

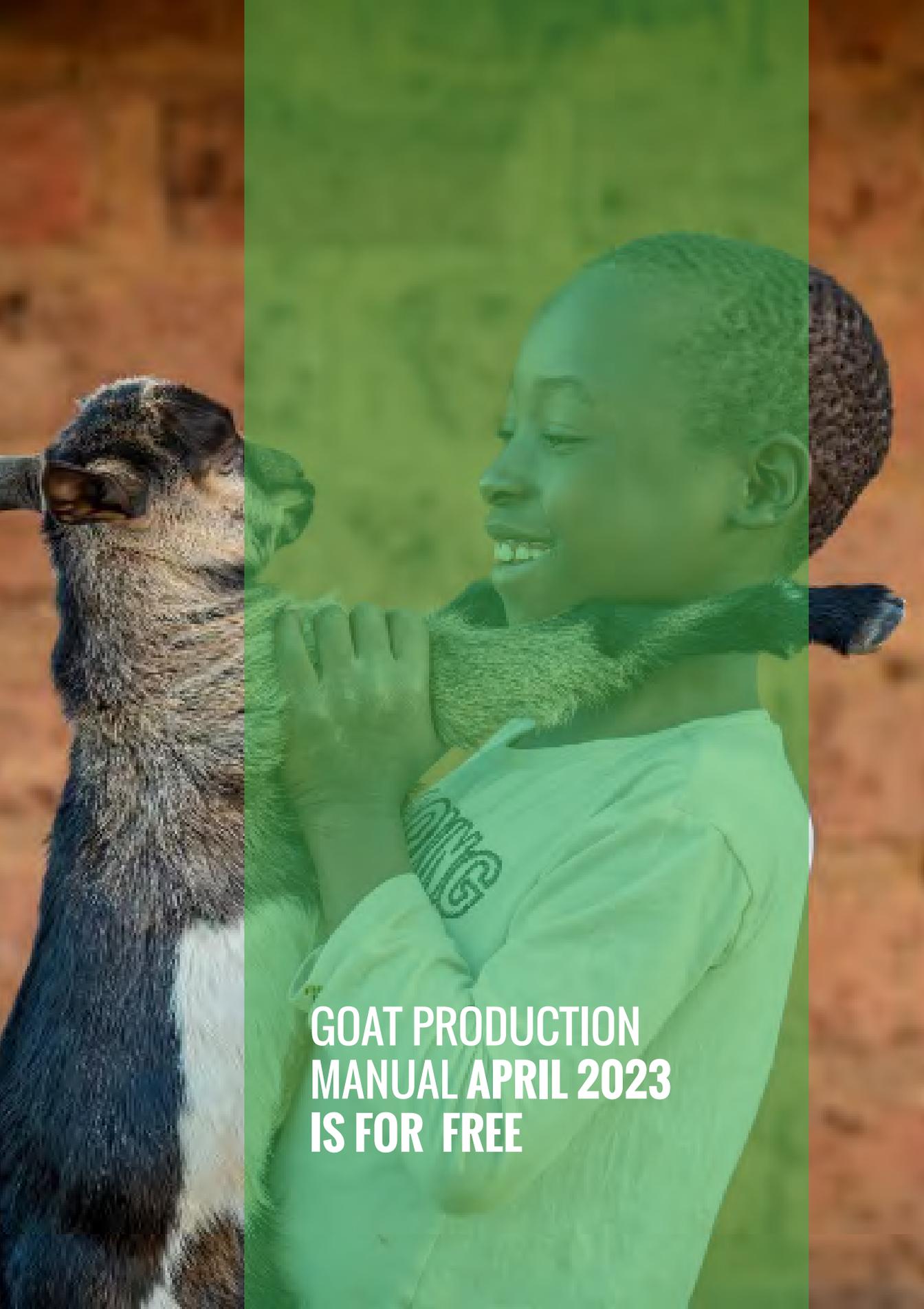


SUSTAINABLE GOAT PRODUCTION ENTERPRISE MANUAL



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**GOAT PRODUCTION
MANUAL APRIL 2023
IS FOR FREE**

