It should be culled to make sure that only healthy goats and sheep remain in the herd. Sick goats and sheep could also cost the farmer a lot of money in time and treatment.

The following are symptoms of sick goats:

- Restlessness and dullness.
- Coughing and diarrhoea.
- Not following the herd at feeding time.
- Too high or too low temperature.

- Inspection of the inside eye lid will give you an indication if the animal is anaemic, which could indicate the presence of high infestation of internal parasites of disease.

The following are symptoms of sick sheep:

- Reduced appetite.
- Looks ill with a dull or matted coat.
- Has a dry nose or has a discharge coming from the nose, eyes or mouth.
- Isolates itself from the rest of the flock.
- Breathing is too fast or too slow.

Unhealthy lambs appear to be weak, lazy and hunched back or unwilling to feed or move.

The importance of flock health

The whole herd can be infected by one sick animal, which can also cause the sick animal to be re-infected after recovery.

When there are sicknesses in one or more different herds, it means that the area is suffering from unhealthy conditions. When this happens, it will be costly and time consuming to keep individual goats healthy. Therefore, if you note any common diseases in your goats, you must think of the correct ways to fight these illnesses, keep your herd healthy and assist in keeping the disease away from the other animals in the community.

You should formulate a flock management calendar with your veterinary professional, which allows production planning and health management planning.

What keeps animals healthy?

The immune system is the main thing that keeps the animal healthy. Its main function is to fight invasive germs as soon as they are detected in the body. It involves many organs, cells, proteins and tissues. The important thing is that the immune system can distinguish between the goat's tissue and foreign tissue. It also discards dead and unhealthy cells. The immune system cells are produced in the bone marrow.

With illnesses like contagious abortion (CA) that can reoccur, the immune system will be able to recognise it when it reappears and then fight the disease. This recognition will last for the lifetime of the goat. The immune system can also recognise other diseases when present, but it 'forgets' when the illness has not been present for a long time.

Diseases caused by ticks are the most common types of diseases that affect goats. Normally, diseases caused by ticks happen in summer when there are lots of ticks around. The immune system will be able to get used to ticks and then easily be able to fight the ticks off. Diseases can further be classified into infectious and non-infectious:

- Infectious diseases: These diseases can be transmitted to other animals from a sick animal. Viruses, bacteria, fungi and some parasites are all examples of agents of infectious diseases.
- Non-infectious diseases: These types of diseases are related to feed, for example, mineral deficiencies. In some cases, it could also be genetic or can occur due to an injury.

Goats and sheep that are likely to be prone to illness are:

- Weak, young, underfed or pregnant animals.
- Stressed-out animals or animals living in poor living conditions, such as unclean conditions and lack of the correct nutrients.

A disease like heartwater (cowdriosis, nintas and ehrlichiosis) infects animals that come from an area where heartwater is uncommon or unknown. You must be careful when introducing animals from these areas into a herd that might have the illness because these newly infected animals are not protected by their immune systems. This could lead to the new animals becoming sick or even dying. You must be aware of the disease at the point of origin when buying new animals, especially imported animals because they might have been previously exposed to the diseases prevalent in Zambia.

The immune system is divided into different parts and each part of the immune system specialises in the particular disease it fights. For example, one section of the immune system may be very good at fighting heartwater but be unable fight redwater. The immune system only fights diseases that it recognises and ignore those it does not recognise.

Vaccinations are a good way to protect animals. During vaccination, an animal is injected with a weak form of the disease, which does not kill the animal but protects it against the same type of disease. Some vaccinations must be administered every year, while others only need to be applied once in the lifetime of the goat. Kids born from a doe that has been vaccinated can also develop their own immune system. Kids suckling on the vaccinated doe soon after birth (drinking the colostrum) will be able to build up a stronger immune system.

Sick animals must be kept in the shade and sheltered from wind and rain to keep them warm. Animals that use less of their energy to cool down or heat up will be able to recover more easily from disease.

Importance of food

The animal's immune system might be extremely good, but if it is constantly hungry or undernourished, it will eventually contract an illness. The immune system of undernourished animals will not be able to combat the different diseases. The animal will eventually get weaker and become more likely to catch diseases.

You must give animals enough quality feed to make sure that they are in a good health condition. A good diet will prevent weakened goats with poor immune systems from contracting diseases. Sometimes, this will also allow the goat to recover from an illness without being given medicine.

Good hygiene practices

You must maintain a high level of cleanliness and hygiene to have a productive and healthy flock. Washing your own hands when treating or vaccinating animals can prevent illnesses from spreading. You must also make sure that the shelters of goats are clean and free from parasites. Clean the shelters often and set up a pest management programme for the

animals' living areas. When treating animals, exchange the needles frequently so that you do not spread diseases, and wash the instruments with hot water after a treatment.

You must also treat the animals for pests and parasites regularly. Set up a dip schedule to get rid of ticks, fleas and lice on the goats to prevent their immune systems from being weakened by the parasites.

Preventative health care

Vaccinations are part of preventative care methods. You should know which common diseases can affect the animals in your area. Knowing this will help you properly plan for the correct vaccinations. There are only a few diseases that can be stopped by vaccinations and therefore vaccinating the goats and sheep early will prevent the goats and sheep from contracting these diseases. Proper timing of vaccinations will help in combating diseases and could possibly control the extent of a disease outbreak. When an animal is sick already, vaccinations might not help.

A vaccination, like Multivax P/ MulticlostriP, is a key type of vaccination. It is important to have a vaccination schedule, for the following reasons:

- Vaccination can control lung infections (Pasteurella), tetanus, black quarter and pulpy kidney.
- Kids must be vaccinated between 4 and 5 months and again at 5 - 6 months.
- Adult goats must be vaccinated every year in September and again about four weeks later.
- Sheep should be vaccinated on an annual basis.
- If an illness, like enzootic abortion or Brucella Melitensis (CA), is positively identified by a vet, other vaccinations can be done.
- You can use your management calendar to help you keep track of these vaccinations.

Figure 2.1: A goat being vaccinated

2.2 Parasites – internal and external

Goats and sheep can have two types of parasites, which can harm them. An internal parasite is found inside the intestines and other organs, while an external parasite is found on the outside of the animal.

Internal parasites

Worms and flukes

These internal parasites can cause harm in two ways:

- By absorbing the host's food.
- By feeding on the tissue and blood of the host.

The four major types of internal parasites found in goats and sheep can be grouped into four categories:

- Absomasal worms also known as round worms.
- Intestinal worms also known as tape worms.
- Liver flukes known as leaf-like worms.
- Protozoa known as coccidia.

The worms come in different types. Some are easy to see and recognise, such as tapeworms and the smaller types, whereas others are difficult to see and recognise, such as roundworms. Roundworms and wireworms can cause big losses in goat and sheep flocks and must therefore be controlled properly. When infected, animals show signs of poor appetite or reduced feed intake while some animals can develop severe diarrhoea with black or dark green faeces. Tapeworms can cause an illness called potbelly (Moniezia expansa) in younger goats.

Liver flukes are another type of internal parasite found in the goat or sheep's liver. The liver gets infested with this parasite when goats and sheep feed near marshes or standing water. This infection usually occurs during the drier seasons.

Lung worms is another example of an internal parasite, these worms block the airways of the lung/s in both goats and sheep. The main signs of this infection in animals are coughing and having difficulty when breathing. If not treated, animals can die within a few days after being infected with the parasite.

Although the goat or sheep might not become sick, the parasites will reduce its productivity. With heavy infestations, the goat can lose large amounts of blood (and become anaemic). This will result in the goat becoming lethargic, show lower lip swelling (bottle jaw), getting diarrhoea and possibly even dying.

Cysts can form in the goats' brains from being infected with certain types of tapeworm. This can also lead to the goats and sheep dying. This type of tapeworm is picked up from dogs.

Coccidiosis is a type of parasite that lives in the intestines of animals. Goats and sheep can get coccidiosis from feeding off food and water that is contaminated by these parasites. Animals infected with this parasite might experience reduced feed consumption, severe diarrhoea, fatigue and tiredness.

How to use dewormers (anthelmintic drugs)

There is a variety of dewormers that you can use to deworm your goats and sheep. Some of these are used for specific types of worms, while others are a general-purpose type, killing different types of worms. Some of the worms build up a resistance against dewormers, so you must make sure that you give the most effective dosage.

You must change dewormers regularly to make sure that different ingredients are present to control different types of worms. The active ingredients in the medicine must be safe for goats.

Use the FAMACHA chart with the check system to control pests in your goats and sheep. You can use standard dosing programmes, based on heavy infestation periods, to control parasites and dose all the goats and sheep in the herd or flock at specific times of the year.

The FAMCHA card has a 5-number scale. Categories 1 and 2 require no treatment, whereas an animal that registers a 3 on the scale requires treatment only if it looks sick. Categories 4 and 5 need treatment. With goats and sheep, you always need to treat these animals with a score of 4 and 5.

Dung samples can be taken and sent to a laboratory to establish the types of parasites and worms present in the specific herd. The sample must be collected directly from the goat or

sheep. Dung picked up from the ground will be contaminated and must not be used. If possible, keep the sample in a fridge, otherwise you can keep it in a cool, dry place.

Internal parasites five-point check

The Five Point Check© is a system developed to quickly check the basic conditions of a goat or sheep to determine what internal parasites might be present. Five different points to check have been identified as following:

- Eyes – Check if the animal has anaemia by using the FAMACHA method. You can use to check for wireworm (Haemonchus contortus) or hookworms. It will not detect tapeworm. To use this method, you must look at the inner membranes of the eyes. If the membranes are pale pink, it indicates that the animal is anaemic. Yellow membranes indicate that the animal is suffering from liver disease because of liver flukes.

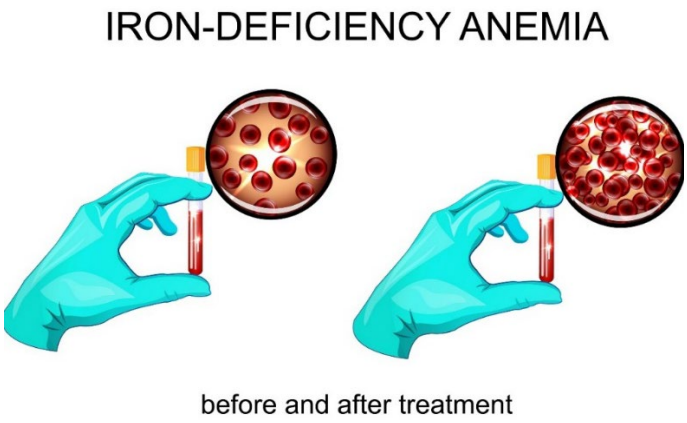


Figure 2.2: How anaemia affects the blood

- Nose – Check for a discharge. This can indicate the presence of the nasal bot fly (Oestrus ovis).
- Jaw – Check for a soft swelling under the skin, also known as bottle jaw, which could be caused by wireworm or fluke.
- Back – Check the overall condition of the back as the condition of the back can indicate the presence of any parasites and worms. Worms can cause the goat to have a lack of appetite. Bankrupt worm, brown stomach worm and conical fluke are the more severe appetite suppressants.
- Tail – Check if the tail is dirty, a dirty tale indicates parasites such as roundworms and conical fluke. The symptom of these parasites is mild or even severe diarrhoea. All animals with diarrhoea must be treated before the parasites spread.

Symptoms like potbelly can also be tapeworm related and must be treated accordingly.

Other methods to control internal parasites

When goats and sheep are grazing, they pick up worms from the grass due to the faeces in the grass. Rotating the camps or grazing areas can reduce or even eliminate the parasites present in the grass.

Leaking and broken troughs can lead to mud, which is a breeding ground for worms. Fix all leaks to prevent mud forming.