FORWARD

Popularly known as a “**Common Man’s Cow**”, goats are among the main meat-producing animals in Uganda. Its meat (chevon) has huge domestic demand in Uganda. Goats are fantastic animals that can help farmers escape poverty, build resilience to climate change and empower women and youth in rural and urban communities. Goats are important in resource-poor communities because they provide tangible benefits such as cash income from animal sales; meat and milk for home consumption and/or for sale, meat, cheese, butter, hides and manure. Goats are small and easy to care for. They are relatively low-maintenance livestock and do not require much up-front investment or land compared to larger animals. This means goat ownership is suitable for women and youth, who often have less access to land and financial resources than men. Goats can be cared for close to home for those juggling domestic responsibilities. Considering the high rate of youth unemployment in Uganda, rearing goats for meat or milk production is a profitable business for youth.

The information in this manual is a review of published work on goat production. The manual covers aspects of: reproduction, health, safety, feeding, management, value addition, marketing, business and diversified aspects. This manual is intended to be a resource that provides educational information for people who are interested in raising goats as a business. THE MANUAL IS FREE.

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ABBREVIATIONS

%	Percentage
°C	Centigrade
°F	Fahrenheit
AI	Artificial Insemination
CAE	Caprine Arthritis Encephalitis
CCPP	Contagious Caprine Pleuro-Pneumonia
Cm	Centimetre
DDA	Dairy Development Authority
DOB	Date of birth
DV	Daily Value
ECA	Eastern and Central African
FMD	Foot-and-mouth disease
GDP	Gross Domestic Product
Gm	Gram
Ha	Hectare
IFTS	Indigenous fodder trees and shrubs
IPM	Integrated pest management
IU	international unit
Kca	Kilocalories
Kg	Kilogramme
MAAIF	Ministry of Agricultural Animal Industry and Fisheries
PPR	Peste des Petits Ruminants
ROI	investment ratio
UBOS	Uganda Bureau of Statistics
UShs	Uganda shillings
Mg	Microgram

SECTION 1: INTRODUCTION

1.1. The Contribution of Livestock to Household Livelihoods in Uganda

According to 2021 data from the Ministry of Agricultural Animal Industry and Fisheries (MAAIF) and the Uganda Bureau of Statistics (UBOS), Uganda had about 14.2 million cattle, 16 million goats, 4.5 million sheep, 47.6 million poultry and 4.1 million pigs. The livestock sub-sector accounted for about 17 percent of agricultural value added and 4.3 percent of Gross Domestic Product.

Over 60 percent of households in Uganda depend on livestock for their livelihoods. Most of them are subsistence-oriented smallholders. Households that include livestock in their enterprise mix tend to be less poor. Livestock provide a wide spectrum of benefits, such as cash income, food, insurance and savings, draft power, energy, and social capital.

1.2. Goat Farming in Uganda

Goat farming in Uganda is becoming popular because the cost of managing goats is relatively low compared to cattle. Many families are taking goat production as a family business venture and revenue stream. Goats have a high multiplication rate because they produce twice a year and the Savanna goats in Uganda have become the preferred exotic breed since it is believed that they are harder than Boer goats.

Rearing goats in Uganda is generally easy because most areas have a wide variety of shrubs, scrubby wood and grass. Goats love to browse, their upper lips are incredibly mobile and with the help of a strong tongue, goats can selectively grab and are able to avoid thorns and spines.

Rearing goats in Uganda is mostly done on a free range basis except those with a few goats in peri-urban areas.

Raising goats is a valuable part of a sustainable farm. Goats often fit well into the biological and economic niches on a farm that otherwise go untapped. Goats can be incorporated into existing grazing operations with sheep and cattle, and they can also be

used to control weeds and brush to help make use of a pasture's diversity.

Goats play an important role in the food and nutritional security of the rural poor especially in the rain-fed regions where crop production is uncertain, and rearing large ruminants is restricted by acute scarcity of feed and fodder. Goats are multi-functional animals. Farmers can rear goats for meat and for milk but there are a wide variety of products which can be got from goats, such as manure and skins, among others.

1.3. Advantages of Starting a Goat Farming Business

- Goats have been considered as poor man's cow (**mini cow**) because of its immense contribution in rural economy and national income.
- Starting a goat farming business requires low initial investment or capital.
- Goats do not require large area for housing because their body size is comparatively smaller than other livestock animals.
- Goats are versatile animals that are raised for a variety of reasons such as meat, milk, cheese, yoghurt and hides.
- Commercial goat farming is a key source of employment particularly for the youths.



Goat farming is a key source of employment for the youths.

- You can use goat manure as a high quality natural fertilizer in crop field. Manure restores soil fertility and promotes plant growth. This guarantees bountiful harvests and full plates..
- Goats are good breeders, they have short reproduction cycles and they reach sexual maturity within 7 to 12 months of age and give birth to kids within a short time. Some goat breeds produce 2 to 3 kids per kidding.
- Risks are less for goat farming (even in drought prone areas) than any other livestock farming business.
- Goats are called the “**foster mother of humans**” because their milk is considered as the best milk for human consumption than any other species of livestock animal's milk. Goat milk is nutritious, wholesome and easily digestible. All people from child to old one can easily digest goat's milk. Goat milk also has lesser allergic problems. Goat meat and milk are cholesterol free and easily digestible.



Goats are called the “foster mother of humans”
(Source: NET)

- Goat milk is suitable for preparing various types of milk products such as: cheese, yoghurt and others) which provide a great source of regular income (employment) for the poor, landless and marginal farmers, youth and women.

- Meat and milk from goats are in high demand on the market.
- Goats are very suitable for mixed farming with other domestic animals.
- Diseases are less in goats than other domestic animals.
- Goats are easily available, comparatively cheaper in price, easy to maintain and always have a friendly disposition than cattle.
- They are capable of adopting themselves with almost all types of agro-climatic environments or conditions. They can tolerate high and low temperature.
- Some goat breeds are popular for meat production, while others are suitable for milk production, and yet others are suitable for both meat and milk production.
- According to the investment per unit they produce more than other domestic animals. The ROI (Return on Investment) ratio is high.
- Goat business requires less labour.
- Goats require less feed because they are smaller animals.

1.4. Socio-Economic Factors Affecting Goat Production

- Diseases and pests,
- Inadequate (quality and quantity) feed due to land shortage,
- Poor breeds,
- Predators,
- Shortage of water,
- Shortage and/or high cost of labour,
- Poor transport,
- Theft,
- Lack of good market,
- Poor quality/high cost of inputs,
- Climate change (floods and drought),
- Lack of expertise regarding how to efficiently run a goat farming business due to lack of veterinary services,
- Lack of capital and,

- In some areas of Uganda, women and children participate less in decision making, although they are responsible for many goat production related activities.

1.5. Goat Production Systems

Goats can be kept in multiple production systems, depending on availability of land, capital and labour. The major goat production systems are: (1) intensive, (2) semi-intensive, (3) extensive and, (4) tethering.

(1) Intensive (Zero-Grazing) Production System

Under this systems, the goats are housed. Feed and water are provided to the goats. Intensive farming is a technique used to yield high productivity by keeping large numbers of improved goats indoors, it is an agricultural system that aims to get maximum yield from the available land. The bucks, does, and kids are kept in different compartments or houses. In the intensive system, mating is controlled, where the farmer can decide which bucks and does mate and the time for mating. This ensures that there is no cross-breeding and flock multiplication is controlled.

Advantages of Intensive Grazing Production System

- Intensive grazing systems does not need a large amount of land.
- Can use agricultural by-products such as sweet potato vines, banana leaves, maize, maize thinnings, bean husks and others to feed the goats.
- Saves time and labour, do not have to take goats out of the crop fields for grazing or spend time looking for them
- Easier to plan and manage breeding.
- Prevents goats from destroying crop fields.
- Makes collecting manure very easy.
- It helps the farmer to supervise and monitor the land and protect his goats from being hurt or hounded by dangerous wild animals.

Disadvantages of Intensive Production System

- Intensive goat farming system requires a lot of labour and capital
- It involves the use of various kinds of fertilizers, pesticides, and insecticides. The use of chemical fertilizers contaminates soil and water bodies such as lakes and rivers. Heavy use of pesticides and chemical fertilizers can also affect the workers (who spray the pesticides) and the people residing nearby.
- It can lead to overcrowding due to the fact that animals are kept in holding facilities which can lead to pollution and break out of diseases and infection.