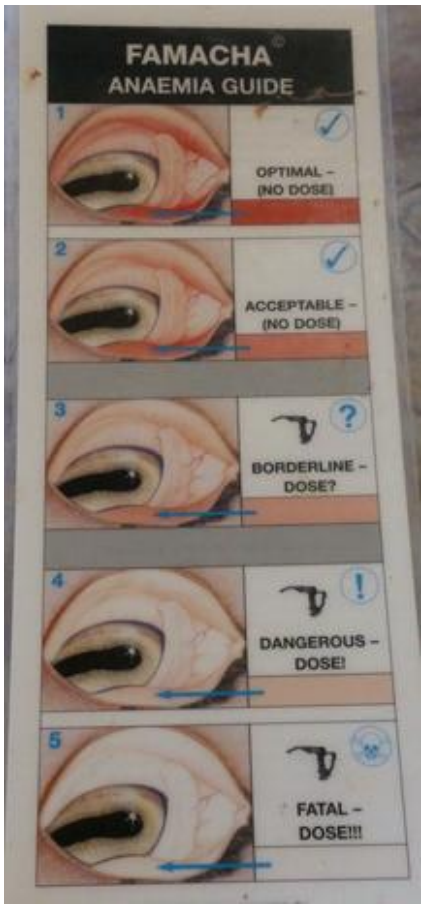


Figure 2.3: FAMACHA guide

Goats and sheep that have previously been identified as susceptible to worms must be culled as they will spread the parasites continuously. Regularly checking the membranes of the eyes can determine if it is worth treating certain goats or sheep. Either sell or cull animals that are not worth treating.

External parasites

Ticks and mange mites are some of the most common external parasites. Blowflies, flies and mosquitos can also cause external irritations that can become infected and cause illnesses.

Ticks

Ticks do not only damage the skin but also carry certain serious diseases such as heartwater. Heartwater can only be transmitted by the bont tick.

Figure 2.4: A red tick

If the number of ticks on the animal are not present in large numbers, then you can kill them by hand by using a needle or thorn.

There are different ways of applying tick insecticides. The most common method is to spray the insecticide on the animal. A common method in Zambia is dipping the animals in a plunge dip or with a bucket and sponge. After dipping the animal, put the animal outside in the sun to dry.

Two other methods of applying insecticide are to pour the product onto the animal's back or inject the animal with a registered product like Ivermectin.

TAKE NOTE

When dipping the animals, you must remember that the dips are poisonous. You must not touch the dip with your hands or body. Wear protective equipment.

Mange

Mange on the skin is caused by small organisms called mites. Mange causes itching and the animal's hair will eventually fall out. Different types of dips and injections are available to control mange.

Figure 2.5: A mange mite

Fleas

Fleas can be found wherever their host animals live. They are the most common external parasite. They move around by jumping from one host to another. Cats and dogs are common carriers of fleas, which can then spread to other farm animals. If your area is affected by fleas, you can control it by dipping and treating the animals with sprays or powders like Karbadust.

Figure 2.6: A flea

Lice

The following two types of lice are common:

- The sucking type (blue lice).
- The biting type (red lice).

The sucking louse sucks blood from the goat, whereas the biting louse feeds on the dead skin. This causes itching and the animal will rub themselves against anything to relieve the itching. This can cause severe damage to their skin and hair.

Figure 2.7: Lice in the hair

Lice are normally found in areas with high humidity. You can typically see them around the neck and on the inside of the legs of the goat. Rubbing can cause bleeding and scabs. There will also be a loss of hair and the coat will become dull. You must separate infected animals from the rest of the herd.

Nasal worm

The larvae or bots of flies are called nasal worms. The eggs from flies will hatch inside the nose of the goat after being laid there by the adult flies. The larvae will move up the nose into the sinus cavities in the head. This will cause irritation and inflammation with mucus eventually starting to run out of the nose. Typical symptoms are coughs, sneezes and a shaking of the head. All this will eventually get rid of the bots, which will grow up into flies.

You can treat nasal bots very easily with products that contain Ivermectin or Closantel. Deworming products such as Tramisol can also be used.

The bots can cause a secondary infection in the sinuses, which can spread to the lungs. The best treatment for these infections is to give the animal 5 cc of a long-acting Oxytetracycline, typically Terramycin, every third day until the animal is healed.

2.3 Common diseases

There are a few common diseases that can affect goats. You should be aware of these diseases and know how to prevent and treat them.

■ Heartwater

Heartwater is a disease that affects livestock. The disease is called heartwater because of the fluid around the heart and lungs of the infected animal. This is one of the most important tick-borne diseases found in goats and sheep.

Cause

Heartwater is caused by an organism transmitted by the African bont tick (Amblyomma hebraeum). Bont ticks are found in dry, hot and bushy areas.

Figure 2.8: Bont tick

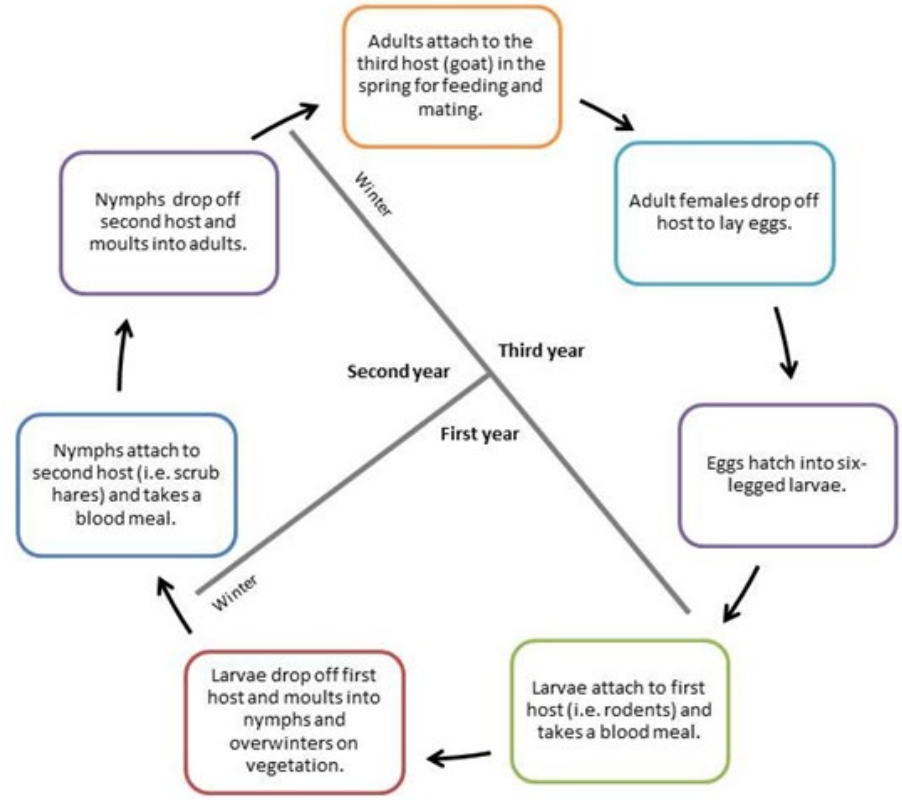


Figure 2.9: Life cycle of the bont tick

Symptoms

Heartwater is a fast-acting disease, causing death within 24 hours. However, there are cases where goats have survived up to five days. One of the easiest symptoms to spot is a very high temperature. The goat will also lift its feet up very high when walking and have a jerky gait, walking in circles and shivering. This will later turn into paddling, jerky leg movements. The head will pull backwards when the animal goes down.

After death, an autopsy will show that there are excessive fluids in the heart sac, lungs, chest cavity and abdominal cavity.

Prevention

Heartwater can be prevented by leaving a small number of ticks on the animal. You will have to dip the animal once a month, if you can see that the number of ticks has increased. Mature goats that grew up in a heartwater area might be resistant to the disease.

Any animal that died because of the disease must be dipped to kill all the ticks (that are now also infected with heartwater) to prevent other goats from being bitten by infected ticks.

Vaccination can be complicated and expensive. Find out from your local vet which steps you can take.

Treatment

The treatment must be done before any of the nervous symptoms appear. Oxytetracycline, (also known by brand names like Terramycin/Oxyject/Maxitet) or a new drug called

Doxycycline can be used according to the instructions, 1 ml for every 10 kg live weight. The best way to use this treatment is to inject the medication intravenously or intramuscularly if possible.

Give mature goats 5 cc of Oxytetracycline every day for three days and give kids 2,5 cc every day for three days. Different medicines have different dosages.

In some areas where ticks are present, you can prevent heartwater can by treating the young goats with a long-term antibiotic. This is called blocking. However, blocking is usually abused. You must do blocking only a few times or else resistance will build up.

Blocking against heartwater

Blocking has been developed to decrease the number of deaths due to heartwater. This is not common practice in Zambia.

Heartwater has an incubation period of 14 - 28 days. Blocking involves giving young goats a mild case of heartwater (this is called inoculation). You then check their temperature every day and start treating them when their temperature starts to rise. If you cannot monitor their temperature, you can block them on day 13 after the vaccination while they are still incubating the disease and not showing any symptoms.

To treat the goats, inject them with a long-acting antibiotic like Oxytetracycline with the correct dose for their body weight.

To treat animals that are new to a heartwater area, give them a dose of antibiotic every 7 days for three weeks (this means a dose on day 7, day 14 and day 21 after they enter the area).

Abscesses

Abscesses in goats and sheep can be caused by a variety of things. The most common causes are a bacterium (Corynebacterium Pseudotuberculosis) a thorn breaking off or needles not alternated or cleaned properly before use in the skin or a tick breaking the skin of the animal.

Symptoms

The abscess will show as a swelling and can appear in various places on the body. When the abscess is broken or intentionally opened, a thick yellowish green liquid will be released.

Prevention

Hygiene is a top priority as secondary infections can happen all the time. Excess ticks must be controlled by dipping the animals. If a goat or sheep has several bad abscesses or abscesses appear often, it must be culled before spreading the infections.

Treatment

As soon as the abscess shows a yellow spot or softens, it must be opened and drained. This is done by making a small crosscut on the soft part with a sterilised razor blade. A syringe

filled with a hot water and salt solution (one tablespoon of salt in a cup of water) must then be injected into the cut. Iodine can also be used.

To keep it clean, the abscess should be sprayed daily with an antiseptic aerosol. Keep the wound open for the pus to run out and be flushed. When treating the abscess, wear gloves. The gloves and the cloths used to wipe away the pus must be burned. The razor blade must be boiled every time before use. To aid recovery, the goat or sheep can also be injected with an antibiotic such as tetracycline.

Tapeworm cyst in the brain

Brain cysts are caused by the larval stage of a parasite called Taenia multiceps and can damage the brain of the goat.

Symptoms

Tapeworm cysts cause permanent damage in the brain, causing the affected goat to walk in circles. This goat will suffer and eventually die.

Prevention

You must deworm goats regularly to prevent brain cysts. Dogs that have contact with the goats must also be dewormed.

Treatment

Once the symptoms are seen, there is no possible cure.

Diarrhoea or scours

Scours can happen when the animal's digestive system goes out of balance due to an incorrect diet, a change in diet, a new feeding area or various foodstuffs. The sickness is usually caused by bacteria, viruses, parasites or bad management practices, and it can either be a symptom of a disease or a disease in itself. This sickness affects both goats and sheep.

Each type of diarrhoea will show a different type of runny stomach, namely:

- Yellow and smooth diarrhoea.
- White and smooth diarrhoea.
- Lumps of thin skin in a whitish diarrhoea.
- Brownish or reddish diarrhoea, which could be an indication of blood.

Symptoms

Fatigue and weakness in sheep could be indicators of this disease. In ewes and does, a decrease in milk production or not having enough milk for their lambs and kids may be symptoms of this disease.

Prevention

Scours can be prevented by regular treatment against worms. Nutritional supplements can be supplied when the feed or grazing has changed. This is especially important in winter.

Treatment

A very basic and simple treatment is to mix one tablespoon of salt and eight tablespoons of sugar into one litre of water. This mixture can be given twice a day instead of milk to young but not yet weaned kids for a maximum of three days.

When there is blood in the diarrhoea, you must inject the goat with a long acting antibiotic or give them a dose of Oxytertracycline powder and water mix. The correct dosage is one teaspoon of Oxytertracycline mixed with water for every 7 kg of body mass, repeated daily for up to five days.

You can also treat diarrhoea with an oxytetracycline dosage. For an intramuscular injection the dosage is 1 ml per 10 kg of body mass. If required, it can be repeated after three days. Also, rather recommend sulfadiazine injection.

You can also give half of a crushed antidiarrheal tablet (like loperamide) per day for a maximum of five days.

Mange

Mange is a severe form of dermatitis that is caused by a severe infestation of mites. These parasites live on or under the skin and feed on dead skin, skin secretions, blood or lymph. This sickness can be found in both goats and sheep.

Figure 2.10: An example of severe mange

Symptoms

Symptoms include:

- Goats and sheep show a loss of hair and a skin irritation.
- Infested skin will be covered with fluid, this eventually dries up and forms a scab/s.
- Lesions may occur on the goat's or sheep's body.

Prevention

If goats and sheep show symptoms of mange, they must be dipped with the correct type of dip, like Amitraz (also known by the brand name as Triatix or Dazzel). Animals can also be given an injection of an antiparasitic drug like Doramactin, known by brand names Doraject and Dectomax. The Ivermectin injection (200 mg/kg) is also effective in treating this disease.

Other preventative measures include:

- New goats or sheep are usually the main carriers of this disease. Before introducing new animals into the flock, check the animal carefully and treat the animal if required.
- Goat and sheep shelters should be sprayed with acaricides.

Coccidiosis

This is an illness caused by an organism that is normally found in communal drinking water and affects both goats and sheep. The organism is called coccidia and it normally affects kids and lambs. Older goats and sheep might also become infected, but there will be no clinical symptoms as they are immune to this illness. However, even though they are immune, the older goats and sheep can still be carriers for the disease and can infect the younger ones.

Symptoms

When the animal is still alive, it will have diarrhoea and an inflamed intestinal lining. This is because the disease attacks the mucus of the intestine. Coccidiosis is not the same as scours and is different because it leads to a short period of diarrhoea and the animals dying quickly.

Other symptoms of coccidiosis include:

- Diarrhoea that is bloody or contains mucus, and can be brownish, yellow or green.
- Dehydration and anaemia.
- Lack of appetite.
- Condition loss.
- Straining of the rectum (may lead to prolapse).
- Rough hair coat.

After death, an autopsy will show that the mucous membrane of the small intestine has greyish-white spots. The guts can be filled with blood and fluids.

Prevention

The goats and sheep that are affected by coccidiosis must be isolated from the rest of the flock to prevent spreading the illness. Overall hygiene is very important at this stage. You must keep enclosures and pens clean and dry. The kids and the older goats must also be kept away from each other. You should give the goats medicines like Rumensin to prevent further outbreak of the disease.

Treatment

The following are way in which you can treat coccidiosis:

- Give the goats Sulfazine 16% as a drink. Start off by giving 14 ml per 10 kg body mass every day for two days. After two days, reduce the dosage to 7 ml per 10 kg body mass for two days. Whenever there is an outbreak, you must treat all does and kids with Sulfazine.
- Give the goats half a loperamide tablet each day for 3 - 5 days.
- Give 1 ml of Vecoxan for every 2,5 kg of body mass. You must do this at 4 - 6 weeks old. All kids must be treated.
- Give the goats electrolytes to prevent dehydration. A general mixture of one tablespoon of salt and eight tablespoons of sugar mixed with 1 litre of warm and clean water is very effective. Give unweaned kids this mixture twice a day instead of milk, but do not give them for more than three days in a row.
- You can treat affected lambs with Sulfaquinoxaline mixed with drinking water at a 0.015% concentration for about 3- 5 days.
- Lambs that are treated will require extra care such as re-hydration and nutrition. Lack of appetite can be treated by using probiotics.
- Amprolium (Corid®) is used to prevent and treat coccidiosis in sheep. The dose varies and it is usually given for 3 – 5 days.

Orf

The orf virus causes an infection that is commonly called scabby mouth or sore mouth and it is found both in goats and sheep. The parapox virus happens naturally where livestock is kept. The virus can also be transmitted to humans.

Symptoms

Sores will form on the goat or the sheep's lips, nose and mouth. The sores look similar to warts and can happen in young kids or lambs that are still suckling on the doe or ewe. An affected kid or lamb can transmit this disease to their mothers, causing the does or ewes to get an orf infection on their udders.

Prevention

Affected animals should be kept away from other goats and sheep to prevent spreading the disease.

You must vaccinate the kids when the does are done kidding females are done kidding. Apply the vaccine by dipping a thick (18 gauge) needle into the vaccine and then piercing the skin of the animal's armpit with the needle.

Treatment

You must apply iodine spray daily to the affected area. Soften the hard scabs with glycerine or Vaseline, so that the animals are able to feed. Using intramammary containing antibiotics spreads the paste on the affected area.


TAKE NOTE

Using gloves is recommended as the disease can spread and infect humans.

Foot problems in goats

Foot problems in goats are quite common and there are a few different types. Table 2.1 describes the causes, prevention and treatment of a few foot problems.

Table 2.1: Foot problems in goats

Foot problem	*Causes*	*Prevention*	*Treatment*
Foot rot	Foot rot is caused by a bacterium that lives in the soil and can be easily transferred to different areas on a farm. Normally, goats on pastures are affected by this bacterial condition. The disease can easily spread between goats.	Keep sheds clean and give the goats a monthly footbath with a 10% zinc sulphate solution. Make sure the goats stand in the bath for at least five minutes. Goats that are affected must be kept separate from the rest of the herd.	An antibiotic like Oxytetracycline must be used to treat the infected goats. Iodine can be sprayed onto the hooves. The solution must be sprayed between the claws.
Excessive hoof growth	The rocks and stones in a goat's pasture naturally wear away at its hooves. If the pasture is soft or the animal is kept where stones are removed, their hooves will become overgrown.	Trim the hooves regularly.	The overgrown hooves will affect the goat's ability to walk properly. This, in turn, will hamper the animal's feeding habits. (This manual discusses hoof trimming in a later section.)
Limping (caused by abscesses)	Ticks, thorns and sharp objects can damage the soft areas between a goat's claws. The foot will be swollen and red, will feel hot to the touch, and can be painful. Sometimes, the wound can burst open and discharge pus.	Goats must not stand in mud or water for too long. Dip their feet to prevent ticks and check their feet regularly to remove ticks. Clean the animals' overnight facilities every month.	When an abscess has a yellow spot or feels soft, it must be opened and drained. Tick dip must be used to kill the ticks. A razor blade that is sterilised by boiling must be used to cut the abscess. Mix 1 cup of water with 1 tablespoon of salt and apply it to the wound, using a syringe or simply by pouring the solution over the wound. Iodine can also be used. The wound must be sprayed daily with Woundsep Plus aerosol or a wound spray like Supaspray, iodine or any

Foot problem	*Causes*	*Prevention*	*Treatment*
			typical antiseptics available. All material (rags or cloths) used to treat the animal must be burned or buried. This will prevent the infection spreading to humans or other animals. The blade used must be boiled before and after use. Treatment with a long-acting medicine, like Oxytetracycline (Terramycin), at a ratio of 1 ml per 10 kg of body mass can also be used.

Bloat

The cause of bloat is gas trapped in the rumen, bloating can affect both goas and sheep. This can be a result of an animal overeating certain damp feeds such as clover, legumes and alfalfa.

Symptoms

A swollen stomach is the first indication. When a goat or sheep becomes uncomfortable and restless, it might lie down, struggle to breathe, or even die.

Prevention

Bloat can be caused by introducing feed to animals without them consuming enough roughage. However, Zambia cultivates legumes that might cause bloat like cow peas, pigeon peas, etc. When green lucerne becomes available, goats and sheep must be rushed into feeding on the lucerne immediately. It must be introduced slowly and for short periods of time. They should get large quantities of hay before getting lucerne. You must remove objects like wires and plastics from areas where the goats and sheep graze.

Treatment

Force feed the goat or sheep 50 ml of cooking oil or Chibuku beer. Keep the animal upright and do not allow it to lie down. Pick it up if it lies down and force it to walk until it has belched. In very severe cases, you can stab the bulging area with a sharp knife or sharp object to release the air build-up.

Mastitis

Mastitis is the inflammation of the goat's udder. It is caused by micro-organisms, viruses or bacteria, typically Lentivirus or Caprine Arthritis Encephalitis and it is a sickness that mainly affects goats.

Symptoms

The udder will leak or produce a brownish water-like fluid or watery milk that contains white or yellow clots or pus. The udder will be hard and hot when touched.

Prevention

To prevent the spread of the disease, make sure that the living area of the goats is clean.

Treatment

Mastitis should be treated with oxytetracycline antibiotics. You can give the goat a dosage of 5 cc Terramycin every third day until healed. If the mastitis becomes severe, the Terramycin must be combined with a lactating cow intra-mammary antibiotic. The medicine must be injected directly into the canals of the teats. You must do this after milking as much milk as possible. This treatment must continue until the goat has healed.

Abortion

Abortion is the spontaneous loss of a foetus at any stage of the pregnancy. Abortions can be caused by a wide range of factors and affects both does and ewes.

Symptoms

The following factors can contribute to abortions:

- Diseases that specifically cause abortions, including enzootic abortion and brucellosis (Brucella melitensis)
- Diseases that cause high fevers, like heartwater.
- Poor nutrition, especially in the late stages of pregnancy.
- A mineral deficiency.
- Stress.
- Certain poisonous plants.

Prevention

The following are a few basic ways to prevent abortions:

- You must not stress the does and ewes for any reason.
- You must not transport the does and ewes.
- You must give the does and ewes adequate nutrition.

Any aborted foetuses and placentas must be buried or burned so that they do not contaminate the environment or make other animals sick.

Vaccinations are available for certain illnesses. The real reason for the abortion should be determined first, either by drawing blood from the doe/ewe or by doing an analysis on the aborted foetus. It is important to keep a record of which does aborted (in terms of a percentage of the total herd), when they aborted and the reasons why. This will help to determine if the abortion is food-related or caused by a disease.

It is important to detect barren does and ewes in the flock, habitual aborters should be identified early on then culled.

Treatment

No treatment is required for abortions, unless there are complications.


TAKE NOTE

Certain diseases can also affect humans, even if they do not cause abortions in humans. Be careful when dealing with foetuses and placentas. You must avoid touching organisms that can cause a disease.

Brucellosis infections can cause abortions and low milk supply in does, and testicular problems in bucks. It can also cause Malta fever in humans. An animal health organisation in your area should help you draw blood to determine if your goats have brucellosis. If they test positive, inform a government veterinarian immediately and cull the animals.

■ Tetanus

Tetanus can affect both sheep and goats and is caused by a variety of factors, such as puncture wounds, bites from dogs, disbudding (removal of horns by burning), castration, tattooing and any action that can cause open wounds that bacteria and other germs can get into.

Symptoms

The symptoms of tetanus are stiffness of the legs that will lead to paralysis and eventual death. Normally, tetanus is caused by a wound that becomes infected by bacteria found in soil and faeces.

Prevention

You can prevent tetanus by vaccinating the animals with the MulticlostriP/Multivax P Plus vaccine.

Treatment

There is no treatment available for tetanus.

■ Infectious pneumonia

Infectious pneumonia, also called pasteurellosis, is one of the most common ailments found in smaller livestock. The illness is caused by the Pasteurella Multocida bacteria.

Symptoms

Typical symptoms of infectious pneumonia are fever, lack of appetite, coughing, rapid breathing, condition loss and a nose discharge.