(2) Semi-Intensive Production System

Semi-intensive goat production system is a mixture of both intensive and extensive systems. The goats are left to graze and also are provided with feed and water. In some cases, the male goats are zero grazed, while the does (female goats) are grazed. The does are brought to the bucks for mating.

Advantages of Semi-Intensive Production System

- Easy access for feeding, watering and good protection.
- Low investments and higher returns, significant savings in feed costs, better meat quality, the meat being lean and fat free compared to intensive system.

Disadvantages of Semi- Intensive Production System

- The need for high quality litter.

(3) Extensive Production System

Extensive goat husbandry systems usually involve larger numbers of animals. The goats graze and browse large areas of land that are usually marginal in nature and/or are unsuitable for other agricultural use. The system is more common in the arid and semi-

arid climates. Extensive systems are common for meat production, but are rarely used for dairy goats, although some goats may be milked temporarily for family supply. A very low level of unpaid family labour represents the main input, although for large herds paid labour may be employed. Little management is practiced except to let them graze in day time and to lock them up for the night in night pens or yards. Breeding is uncontrolled. The goats are watered during the day at streams, lakes and ponds or water is provided from wells. After the harvest of crops the animals can feed on the residues and weeds left in the field. Sometimes mixed herds of sheep and goats graze together. The droppings in the night yards can be collected as manure.

Advantages of Extensive Production System

- Although extensive production is not very productive, it is of great importance regarding the maintenance of the rural landscape and with the aim of the biomass management that avoids the occurrence of forest fires, and where the goats are well adapted to take advantage of these feed resources.
- The extensive system uses family labour, often as a second source of income for families. Goat milk is obtained for family consumption or for cheese to sale.

Disadvantages of Extensive Production System

- Usually, the number of animals produced is low and they are usually raised under climate adversities, where probably there are no shelters, no food supplementation and also often these animals have hygienic sanitary problems, which leads to poor economic results.

(4) Tethering Production System

Tethering describes a system in which goats are kept in a shed during night time, whereas during daytime they are tethered in the vicinity of the house, along the roadside or on public grounds. Tethering of goats is practical only for very small herds. Only adults are tethered, while young kids are often let loose. Often the sexes

are not separated in the shed, so mating is uncontrolled. Feed and water should be provided in the shed. Goats, sometimes 1 to 3 together, are tied to a peg by a rope of 3-5 meters length. By shifting the peg or choosing a different tree or post, the goats are offered a fresh grazing/browsing area. A rope of about 2-3m long is tied to a ring which slides on a wire about 3-5 meters long.

Advantages of Tethering Production System

- Tethering is used to prevent animals (e.g. dogs) straying in the owner's absence or to allow animals (e.g. sheep and goats) to graze unfenced pasture.

Disadvantages of Tethering Production System

- Care has to be taken that the goats do not get entangled or even strangled and that the goats will not be attacked by dogs/predators.
- It is advised to provide a small area with fresh grazing and/or browsing each time.
- To prevent trampling of the grass the pegs should be shifted 2 to 3 times per day to offer fresh grazing.
- The tethering area must offer some shade, especially when the tethering period is prolonged and includes the hottest part of the day.
- Tethering of goats may expose them to increased risk of stress, injury or death.
- Tethered goats are very much at risk of theft and of attack by dogs. They should be supervised at all times and brought close to home at night and at any other time when they can't be supervised.

SECTION 2: IMPORTANT TIPS FOR PROFITABLE GOAT FARMING BUSINESS PLAN

Goat farming is becoming very popular day by day due to its high demand and good economic prospects. Commercial goat farming is a great business idea with Good Returns on Investment ratio (ROI). For starting and maintaining a profitable business, you must have to make a proper and effective **goat farming business plan** and go according to the plan. This involves (not in order of importance):

(1) Practical Experience is More Important Than Book Knowledge

Having training on goat farming system before starting commercial goat business is highly recommended. Learning from existing farmers is a very good option. Goat management skills and experience of available staff and of veterinary personnel are important.