Prevention

You should vaccinate your animals with a vaccine with multi-components, like Multivax P, to prevent infectious pneumonia. This vaccine can prevent certain types of lung infections.

Treatment

An oxytetracycline antibiotic like Oxyject /Terramycin or Hi-Tet can be used to treat sick animals. The dosage for Hi-Tet 200 LA is an intramuscular injection of 1 ml for every 10 kg of body mass. This injection must be repeated after three days, if necessary.

Pulpy kidney (enterotoxaemia)

Enterotoxemia or pulpy kidney is a common disease found in goats and sheep of all ages. Pulpy kidney is caused by a bacterium that is normally found in the stomach and intestines of the animal. If it begins to multiply, it produces a toxin that poisons the animal. It can also be caused by exhaustion, a change in grazing, a change in diet and being dosed with deworming agents.

Symptoms

Pulpy kidney symptoms are different, but include the following:

- Looking exhausted,
- Showing paralysis
- Losing consciousness and having difficulty breathing
- Salivating
- Diarrhoea
- Nervous symptoms:
  - Convulsions
  - Teeth grinding
  - Twitching muscles until death happens.

Some animals may not have any symptoms. You may simply find them dead. The carcass of an animal with pulpy kidney decomposes fast. Doing a necropsy can show bleeding around the heart and blood under the skin in the neck area. It can also show a lot of blood in the lungs and a lot of fluid in the heart sac. The kidneys will be enlarged and be dark red or brownish. Both kidneys will also contain a lot of blood.

Prevention

Pulpy kidney is more common in sheep than in goats, but in goats it can still be prevented by vaccinating the animals with MulticlostriP/Multivax P Plus.

Vaccinating kids with Enterotoxaemia vaccine can also prevent this disease. However, this vaccine needs boosters to work and therefore the animals must receive the vaccine every year. The animal must be injected under the skin with 1 ml of the vaccine. You should vaccinate the animals before deworming them.

Treatment

There is no treatment available, which makes it important to prevent the disease using vaccines.

Black quarter (also called quarter evil)

Black quarter Is a highly fatal disease found in both goats and sheep is caused by a bacterium called Clostridium chauvoei. The disease normally attacks the younger animals, but it is not restricted to young animals. It normally happens during hot and humid periods, and also when there is a sudden cold spell.

Symptoms

The disease causes inflammation of the muscles and blood poisoning (toxaemia) and has a high death rate.

When the animal is still alive, the symptoms are fever, appetite loss, stiff gait, depressed behaviour and lameness that results in a reluctance to walk. Gas bubbles will form in the muscles before the goat dies. The disease can also cause nose bleeds and swelling of the head.

An autopsy will show an accumulation of blood underneath the skin and in the cavities of the lungs and body. Muscles that are affected by the bacterium will be brown, dry and feel like a sponge. A bad smell will be present.

Prevention

The black quarter bacterium is found in contaminated soil and the animals take it in when they feed or when they have open wounds that contacts this disease.

The carcass of a goat that died of black quarter must be burned or buried to prevent spreading germs. Humans can also become sick if they eat the meat of an animal that died from black quarter.

Vaccinate the goats with Multivax P or Blanthrax to prevent black quarter. Blanthrax can also prevent anthrax.

Treatment

Treatment might not always be successful. Penicillin can be used, but only a vet can give this medication. Contact the nearest vet when you have a case of this disease.

Sheep pox

Sheep pox occurs both in sheep and goats. The disease spreads between direct animals and materials that are contaminated.

Symptoms

In most cases, kids and lambs suffer severe symptoms and can die before even showing any symptoms of the disease. Animals experience fatigue, lack of appetite, a difficulty in breathing and a watery discharge from the nose and eyes.

Prevention

Vaccinating goats and sheep on an annual basis will provide protection against this disease.

Treatment

There is no treatment for this disease, however you can use a topical antiseptic treatment for severe sores. The use of antibiotics also helps with preventing secondary infections.

Bluetongue

Bluetongue is a disease commonly found in sheep and not in goats. Although, goats can get affected, they usually do not show signs. This disease is transmitted usually by blood sucking flies.

Symptoms

Symptoms of this disease are:

- Swollen lips and tongue.
- Head and ears may be swollen.
- Diarrhoea with signs of blood.
- Thick nasal discharge.
- Blood can appear in the nasal discharge.
- Pneumonia can develop due to a secondary infection.

Prevention

During the rainy seasons, move sheep to higher ground that has well-drained ground. Also, dipping the animals in insecticide could be a useful method of controlling the disease.

Treatment

Keep infected animals in the shade as direct sunlight can worsen the condition. Any lesions on the mouth area can be treated with an antiseptic.

Uncommon diseases

The diseases listed in Table 2.2 are uncommon but highly dangerous and are diseases that are found in both goats and sheep. If you find any of these diseases in your herd or flock, notify your local agricultural department immediately.

Table 2.2: Uncommon goat and sheep diseases

Disease	*Cause*	*Symptoms*	*Prevention*	*Treatment*
Anthrax	Bacillus anthracis causes anthrax. It cannot survive without oxygen but can live for many years in contaminated soil. It has two forms: a vegetative form and a spore form. Anthrax is rare in goats and sheep	A live animal will not show any symptoms of anthrax infection, but it will die suddenly (within a few hours of infection). After death, you will see thick and dark blood flowing from the animal's	Burn all carcasses of animals that died from anthrax infections. Wear the proper protective gear to avoid contact with the bacteria. Vaccinate your animals every year with Blanthrax. This will protect	It is not possible to treat an anthrax infection because the disease kills the animal too quickly for any treatment to be effective.

Disease	*Cause*	*Symptoms*	*Prevention*	*Treatment*
	and more commonly found in cows. It is extremely infectious and can also infect humans, so it must be reported immediately. The disease can be released if the carcass of a dead animal is cut open. DO NOT CUT CARCASSES OPEN.	mouth, nostrils and anus.	the animals from both anthrax and black quarter.	
Rift Valley fever	Rift Valley fever is carried by mosquitos. They are very rare and are usually only found where there is a lot of standing water.	Young kids are not likely to show symptoms. Adults may have a fever, vomiting and diarrhoea, show nasal discharge, have weak legs and pregnant does and ewes may abort. About 20 – 30% of animals die.	In very wet years, you should consider vaccinating the animals.	There is no treatment.
Foot and mouth disease	Foot and mouth disease is a severe and highly contagious viral disease. It survives in the lymph nodes and bone marrow of the animal. The virus is constantly mutating, it is therefore difficult to find a cure for it.	The animal will have mouth sores, sores on the feet, lameness and excessive salivation.	Vaccination is only done by the government. The vaccine will only be released under certain circumstances.	No treatment is available. All cases must be reported to the local authorities immediately and all goats affected must be slaughtered to prevent the illness spreading.

2.4 Other causes of illnesses

■ Poisonous plants

Goats and sheep normally do not eat poisonous plants. They will only eat poisonous plants when they are forced due to:

- Overgrazed veld
- Drought
- Too many animals in one area
- Inadequate nutrition in the available food.

Too many animals grazing on one area of land can cause an invasion of plant species that could be non-palatable or even poisonous to goats. A typical plant that can invade is nightshade (Solanaceae). Some other plants, such as garden shrubs, can also be poisonous. Lantana can cause light sensitivity (sun or photosensitivity) in goats. Prussic acid poisoning happens when animals eat young growing plants that become dry and wilt, for example forage sorghum.

Figure 2.11: Lantana (left) and forage sorghum (right)

You must know the different types of poisonous plants that occur in the area or region where your animals graze. You should be able to distinguish these plants and try to prevent the animals from grazing there. It is very difficult, expensive or even impossible to treat animals that have been poisoned. To minimise plant poisoning:

- Prevent overgrazing and overstocking land.
- Keep an eye on the grazing during hot, dry periods to see if any poisonous plants are invading.
- Give goats enough nutrition to prevent hunger in harsh times, such as winter and dry season. You should also provide supplementary feeds when grazing is not adequate.
- Pay attention to what the goats eat at the end of winter because food is at the lowest levels and goats tend to eat anything.
- Monitor new animals to check that they do not graze poisonous plants.

Treatment

You must dose a poisoned animal with 2 g of activated charcoal mixed with water per kilogram of body mass. Use a stomach tube to administer this. Inject Vitamin B to strengthen the liver.

The animal should be kept in a quiet and shaded area and given enough clean water and quality feed. Give the animal enough time to rest and recover. This is especially important for animals that have eaten lantana.

Other treatments include:

- Give milk by mouth.

- Give vegetable oil by mouth.

Do not stress the animals. Any exertion can kill them.

Eating plastics

It has become more common for animals to eat plastic that is lying around. Plastic bags or wrappers might contain some salt and goats and sheep that have a salt shortage may eat the plastic. In very dry areas with a shortage of natural food, goats and sheep become hungry and eat anything that is available.

The plastic cannot pass through the rumen (first stomach) and so the rumen fills up with plastic that blocks the normal food being eaten. This can eventually lead to the goat or sheep dying. Providing goats and sheep with a supplementary lick could reduce the intake of plastic. Wherever plastic pollution is common, it should be cleaned up before goats and sheep get an opportunity to eat the plastic.

2.5 Vet kit and essential equipment

To keep your goats and sheep healthy and be able to treat them quickly, you must have access to basic equipment and vet essentials.

Basic equipment

You might not have all the equipment you need available, but you should be able to get hold of it if required. You should have the following equipment handy:

- Cooler box to keep the necessary equipment and vaccines.
- Book with general information about goats and sheep.
- Book with information about goat and sheep health.
- Burdizzo for castration or rubber rings with applicator.
- Applicator for ear tags and ear tags.
- Trimmer to trim hooves.
- Knapsack sprayer to spray goats or sheep, if spray is done with knapsack. The knapsack is carried on the back of the person spraying.
- Equipment to weigh goats and sheep.
- Small scales to measure dosages.
- Knives.
- Face mask for you to wear when applying sprays.
- Gloves to protect hands from chemicals.
- Blades for doing incisions into abscesses.
- Sterilisation kit.

- Thermometer, preferably digital, to measure the temperature of the goats and sheep.
- Antiseptic handwash to wash hands after treating goats and sheep.
- Swabs to clean incision areas, wipe away pus and clean injection sites.

The items in the basic equipment are list are the minimum items needed to treat and keep goats healthy.



Figure 2.12: Knapsack sprayer, face mask and cotton pads

Medicines, consumables and vet equipment

Some of the more important items a goat and sheep farmer needs are the medicines and the application equipment needed for the treatment of animals. These are:

- Disposable syringes in a minimum of two sizes – 5 cc and 10 cc.
- One large syringe for applying cleaning liquid, removing liquids from affected areas or draining abscesses.
- Non-disposable syringes that can be cleaned and sterilised for repeated use.
- Different size needles for injections. Normally, 19 and 20 gauge are required, but other sizes can also be made available.
- Eye powder antibiotics like Oxytetracycline powder.
- Dewormers like Prosdose Orange, Trinex and Ovidose.
- Conventional dip that can be mixed with water, like Tritix, Supatraz.
- Fly repellent antibiotic wound spray.
- Wound oil, like Coopers.
- Tick grease.
- Denatured alcohol.
- Oxytetracycline like Oxyject, Maxitet and Hitet to use as a long-term antibiotic.
- A short-term antibiotic like Oxytetracycline 120, Hitet 120 or Maxitet 10%.
- An antibiotic that is sulphur-based for treating coccidiosis, like Disdulphox 120 or Maxisulf.
- Solutions that can be injected for mange and lice, like Ivermectin or Doramectin.
- Iodine that can be sprayed on infected areas.
- Iodine drops to be used on new-born kids.

- Foot bath solution, such as copper sulphate ($CuSO_4$).
- Vitamins supplements like Multivite or Complex AD3E and Minerals, B-Co Bolic

The needles for disposable syringes must only be used once. The syringes must be cleaned by boiling them to kill any germs, before they are used again. Do not inject more than one goat with the same needle, to prevent any disease from spreading between goats.