(2) Select a Very Good Farm Area/Location

You must ensure that your selected location has all types of facilities for a profitable goat enterprise. The necessary facilities for goat farming business include the following:

- Source of fresh and clean water supply.
- Availability of required equipment.
- Easily available feed source.
- Fertile field for crops, pastures (grasses and forage legumes) and other green fodder species. Feeding green fodder keeps the animal healthy, productive and reduces feeding costs.
- Availability of full time labour.
- Good transportation and veterinary service.
- A market near the farm land so that you can sell your products easily and buy necessary commodities.

The acreage needed is determined by the number of goats being raised. To raise 500 goats, about 10 acres of land, including shed construction area, is often necessary. If you want to begin with a small number of goats, say 50, you'll need 1 acre of land.

(3) Fixed Capital and Circulating or Working Capital

Fixed capital is required for putting up farm structures like housing, fencing and equipment. **Circulating capital** is required to finance the production cycle e.g. purchase inputs such as feed supplements, drugs, equipment, forage seed, fertilizers, irrigation equipment, building materials, fencing. Returns on initial capital are very important. Goats kept at commercial and medium scale and milking goats have higher returns to capital than small-scale enterprise.

(4) Choose the Products You Want to Produce

First, determine whether goat meat or milk has a great demand in your local area. Then, depending on the demand, you should start a commercial dairy goat farm. If your location has sufficient facility for marketing your products internationally, then you can establish goat farm for producing any types of products. But for commercial purposes, you must establish meat or dairy goat farm which will give you more profit.

(5) Choose the Right Goat Breed

Before selecting a goat, you should ask yourself what kind of goat you want. Do you want a goat for meat or milk production? Also, it is important to understand what kind of goat you can provide and care for. There are different types of goat breeds available for rearing in the goat farm. Some of the available goat breeds are famous for tasty and nutritious meat and some breeds are famous for milk production. Dairy goats are raised mainly for commercial milk production or for family milk consumption.

What to Look for in a Goat

Look for these general characteristics when selecting a goat:

- Large, alert, growing, and upstanding kid
- Free from disease and injury
- Good appetite, vigorous, and healthy

(a) Dairy Goats

The most important characteristics of a dairy goat:

- General appearance
- Body capacity
- Mammary system
- Dairy character

A good milking doe produces at least 3.62 kg of milk a day. A doe should be selected with great care since an outstanding doe may be the backbone of a productive herd.

A dairy goat should have the following:

- An excellent temperament
- Good body development
- Prominent hip bones
- Thin thighs to provide plenty of room for a round, well-attached udder of fair size
- Good length through the neck and body
- A thin and graceful neck with or without wattles
- A feminine head
- A long middle, and the ribs should have great spring and depth; this indicates a capacity for consuming large amounts of roughage as well as the ability to carry two or more kids
- Loose and pliable skin free from dryness; goats in proper condition have fine, silky hair
- Clear and bright eyes

The milking potential of a doe cannot be estimated by the size of its udder, as a large udder may give a very small amount of milk, especially if it is fleshy and lacking quality. The udder of a good dairy doe should

- Be thin-skinned rather than meaty
- Show plenty of capacity
- Be well attached and supported by the suspension ligament
- Have teats that hang straight down and are about the size of a thumb
- Be soft to the touch and have a collapsed appearance when freshly milke

(b) Meat Goats

A meat goat has six important characteristics:

- Muscle
- Structural correctness
- Volume and capacity
- Style and balance
- Growth and potential
- Functioning udder (does)

The muscling of a meat goat is its strongest attribute. In order to support muscling, the goat's bone structure needs to be correct. A meat goat should have

- A wide stance to accommodate heavy muscling
- A wide chest floor, with bold shoulders and a prominent forearm muscle; the chest and forearm are the best indicators of muscling in a goat
- A deep, heavily muscled leg and rump; when viewed from behind, the widest part of its leg should be the stifle area
- A broad, thick back and loin
- A long body with adequate depth and spring of rib
- All the parts of its body blending together for style and correctness
- Great growth potential; the quicker an animal grows, the fewer days you have to feed them, and the more profitable they are

(6) Construct a Shelter or Housing For Your Goats

Housing is an important factor for profitable goat farming business. Small-scale farmers generally keep their goats with their other livestock animals. But for commercial production, a good goat housing system is highly recommended. A good house not only gives shelter and protects the goats from predators but also prevents them from bad weather and various types of goat diseases. Always keep the house neat, clean and dry. Make proper ventilation and drainage system inside the house. Also ensure availability of sufficient fresh air and light inside the house. Housing and goat farm design are of various types according to the production type and breed.

(7) Nutrition and Feeding

Most of the goats in Uganda are fed on maintenance rations due to lack of planned objectives. The current production systems are low input, low output type i.e. low productivity types. There is need to invest into providing balanced feed rations to achieve targets for instance attaining a particular weight at a certain age through feed supplements etc.

Goats prefer to eat grasses, plants, shrubs, weeds and herbs. Besides those feeds, goats need energy, protein, minerals, vitamins, fibre and water for proper growth and for making better profits from this business. It is recommended to have sufficient knowledge about what to feed goats. Goat farmers need a balanced feed ration for healthy growth and high-quality milk and wool yields.

An example of a balanced goat feed ration

- High quality pastures are a must for commercial goat farming business. Pastures help to decrease complementary food cost. Browsing in the pasture helps to keep the goats healthy.
- Silage (conserves green fodder from home grown crops) in the amount of kg/goat should be fed twice a day, 1 kg in the morning and 1 kg in the evening.
- Feed any leguminous/grain fodder weighing 500-600 grams/goat once a day.

- A concentrate of 200-250 grams/goat/day should be fed once a day.
- Provide mineral blocks all the times.
- Provide clean water throughout the day

(8) Breeding

In any commercial goat farming operation, the choice of goat breed is the key source of profit and loss. Select goats that are capable of multiple kidding and have a short gestation period. One male goat is required for every 20-25 female goats. Bring a healthy and robust male for breeding purposes.

In today's time, various modern farmers are using artificial insemination system for breeding in commercial goat farming. It is very suitable for large scale commercial goat farming. If you have just started up with few goats then you must use natural goat breeding.

(9) Fattening

If commercial goat farming is designed for meat production, a fattening method should be considered in order to make quick money from the sale of those goats. In the fattening system, 3 to 4 months old male goat kids are selected and given a zero grazing diet for 6 to 7 months before being sold in the market for mutton at the age of 9 to 10 months. This will assist goat producers in rotating their funds or expanding their operations.

(10) Care and Management

- Always take good care of your goats. Never feed them on contaminated food or polluted water.
- Keep their house clean.
- Keep kids, bucks and does separated for each other.
- Take extra care to the breeding bucks, kids and pregnant does. Keep the kids with their mother for several weeks after their birth.

- Avoid using same buck for mating with numerous does at same day.
- Artificial insemination is a great way for breeding your does.

(11) Fencing

Make a fence around your farm area. It will keep your goats safe and free from other harmful animals like dogs. You can make a fence with general wire or electric wire.

(12) Veterinary Services

The health of goats plays vital role to generate a good and profitable business. Be sure of the availability of proper and sufficient veterinary service on your farm. You must store the necessary drugs and vaccines in your farm so that if the animals are affected with diseases, then you will be able to provide first aid.

(13) Marketing

Marketing is the most important but easiest step of goat farming business. Goat products like meat and milk have a huge local demand and popularity. You can easily sell your products in your nearest market. Commercial producers can target international market and export the products in foreign countries.

(14) Total Expenditure and Profit

Total expenditure and profit from goat farming business depends on the farming system, location, breeds, feeding cost and other factors. With good planning and proper management you can easily make goat farming business profitable. Small-scale farming requires less investment and profit can contribute your regular income. On the other hand, large scale or commercial production require high investment and some other additional costs.

SECTION 3: COMMON GOAT BREEDS IN UGANDA

When selecting goats, it is important to consider the environment that they will have to live in, and if they are suited to such environment. There is a high demand for the supply of goat meat and milk in Uganda but the major constraints to adequate supply of these two products are the scarcity of suitable breeds and poor nutrition. There are many breeds of goats, large and small breeds, specialised in dairy and meat. A few of the common goat breeds in Uganda are described below:

(1) The Savanna Breed

The most profitable goats at the moment are the white Savanna goats. Savanna (also called "Savannah") goats originated in South Africa by breeding Boer goats with local landrace goats.