Figure 2.13: Iodine droppers and copper sulphate crystals

2.6 Medication storage and important information

All the information you must know about storing medicines will be supplied on the medicine packaging. You must know:

- Dosing rates.
- Expiry dates.
- Storage temperatures.
- Safety to use on pregnant animals
- Withdrawal times and periods.
- Application.

Furthermore, the expiry date on the medicine is very important:

- Check the expiry date to see if the medicine is not too old to work properly when you buy new medicine.
- Do not use or buy expired drugs because they are useless.
- Buy in smaller quantities or share with other farmers to avoid storing medicine until it reaches expiry date. However, sharing with other farmers can be risky because hygiene around medicines is very important and the other farmers must also follow the same hygiene standards.

Withdrawal periods are also important. There must be enough time between the last dose of medicine and the time when the goat or sheep will be slaughtered or milked for the medicine to work out of its system. This could be a few days or a few weeks, depending on the medicine, and the withdrawal period will be indicated in the instructions. Medicines

can be absorbed by humans if the meat is eaten or the milk is used before the withdrawal date.

2.7 Correct treatment of animals

Sick animals must be treated differently compared to healthy goats. They must be kept in a sheltered place with enough green feed and clean water, and they need to receive the correct medication.

Giving of medication

There are different ways to medicate animals, whether it is pills, dips or dewormers. Read the instructions on the enclosed pamphlets and follow them or listen to the instructions given by the vet.

Methods for administering medicine include:

- Applying directly to the skin or onto the wound.
- Injecting directly into the vein (intravenously) or directly into the muscle (intramuscularly) or under the skin (subcutaneously).
- Dosing, dipping or drenching.
- Giving medication by mouth (orally).

Weighing the goat or sheep

A scale is the most accurate way to determine the goats' weight, but you can also use a weigh belt to get a good estimate of the weight. A weigh belt is made to show the specific relation between measuring around the goats' middle (their girth) and their weight. There are different belts available for different breeds of goats, so using the wrong belt can give you a wrong reading.

Why you need to know the goat or sheep's weight

You should know the goat or sheep's weight to control and apply good animal husbandry. This will assist in good health management, nutrition breeding and marketing, like in the following ways:

- Dosing an animal with the correct amount of dewormers and other required medication.
- Detecting the presence of other wellness problems and assessing the overall wellbeing of the goat.
- Feeding an animal with the proper amount.
- Mating young females at the correct weight.
- Selling the animals at the correct weight.

How to determine the weight

The simplest way to determine the weight of the goat is to weigh yourself and then note the weight. Then pick up the goat and stand on the scale again. Read the weight and subtract your own weight from the total. The answer will be the weight of the goat.

Figure 2.14: Dairy goat weigh tape

Use a weigh tape designed for the specific breed of goat. There is a mutual relationship between the weight and the girth of the animal. The weight belt was specifically designed so that you can measure around the girth and get a very close estimate of the animal's correct weight.

By using the table, you can also make your own belt. You can use different materials and mark the material according to the information in Table 2.3.

Table 2.3: Girth and weight measurements belt example

Girth in mm	*Weight in kg*
377	5
459	10
530	15
592	20
648	25
699	30
745	35
787	40
826	45
863	50
897	55
929	60
960	65
989	70

Sheep weight

Sheep are weighed at different times for different purposes. For light animals, a weigh scale is hung from a tree or a cage weighing scale is used to weigh sheep.

Correct dosage

The amount of medicine given to goats and sheep must be given at the correct dosage, whether the medicine is injected or given orally. The dose is normally indicated on the pamphlet supplied with the medicine. The dose is normally higher for heavier animals.

Under-dosing can have negative outcomes. A dose that is too small will not work and, when you try to give another dose, the disease organisms will have become resistant to the medicine.

Knowing your animals and being able to estimate their weights is quite important. This knowledge can help you determine the dosage to give a goat or sheep. Deworming is a good example of why estimating weights is important. When dosing a group of animals for worms, you can base the dosage on the heaviest animal. Splitting the herd into smaller, similar-sized groups and then estimating the dosage for each group will simplify the task than determining the dosage for every individual goat.

Taking the goat or sheep's temperature

Normally, a thermometer is used to measure the animal's temperature. There are different types of thermometers available to measure the temperature, but digital thermometers are becoming more popular. Measuring the temperature can determine if the animal is sick or not. Keep the following in mind when measuring temperatures:

- Mercury thermometers should be shaken down to normal before use.
- The thermometer must be inserted into the goat's rectum and allowed to stay there for at least two minutes to register the correct temperature.
- Goats' normal temperature is between 38,8°C and 40,2°C. If an animal is below or above this temperature it means the goat could be sick. Do not give antibiotics if the temperature is normal.
- The temperature of adult sheep range from 38,5°C and 40,5°C and lambs range from 38,5°C and 40°C.
- Clean the thermometer with antiseptics before reuse and storage.

Figure 2.15: Taking a goat's temperature

Injections

Injections must only be done with clean and sterilised equipment. A new needle must be used for every and the syringes must be boiled for a minimum of 10 minutes to sterilise them before reuse.

Subcutaneous injections

A subcutaneous injection is done under the skin. A 20-gauge needle must be used for an adult goat and a 22-gauge for a kid. These needles are about 16 mm long.

The skin must be lifted and loose. Insert the needle at an angle between the flesh and the skin. Try not to pierce the skin again at the other end of the fold. These types of injections can leave a small lump at the injection site, which will disappear later.

Intramuscular injections

An intramuscular injection is applied directly into the muscle of the goat. A 20-gauge needle should be used for an adult goat and a 22-gauge for a kid.

The injection should be given in the heavy part of the thigh or neck. The needle should be slightly withdrawn after inserting it, to make sure there is no blood flowing into the syringe. If there is blood, draw the needle out and insert it into another part of the muscle.

Figure 2.16: Different needles and syringes

Intravenous injections

An intravenous injection is given into the vein of an animal. It is a more complication injection than the other types, and it must be done by qualified people only.

Hoof trimming

If goats and sheep graze in hard, rocky areas, their hooves will not become overgrown. However, if they graze on soft vegetation, their hooves become overgrown. Goats and sheep with overgrown hooves will have difficulty walking and may struggle to get to the food. It could even result in diseases such as foot rot, to avoid this, hoofs need to be trimmed.

Hoof trimming procedure

Follow the following procedure to trim the animal's hooves:

- Trim the hooves properly with the animal lying down.
- Use hoof shears to trim excess growth.
- Clean the dirt under and between the toes.
- Trim the hoof parallel to the hoof hairline and trim the excess nail.
- Pare the heels to the same level as the toes.
- Snip away the small flap that grows between the toes.
- Trim the soft heel tissue until the hoof surface is flat and smooth.

2.8 General goat and sheep management

How to do condition scoring

Everyone working with or rearing goats should always consider the overall body condition of their breeding animals. Body condition scoring (BCS)refers to the amount of fat a goat or sheep has. When does become too thin, their overall condition deteriorates and their ability to reproduce declines. That means that the chances for twins and triplets becomes extremely low and the rate at which kids become weaned also decreases. At the time of mating, body condition has an important influence on the number of kids and lambs born and on the proportion of barren does and ewes.

When does become too fat, they can develop a condition called pregnancy toxaemia (pregnancy disease), which is caused by low glucose concentrations. Fortunately, this condition is rare.

To do body condition scoring, the goats and sheep must be assessed in a standard way. You must look at specific points. A scale of 1 - 5 is used, where 5 is too fat and 1 is too thin. A doe and ewe that has a result of 3 is in good condition. The following parts of the animal must be assessed:

- The backbone
- The ribcage.
- The sides of the backbone above the tail (the loin area)

TAKE NOTE

Body conditioning is similar for goats and sheep however there are some important differences that you should take note of:

- Goats have much less subcutaneous fat cover compared to sheep. In fat-tailed sheep breeds, the tail can also be used as an additional measure of body condition. In goats, this measure does not exist.
- The sternum can be used as an additional measure of body condition in goats, however in sheep this would be difficult for sheep that have a mane.

Backbone

Ribcage

Loin

Figure 2.17: Body condition check points

Table 2.4: Body condition indicators

Score	*Condition*	*Backbone*	*Rib cage*	*Loin area*
1	Very thin	Vertebrae sticking out sharply. Individual vertebrae can be felt.	Each rib can be felt sharply.	No fat covering.
2	Thin	Vertebrae smooth but can be felt.	Slight pressure needed to feel ribs. Smooth.	Even, smooth fat cover.
3	Good	Rounded and smooth.	Well-covered and smooth.	Even, smooth fat cover.
4	Fat	Can feel the vertebrae when applying firm pressure.	Individual ribs cannot be felt. Indents between ribs can be felt.	Thick fat cover.
5	Obese	Cannot feel individual vertebrae.	Cannot feel individual ribs or the indents between them.	Fat accumulated around the tail area.

Condition scoring in ewes

All ewes should be condition scored after weaning. Ewes should be managed accordingly to have a score of 3 to 3,5 at least two weeks before mating. The following are some guidelines that you should take note of:

- Score of 3 to 3,5: Maintain current condition.

- Score that is lower than 3: Give ewe more feed until a score of 3 to 3,5 is achieved.
- Score of 4 or higher: Reduce feed intake for score to drop to 3.

How to check the age of a goat

The best way to determine the age of a goat is to look at their teeth. The following shows how to determine the age of a goat by looking at their teeth:

Figure 2.18: Goat tooth growth

- At the age of about 15 months, the first two permanent incisors will come down. The goat now has two permanent teeth.
- At the age of about 21 - 24 months, the next two incisors will come down. The goat now has four permanent teeth.
- At the age of about 30 months the next two incisors will come down. The goat now has six permanent teeth.
- At the age of about 36 months, the last two incisors will come down. The goat now has eight permanent teeth, which is also called full-mouthed.

Telling the age of sheep

The number, condition and when the permanent incisors have grown out are all key indicators of a sheep's age. The teeth of sheep are divided into two main sections:

- Eight permanent incisors in the lower front jaw.
- Twenty-four molars divided by six found on each side of the upper and lower jaw.

Lambs at birth do not have teeth. After a week, milk teeth or temporary teeth start to appear in the front lower jaw. At two months, the lamb will have eight temporary teeth. These temporary teeth are then replaced by permanent incisors which appear in pairs. The figure below shows a guide to estimating the age of sheep by their teeth.

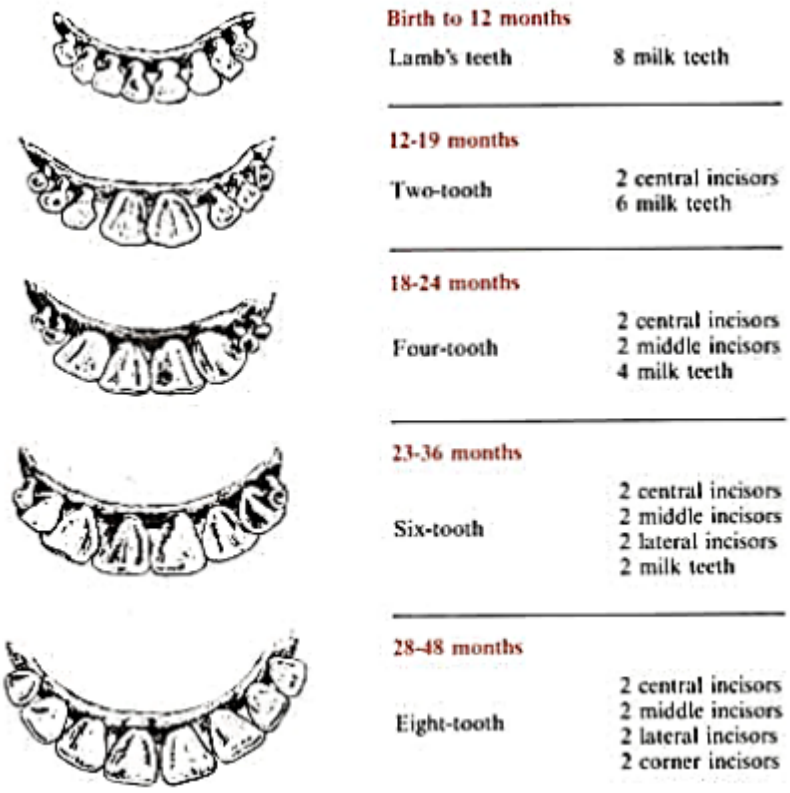


Figure 2.19: Estimating the age of sheep by their teeth

Health management for ewes

The following are important vaccines that should be used for the ewe immunisation program:

- *E.coli* should be given before four weeks before lambing.
- Lamb dysentery (1) should be given six to ten weeks before lambing.
- Lamb dysentery (2) should be given four weeks before lambing.
- Enzootic abortion vaccine should be given four to six weeks before mating.
- Bluetongue A, B and C should be the last vaccine given at least two weeks before mating season.
- Enterotoxaemia should be given to ewes every six months.

Calendar for treatment

You should create a calendar to keep track of all the treatments the goats must receive. This will include vaccinations. Any type of calendar will work if it is kept up to date when treatments have been completed. This calendar can also help with planning long-term treatments. Table 2.5 and Table 2.6 are examples of treatment plans and calendars for goats.

Table 2.5: Example of a treatment plan

Age	*Treatment type*	*Remarks*
1 day	Iodine	Tongue
3 months	Castration	Burdizzo used
4 - 5 months	Multivax P	
5 - 6 months	Multivax P booster	Booster

Table 2.6: Example of a treatment calendar

Season	*Treatment type*	*Remarks*
Spring, September	Multivax P	All animals repeat after 1 month
Spring, before mating	Enzootic abortion vaccine	All females
All year	Copper sulphate foot bath	Monthly
All year	Hoof check	Monthly
Summer	Tick control	When required
All year	5-point worm check	Monthly

Chapter 3

Marketing and value adding

To be successful when farming goats and sheep, you must understand a few important factors related to marketing and value adding. You must understand the benefits of the different production systems. What would be the best composition of goats and sheep for each area and farmer to have? Understanding your expenses, what type of income to expect and how profitable goat production can be will also help you choose the correct type of goats.

3.1 Economics of keeping goats and sheep

Differences between production systems

Costs and profits are two of the most important aspects of any commercial farm or production. These normally consist of two different types of farming systems, namely intensive conditions and semi-intensive conditions.

Intensive conditions

Intensive conditions refer to when the goats and sheep are kept and fed in feedlots. All their feed requirements are fulfilled in such a system. In this system, the goats and sheep have enough quality feed and quality drinking water.

Figure 3.1: Goats in a field

Semi-intensive conditions

Goats and sheep kept in semi-intensive conditions are normally sent to a pasture and only brought back at night. The food might be enough but not necessarily of the highest quality. Goats and sheep have water available to them, but it may be from streams and dams.

Figure 3.2: A large herd with different goats

Composition of the herd

When you decide to farm commercially, you must decide on what will be the composition of your herd or flock. Composition refers to how many bucks, does and castrates your flock is made up of. It could also refer to how many rams, ewes and castrates your flock is made up of.

What will your ultimate marketing goal be? If your plan is to sell castrated goats or sheep, then you must castrate the young males early.

The best way to have a productive herd is to replace breeding female animals every 4 – 5 years. When you cull older females, you must already have younger females ready to take their place and role in the herd.

Understanding the business, profitability, costs and income

What will the potential profitability of your farm be? The following are a few aspects to consider:

- How many kids do you want your goats to produce per year?
- How many lambs do you want your sheep to produce per year?
- Are you planning to sell wool?
- Are you planning to sell feeder lambs, slaughter lambs, breeding stock or all of the above?
- What percentage will survive until they are sold?
- What price will you consider for the goats when selling them?
- What price will you consider for the sheep when selling them?

- What are your costs per to raise and keep the goats and/or sheep per year? This includes food, supplements, labour and medicines.
- Which sex and at what age do you plan to sell goats?
- Which sex and at what age do you plan to sell sheep?

By getting all this information together, you will be able to calculate the amount of money you can make and what your profit will be. The success of your business depends on how well you manage your goats and sheep. If most of your animals die, your profit will also decrease. If the cost of looking after the animals is too high, the profit will also decrease. You should work to reach a solid middle-of-the-road approach.

See the Resources section of this manual for more information on different goat and sheep businesses.

3.2 Selling your animals

This section will focus on the different reasons and ways goats and sheep are sold.

Selling your goats

In Zambia, most goats are sold for meat. There is a high demand for goat meat in the country. Other African countries, like the DRC and Angola, also buy Zambian goat meat. Middle Eastern countries, like Saudi Arabia, may also become a promising market in 10 - 15 years. Currently, the barriers are very high due to FMD, Halal certification and HACCP in abattoirs.

The second way to profit from goats is to sell the milk dairy goats produce.

Meat goats are usually sold informally, next to the road or in an area where a fair number of people are present. Most of the goats sold in this way are castrates of three years and older. Young maiden goats will be difficult to sell because they are the mothers of the next generation. The best marketing time is when Eid is near, as the Muslim's demand for goat meat is higher around that time of year.

Statistics from 2015 show that out of all the goats in Zambia, only 16% in total were sold. Of these goats that were sold, almost all were sold to small-scale livestock traders or to private households. Only 1% were sold to large-scale traders or abattoirs.

These statistics show that Zambian goat farmers keep most of their animals, sell a low percentage of animals, and slaughter a small percentage of animals for their meat. (Refer to Annexure A, Unit 6.2, Slide 1).

Of the goats sold, 20 – 60% are sold domestically. The average price for a goat is 250 – 500 ZMW. The two biggest markets for goats are Lusaka and the Copperbelt. When looking for goat meat, it is more common to buy it slaughtered fresh at the market, than from an abattoir. Supermarkets do not report that people often want to buy goat meat from them. (Refer to Annexure A, Unit 6.2, Slide 2).

Out of Zambia's neighbouring countries, the DRC is still the most attractive market for goats. There is an established market for goats, but the price for them can be unstable due

to the political situation. Other neighbouring countries such as Tanzania and Zimbabwe already have plenty of their own goats, while the political and economic instability in countries such as Zimbabwe and Mozambique make trade difficult. (Refer to Annexure A, Unit 6.2, Slide 3)

One of the main problems that can arise in the goat market is that the Middle Eastern demand for goat meat can potentially make goat meat too expensive for Zambian buyers. Meat goats usually sell for between K380 and K600 each, but Middle Eastern buyers are willing to buy live goats for as much as K2 000 each.

The typical high demand periods for goat meat are:

- March and April, around Easter.
- October and November, for the Muslim markets.
- December, for Christmas.

The best (and most formal way) way to sell live goats is at an auction, but some farmers and farmer associations prefer to sell their goats in more informal settings.

Selling your sheep

Currently the livestock sector in Zambia contributes to about 3,6 percent to the overall gross domestic product and 42 percent to the agricultural gross domestic product. In 2017, Zambia's sheep population was estimated to be over 150 000.

Selling stock

Stock should be sold at the right time and the condition of the stock is important for you to get a good price. Better prices can be obtained if stock is sold early in the drought before the market becomes congested with a high supply of animals. Stock should be in healthy and a good condition to fetch excellent prices.

Sheep markets

Sheep markets can be classified as primary, distributive and terminal depending on the objective of animal buyers.

- Primary markets are markets where the majority of sheep is bought for reproduction or resale. An example of this type of market would be remote rural areas.
- Distributive markets are markets where the majority of sheep are bought for resale and consumption. An example of this would be markets in small towns.
- Terminal markets are markets where the majority of sheep are bought for consumption. An example of this type of market would be a big city such as Lusaka.

Demand for sheep

The typical high demand periods for sheep meat are:

- March and April, around Easter.
- October and November, for the Muslim markets.

- December, for Christmas.

Due to the population growth and the change in preference to meat, the demand for lamb and mutton has increased immensely not just on a local or national level but on an international level as well.

Lamb vs. mutton

Lamb is the meat that is from a sheep which is less than one year old. Mutton is the meat from a sheep that is older than one year. Most consumers prefer lamb over mutton. As you have learnt, the age of sheep is determined by examining the front incisors.

Auctions of live goats and sheep in large numbers

Auctions can help with selling large numbers of goats and sheep in a short period of time. The most profitable way of selling goats and sheep at an auction is to have several owners and farmers form a group and sell their goats and sheep together. This way they can control the prices of goats at the auction or market. The success of a market depends on the following:

- The timing of these auctions should be planned with the community in mind. There must be a need in the community to buy goats and sheep.
- Around November is the best time to sell meat goats.
- The best time to sell sheep is before the drought or warmer seasons begins.
- The best time to sell breeding stock (bucks and does) is in March when the goats are in their best condition.
- The best number of goats to have for sale at an auction is about 400 – 600 goats. If there are fewer goats, costs might be too high. If there are more goats at the auction, prices might be too low.
- There should be at least 10 – 20 buyers at an auction for the event to be a success. The buyers will not compete on bidding if there are not enough of them. This system of making sure that the correct number of goats and buyers come together in one place is called supply and demand trading. To be successful, you must meet (supply) the needs of the buyers (demand).
- Farmers and owners who do not belong to the local community might also present their goats, but these will normally be auctioned last and can sell for lower prices.
- All goats must have tags or identification and at least a dip tank number. They must be treated for worms and ticks before going to auction. The seller must be able to prove ownership.
- The minimum selling price should be agreed on by the farmers and auctioneer beforehand, otherwise prices might not be acceptable, and the farmer might lose money.
- If possible, a livestock theft unit should be present at the auction or market.
- Advertising for the auction should be well-planned and done in advance so that everyone interested can be present.

- The after-sales process should be well-managed so that farmers can take their money or unsold stock home.

Figure 3.3: Goats at an auction

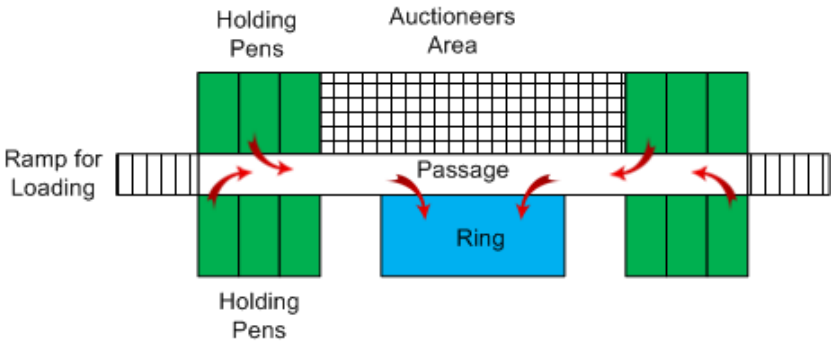


Figure 3.4: Auction area layout

Financing options

There are two types of financing available for auctions:

SUBSIDISED AUCTION

A subsidised auction is paid for by the state or other non-governmental organisations (NGOs). A group or institution that is separate from the farmers' or livestock association will pay for the infrastructure and processes.

PRIVATE OR INDUSTRY PAID AUCTION

This is the most common type of auction. The local farmers' association will sponsor or pay the auctioneer. The auctioneer will normally charge a fee based on the amount or percentage of animals they manage to sell. Usually, the fee is about 8% of the price an animal sells for. This may be different depending on the region. If a guaranteed number of quality animals is available, the auctioneer will not charge the farmers' association, but will make enough money from the commission. When an auction sells a minimum of 400 goats and the auctioneer gets their commission, the only cost that the farmers' association will have to pay is advertising costs for the auction.

Costs for auctions

The following items are all counted as costs for the auction and may need to be covered by the farmers' association:

- Advertising and informing buyers. The livestock association will normally inform the sellers.
- Renting sales pens and the costs of using loading ramps.
- Pay for goat handlers and other staff to handle the animals, check ownership, hold and control the goats, and feed and water the goats.
- Cost of feed and water.
- A financial system for transferring money.
- Security at the facility.
- Price of the auctioneer.
- Goat transport.
- Facilities and seats for the buyers.

Big auctions can cost up to K370 000.

Roadside sales – informal

Smaller or more informal sales have a lower cost to set up. Roadside sales are an alternative to formal auctions.

Figure 3.5: Roadside goat sale

The advantages of these is that it does not require organising, and the sales price can be negotiated between the buyer and seller.

The disadvantages of these type of sales include:

- No proof that animals are not stolen.
- Abuse by local speculators, if the owner is not informed about the real value of their goats.
- No health guarantees on the animals.

- Quick sales for a lower price when a farmer or owner is short of cash.

Farmers' markets

Selling at a farmers' market is a bigger event than selling at the roadside, but it is still informal. The advantages of these markets are:

- Less chance of stolen goats and sheep being sold because there is more control and supervision.
- More buyers because it is a regular event, so prices will be better.
- Smaller walking distance to the market because these markets are in all regions and will service the local farmers, which means that the farmer has little to no transport costs.
- Lower fees since the livestock association charges less than an auction.
- Farmers being able plan and manage their herds better as it is a regular event.
- Better quality than at the roadside sales.
- Traceable supply and demand for indigenous goats, roadside sales cannot do this.

The following are some of the disadvantages of these markets:

- Speculators can still manipulate prices to suit them.
- There is a higher risk of robberies because people carry cash.
- No pens or other infrastructure are available, so the goats will have to be tied up or tethered for long periods of time.

Sales of skins and other products

Skins

Goatskins have been used for many years for traditional clothing and ceremonies. These days goatskins are also used for decorative handbags and floor coverings. The prices for the skins and finished products are increasing, but it is still a limited market at the moment. However, when you do make a sale, the value can be quite high.

Figure 3.6: Goat hide products

Wool

The annual production of wool is not documented in Zambia, however there is a growing demand for wool in the marketplace.

The wool produced can be sold as a raw material to factories or individuals. Coarse wool is used to make blankets and carpets.

Figure 3.7: Wool manufacturing

Goat and sheep milk cheese

There is a growing market in Zambia for a variety of other products manufactured from the milk of dairy goats. Some of the typical products include yoghurt, butter and cheese.

Figure 3.8: Goats' milk cheeses

■ Different colours

Another market that is becoming quite popular is to sell goats to stud breeders. The colour variation on the goat can also influence market prices. Popular colours are goats that are spotted and dapple coloured. Breeders buy based on quite different interests compared to local African buyers who are not concerned with the colour a goat.

Figure 3.9: Spotted or dappled goat

3.3 Transporting goats and sheep

In rural areas, the transportation of goats can be non-existent. However, a farmer that wants to sell a large number of goats at a market or auction that is very far way will have to use a form of transportation, such as trucks and trailers.

Figure 3.10: Truck with trailer for livestock transportation

Vehicle requirements

To prevent goats or sheep from jumping, the sides of the truck or trailer must be high enough. The goats and sheep must be protected from rain and wind while being transported. Shade cloth or hessian must be fitted to the sides of the transporter. Goats are sensitive to cold. Also, good ventilation must be available to prevent goats from suffocating.

The transportation trailer must have rubberised floors to prevent the animals from slipping. Large transporters must have partitions to control the movement of goats.

Goats must be protected from anything that can harm or injure them. These includes sharp edges, loose items and gaps in the floor. To prevent any injuries while travelling, the driver must drive smoothly so that the animals do not fall and get injured.

Number of goats and sheep transported

The transporter must have an area of about 0,4 m^2 (1 m x 0,5 m) available per goat present.

Try to plan in such a way that you do not have too few goats on the transport. If possible, try to partition. When you only have to transport one or two goats, you can put them into a hessian bag for a maximum of four hours.

Sheep and goats must be transported in such a way where they are not overcrowded.

Sheep, lambs, goats and kids should have sufficient space to lay down without being crushed or stood on.

Also, never pick up sheep or goats by their horns when transporting the animals from one place to another.

Long distance travel

Fresh water and food must always be available during the trip.

Long trips must not be longer than 36 hours. A rest period after 24 hours of travelling is required. This means that the goats must be removed from the transporter for 12 hours and supplied with adequate food and water.

As soon as you know that the goats and sheep will be transported, you must administer Multivax P to prevent diseases from spreading. On travel day, the goats must also be given a dose of long-acting Tetracycline.

Appendix A

Glossary

4.1 Definitions

Word	*Definition*
Anaemic	Suffering from anaemia, which is caused by a lack of red blood cells in the blood.
Bankrupt worm	A type of roundworm that typically affects young goats after they are released into pastures in spring.
Black quarter	An infectious disease that causes muscle damage in the hindquarters of goats. Its name comes from the black appearance of the muscles of dead animals.
Body condition	The amount of body fat and muscles an animal has. This is evaluated on a scale of 1 – 5 with 1 being the lowest score.
Brown stomach worm	A major parasite of sheep and goats. It is usually found in the fourth stomach (abomasum) and can cause condition loss and even death.
Browsers	Plant-eating animals (herbivores) that feed on the leaves, soft shoots and fruits of woody plants (like shrubs and trees).
Brucella melitensis	The bacterium that causes brucellosis, a fatal disease that causes does to abort.
Burdizzo	A tool designed to be used for castration.
Clostridial organisms	Bacteria that form part of the necessary bacteria in animals' digestive systems. They can cause severe illness when they grow out of control.
Colostrum	The first form of milk produced by the mammary glands of mammals immediately after delivery of the new born.
Conical fluke	A cone-shaped parasite that lives in the rumen of sheep and goats. Animals with this parasite often suffer from severe diarrhoea.
Contagious abortion	A disease caused by an organism called Chlamydia psittaci that causes female goats to lose their unborn kids. This disease spreads easily through a herd.
Creep feeding	The practice of giving food to kids that the adult female goats do not have access to while the kids are still nursing from their mothers. This is to increase kids' weight at weaning time.
Cud	Partially digested food that is returned from the rumen of any cud chewing animal (cows, goats and sheep) so that it can be chewed for a second time.

Word	*Definition*
Cull	The process of killing the weaker animals in a herd to make more resources available to the stronger animals.
Cyst	A growth filled with liquid or puss that forms in or on a body.
Dapple	Marked with spots or rounded patches.
Dermatitis	A medical condition where the skin becomes red, swollen and sore (sometimes with small blisters on it), caused by a direct irritation of the skin or an allergic reaction.
Eid	The name of one of two Muslim religious festivals. The most important of these is called Eid ul-Fitr and is celebrated to mark the end of the month of fasting (Ramadan).
Encroaching	Gradually moving or going into an area beyond the usual or desired limits.
Enterotoxaemia	Blood poisoning caused by absorbing Clostridum perfringens (a gut bacterium) from the intestine.
Enzootic abortion	See contagious abortion.
Faeces	The solid waste that remains after food has been digested and is usually discharged from the bowels. Can also be referred to as droppings.
FAMACHA chart	The Faffa Malan Chart, a laminated colour chart that shows five colour categories that match different levels of anaemia caused by worm infestations.
FAMACHA method	The method of using the FAMCHA to determine which animals in a herd need to be treated for worms by checking the animals' bottom eyelid and comparing it to the colours on the chart.
Five-point check	A method to determine animals' parasite level by checking the condition of their eyes, jaw, coat, back and tail.
Foetus	An animal or human being in the later stages of development before it is born.
Grazers	Animals that feed on soft plants like grasses.
Heartwater	A tick-borne disease that causes a high fever, nervous system symptoms and a build-up of fluid around the heart, lungs and brain.
Incubation	The period of time between infection with germs and the appearance of symptoms of illness or disease.
Ingested	Eaten or taken in.
Inoculation	Injecting a weak form of a disease into an animal to protect it from stronger forms of the disease.

Word	*Definition*
Intramuscularly	Into the muscle.
Intravenously	Into the vein.
Kidding	The time when female goats give birth to kids.
Laminitis	An inflammation of the soft tissues of the foot caused by a lack of blood flow to the area.
Larval	The first stage of an insect's life after it has hatched from the egg. These insects are usually called larvae.
Lespedeza	Any one of about 40 flowering plants in the pea family, commonly known as bush clovers.
Lethargic	Having little energy, feeling unwilling and unable to do anything.
Liver flukes	A parasitic worm that lives in the liver of infected animals. They cause diseases of the liver and bile ducts that can be fatal.
Mange mites	A common external parasite that causes mange, a skin condition that can cause serious health issues in animals.
Marshes	An area of low-lying land that can get flooded in the high season. It is typically wet all throughout the year.
Mastitis	An inflammation of the mammary gland in the udder, typically due to a bacterial infection caused or introduced by a damaged nipple or teat.
Mould	A soft, grey-green growth that forms on old food or on objects that have been left in warm, wet air.
Napier grass	A native African grass that can be used as a highly nutritious fodder for cattle, sheep and goats.
Nasal bot fly	A widespread species of fly that typically lays its eggs in the nose of sheep and goats.
Orally	By or through the mouth.
Orf	Also called scabby mouth, orf is a highly contagious disease in sheep and goats that causes painful scabs to form around the mouths of lambs or kids which make it difficult for them to suckle.
Overgrazing	A situation where too many animals are eating the grass in an area. This leads to environmental damage in that area.
Palatable	Pleasant tasting.
Pasteurella	A small, rod-like bacterium of the genus Pasteurella that causes serious infectious diseases in warm blooded animals.
Pathogens	Any bacterium, virus or other microorganism that can cause disease.

Word	*Definition*
Perennial pastures	Pastures that do not die during winter.
Photosensitive	An extreme sensitivity to ultraviolet rays from the sun or other light sources. Photosensitivity can affect the eyes or the skin or both.
Potbelly	A large, rounded stomach that sticks out.
Preventative care	Any care (medical or otherwise) to prevent illnesses or disease.
Prussic acid	Another name for hydrogen cyanide, a colourless and extremely poisonous chemical.
Pulpy kidney	See enterotoxaemia.
Redwater	A tick-borne disease that causes a high temperature, weakness and red-coloured urine.
Retained placenta	Afterbirth that has not been expelled from the uterus.
Roundworms	Worms with a long, round body that can affect a large variety of creatures including humans, goats and dogs.
Ruminal acidosis	A condition where the rumen of a goat shuts down because of a sudden change in feed.
Scours	A general term for any type of diarrhoea affecting farm animals.
Speculators	People who buy goods or property in the hope of selling them again for a profit.
Stover	The leaves and stalks of field crops, such as maize, sorghum or soybeans, that are commonly left in a field after harvesting the grain.
Suppressants	A drug or infection that prevents or controls something. For example, appetite suppressants cause a loss of appetite.
Susceptible	Easily affected, influenced or harmed by something.
Tannin	A yellowish or brownish, bitter-tasting organic substance present in some galls, barks, and other plant tissues.
Tapeworms	Intestinal parasites that are long, thin and flat.
Testicular necrosis	The death of testicles caused by the spermatic cord being twisted or clamped, leading to a loss of blood supply.
Tetanus	Also known as lockjaw. An infection caused by a bacterium. It causes stiffness of the muscles and can lead to death.
Tick clover	A small, flowering plant in the bean family. It has very little nutritional value as an animal feed.
Undernourished	Not having enough food or nutrition for good health.

Word	*Definition*
Urinary calculi	Solid particles in the urine, also known as bladder stones. They cause pain, nausea, vomiting, as well as chills and fever due to secondary infections.
Vaccinations	Drugs containing a weak form of a disease that are injected into an animal or human to give them immunity to that disease.
Wireworms	A parasitic worm that lives in the abomasum of sheep and goats. The worms feed on blood, which can cause anaemia in the animal.

4.2 Measuring units

Unit	*Description*
°C	Degrees Celsius. A measure of temperature. It is an SI unit.
cc	Cubic centimetre. A common medical measurement. 1 cc is equal to 1 ml.
cm	Centimetre. An SI unit of length equal to $\frac{1}{100}^{th}$ of a metre.
g	Gram. The base SI unit of mass.
kg	Kilogram. Equal to 1 000 grams. The kilogram is the SI unit of weight.
L	Litre. An SI unit of measurement for volume.
m	Metre. The SI unit of distance, equal to 100 centimetres.
mg	Milligram, a unit of mass equal to $\frac{1}{1\,000}^{th}$ of a gram.
MJ	Megajoule. One million joules. The joule is the SI unit of energy.
ml	Millilitre. A unit of volume, equal to $\frac{1}{1\,000}^{th}$ of a litre.
mm	Millimetre. A measurement of length equal to $\frac{1}{1\,000}^{th}$ of a metre.

4.3 Abbreviations

Abbreviation	*Description*
CP	Crude protein.
DM	Dry matter.
IVG	Indigenous veld goat. Goats that are native to a specific area.

Abbreviation	*Description*
NGO	Non-governmental organisation. Non-profit organisations are not associated with a specific government.
UHT	Ultra-high temperature. A method of pasteurising and preserving milk for long term storage.

Appendix B

Resources

5.1 List of resources

The following resources were used in writing this manual.

- ESGIP Publications Volume 2, No, 6 to 10
- Livestock levies in Zambia – Study – Zambia National Farmers Union
- A Review of the Status of Livestock Production and Stocking in Zambia – Musika Development Initiatives
- The Farming Handbook – Barry Smith
- The Tropical Agriculturist, Food Crops and Drought – John Ashley.
- Goat Production Handbook
- Cedara Goats Vet Program
- http://www.viableplans.com/14-must-know-things-about-starting-a-goat-farming-small-business-meat-and-milk-production/
- http://voermol.co.za.dedi406.flk1.host-h.net/wp-content/uploads/2017/08/Dundee-Lick-Concentrate
- http://www.heifer.org.za/assets/attachments/Goat_Production_Handbook_WEB.PDF
- https://wildflowernursery.co.za/indigenous-plant-database/sporobolus-africanus/
- https://wildflowernursery.co.za/indigenous-plant-database/aristida-junciformis/
- https://www.cabi.org/isc/datasheet/114171
- https://en.wikipedia.org/wiki/FAMACHA#/media/File:FAMACHA_chart.jpg
- Philip Randall, PhD. University of Pretoria, Dept of food sciences. 1993
- USDA Agricultural Research Service
- https://www.bbc.com/news/av/business-38611405/zambian-goat-farmers-see-surge-in-demand
- https://zambiafarmershub.wordpress.com/2017/04/17/kasumbalesa-market-prices/
- https://www.livestocking.net/5-methods-of-identifying-farm-animals

Annexure A

6.1 Other resources and information

Animal health workers in the community

There are different resources for getting help with producing goats. You can make use of young volunteers that can help with production and health support. These volunteers can then later use this knowledge to look after their own herds. This creates opportunities in households where women are the head and there are livestock to look after.

Keeping records

Keeping records of all your animals is important if you want to manage your herd properly.

Field book

This book is used daily to keep records and to make notes of every incident involving the goats. Some of the points that can be included in the daily books are:

- All does with kids or new-born kids. The information is:
  - Tag (in Table 6.16.1 X319 is goat info).
  - Date.
  - Number of kids.
- All deaths to be noted.
- Any treatments given for worms and other illnesses.
- Flock movements between camps.

Table 6.1: Example of a field book

Date	*Information*
13 April 2015	X319 worms and dosed
	Herd moved to camp 1
	X309 2 kids, 2 males
27 April 2015	X319 died of worms
	X333 1 male kid

Office records

The information in the field book must be transferred to the office book. The office book is the official book where all relevant information is recorded. The office books can be used to track all records of every goat and to make decisions regarding individuals or the herd.

The office book has four sections for different tasks or records:

- Animal register – all animals are recorded.
- Kidding register – does that kidded and the number of their kids.
- Health register – sick goats and their treatment.
- Sales register – all sales, including age, sex, price, and group or individual.

Table 6.2: Example of animal register

Tag No.	*Sex*	*Source*	*DOB or when bought*	*Exit date reason*
X323	Doe	Homebred	21 April 2015	3 March 2016 Sold
X305	Buck	Purchased, Mr. Mudenda, Kafue	4 May 2015	Died, heartwater

Table 6.3: Example of kidding register

Date	*Doe tag no*	*Kids and gender*	*Observations*
5 May 2015	X294	1 male	Normal
7 May 2015	X298	1 male, 1 female	Difficult birth

Table 6.4: Example of health register

Date	*Tag number*	*Problems (symptoms)*	*Treatment*	*Result*
7 May 2016	X272	Heartwater	Terramycin	Died
7 May 2016	X286	Heartwater	Terramycin	Survived

Table 6.5: Example of sales register

Tag number	*Date*	*Weight (Average)*	*Price*	*Detail*
B167	5 May 2016	32 kg	KW 600	Group of 12 sold to Mr. Madenda – Lusaka

You also need to keep a monthly record to keep track of the number of goats and the changes that happened in your herd during the month.

The business profitability

In any business some assumptions can be made to help with decision making:

- 20% mortality rate for kids.
- 10% mortality rate for adults.

- Twinning rate 20%.
- Doe can kid twice in 18 months.
- 50% males, 50% females.
- Castration of 80% of male kids and selling at 3 years.
- 20% of reproducing females will be culled every year.
- Breeding stock will retain 40% of female kids.
- 3-year-old castrates will all be sold each year. All of year 1 castrates and 33% of existing year castrates will be sold.
- 3-year-old castrates will be 33% of castrates because of varying ages.
- After five years bucks will be sold and replaced with uncastrated young from the pool.
- 40% of uncastrated males will be sold each year.
- No male kids sold.
- 3 year castrates sold at K1 200.
- 1-year old females sold at K679.
- Culled older females sold at K600.
- Uncastrated males sold at K890.
- Bucks sold at K1 120.

6.2 Selling your goats - statistics

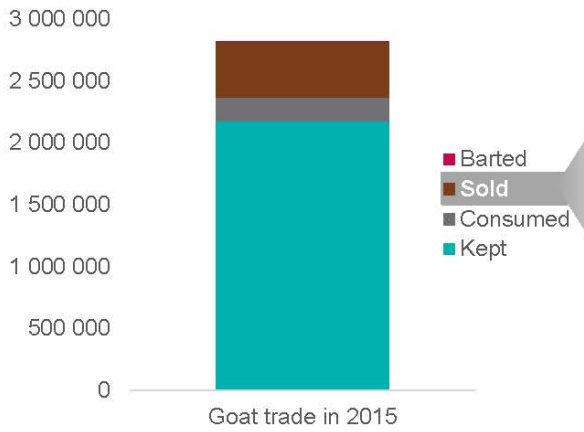
Refer to the following three slides.

3. INDUSTRY DIAGNOSTIC – GOAT SALES

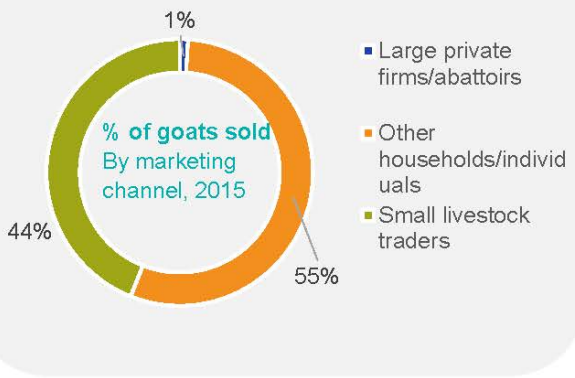
Market opportunity: Volume

Just ~16% of goats – less than 0.5M – were sold in 2015; they were sold mainly direct to other households, or to small-scale livestock traders

Goat trade volume
# of goats in Zambia, 2015



Goats are rarely sold through a formal channel



Source: RALS 2015, TNS analysis, IAPRI goat value chain report

Slide 2

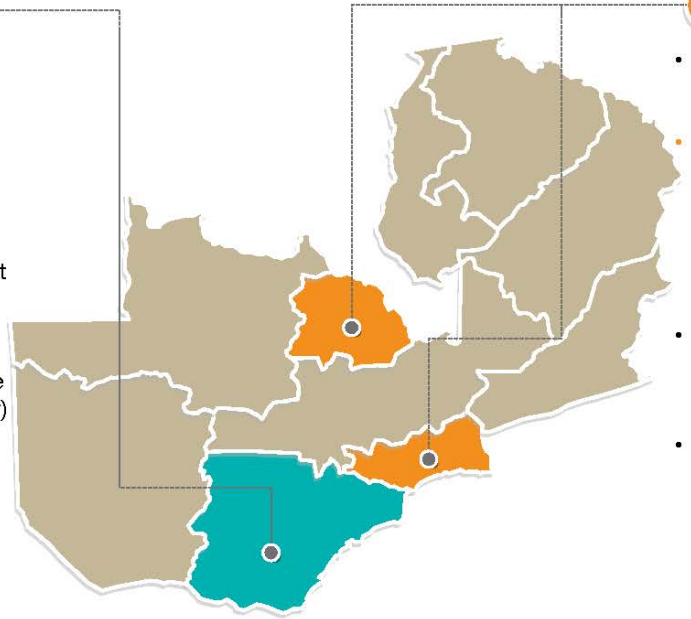
3. INDUSTRY DIAGNOSTIC – LOCAL DEMAND

Market opportunity: Volume

20-60% of goats traded (±100k – 250k) are sold domestically, at an average price of 250-500ZMW per goat

Ownership

- Nationally ~35% of all SHFs in Zambia owned goats (as of 2015). However, ownership differed largely by geography
- Prevalence of goat ownership is the highest in the **Southern Province** (50% of households in the Southern Province have goats vs 35% nationally)



Consumption

- Between 20-60% of all goats traded in Zambia are consumed domestically
- **Lusaka** and the **Copperbelt** are the two key markets. Goats are usually slaughtered fresh at the animal markets (e.g. Chibolya, Chilenje) rather than at abattoirs
- Supermarkets report low demand for goat meat, and do not see this changing in the short to medium term
- Local pricing in Lusaka and Copperbelt for a live goat is between **250-500 ZMW per goat**

MUSIKA

Source: Interviews; IAPRI goat value chain report, SLAZ trade data; TNS analysis

3. INDUSTRY DIAGNOSTIC – REGIONAL DEMAND

Market opportunity: Volume

Quick scan of neighboring countries suggests that DRC is still the most attractive market regionally

Highest potential

Lowest potential

Country	Existing market condition
 *DRC*	× Lacking formal export channels, hard to formalize trade given political instability ✓ Established informal market in Kasumbalesa (~40-80% of total goats sold in Lusaka) ✓ Price in DRC is unstable but can be higher than those in domestic markets, ~450-850 ZMW ✓ Given political instability, often rely on neighboring countries for livestock & agriculture needs
 *Angola*	○ Additional investigation required, preliminary interview with farmers/traders did not reveal much demand from Angola
 *Mozambique*	✓ High demand for goat meat domestically × Similar informal goat value chain to Zambia × Preliminary scan suggests exporting may be less profitable (<$2.9/kg carcass weight)
 *Tanzania*	× No shortage of goats × Already exporting their own goats to the Middle East
 *Zimbabwe*	× Unstable country currency and political climate × No shortage of goats - already looking to export their own goats

**Based on quick market feedback, additional in-country research is needed to gauge true potential*

MUSIKA

Source: Interviews; SLAZ trade data; TNS analysis,


impuls
Africa