Savana goat breed



Savanna goat meat

Savannas were selected for strong jaws, long-lasting teeth, and sound legs so they could stand on their hind legs to efficiently browse brush, leaves, and any other green thing in their harsh environment. They were developed to be a low-input meat goat, able to adapt to rough climates and poor forage. The white savanna goat offers more opportunities because of its niche Arabian market, especially for its meat. They were also specifically developed for their rare white hair and dark skin.

Does average 50-100 kgs, while bucks weigh about 90 kgs or more under good management. Savannas easily endure heat, intense sunshine, cold and rain. Savanna goats can be raised and live

like other small-farm meat goats, with about 250 feet of pasture space per goat for exercise and social needs. In such a setting, high quality fodder and mineral supplements must be provided for the goats, and breeding is typically controlled.

(2) Saanen Breed

The Saanen originates from Switzerland, but at present is widely spread in many parts of Uganda. The Saanen coat is all white or all cream and the hair is generally short and fairly fine although some may have longer hair along the spine, hindquarters, or both. Horns may or may not be present at birth. The ears are generally pointed and erect and the head is usually lightly structured.



Saanen goat

The Saanen is a typical dairy-type animal. Saanen does are heavy milk producers and usually yield between 3 and 4 percent fat. If well fed, a Saanen can produce more than 3 litres/day of milk, making it good for milk and milk products businesses. Saanens have a dished or straight facial line and a wedge-shaped body. Saanens are of medium height when compared with the other breeds. The breed is sensitive to excessive sunlight and performs best in cooler conditions. The provision of shade is essential, and tan skin is preferable. Saanens are usually very docile animals and like to keep to a routine so are well-suited to machine milking. They respond quickly to affection.

Saanen Doe

The high-producing Saanen doe should be an efficient reproducer. She should have a docile nature, and appear alert and feminine. The udder should be well developed not fleshy, and have a collapsed appearance and a soft texture after milking. It should be round or globular, and not pendulous or 'split' between the halves. A fairly flat udder sole is preferable. The udder should be carried high and well under the body. Good udder attachment is particularly important. The teats should be distinct from the udder and moderately sized.

They should be squarely placed and point slightly forward. Does with abnormal teats and udders may prove difficult to milk and should not be used for breeding replacements. The jaw should be square (not overshot or undershot) and the teeth should be sound. The muzzle and nostrils should be wide, the lips broad and the eyes set well apart. The neck should be long, slim, of good depth and connect evenly with the withers and shoulders.



Well-developed Saanen udder

Saanen does can grow up to 63-77kg whereas the male, 80-100kgs of live body weight. They have no horns and have higher chances of producing 2 kids per birth. It is important to note that a Saanen does not prefer hot areas. This breed is known for it is intersex/free martin offspring, therefore horned animals are preferred, but they may be dehorned.

The Saanen Buck

The Saanen buck's ability should be gauged by his reproductive performance and the quality and performance of his offspring. The buck should have good conformation and depth of body, be masculine but not coarse in appearance and have vigour.



Saanen buck

The testicles should be of good size, well balanced and firm. The scrotum should be well placed, not divided and allow the testes to hang away from the body (not excessively). Polled bucks are not generally used in breeding programs as offspring resulting from matings with polled does may be born as either intersex females or sterile males. If polled bucks are used, they should only be mated with horned does.

(3) Anglo-Nubian Breed

The Anglo-Nubian goat has been bred from crosses of English, Indian, Egyptian and other goats. The colours vary, but brown and white dominate. The Anglo-Nubian is a relatively large and graceful dairy goat. The Anglo-Nubian goat is named for Nubia, in north-eastern Africa. The breed is an all-purpose goat, useful for meat, milk and hide production. A useful characteristic is that the

milk is very concentrated (4 to 5 percent butterfat content). It is the best suited of the dairy goat breeds to hot conditions. The Anglo Nubian has been used in grading-up programs in many tropical countries to increase milk and meat production of local breeds. The udder of the Anglo-Nubian is capacious but is sometimes more pendulous than that of the Swiss breeds. A mature doe should weigh over 50 kgs, while the males should weigh over 70 kgs.



Anglo-Nubian udder



Anglo-Nubian



Anglo-Nubian kid

(4) Toggenburg Breed

Toggenburg breed is imported from South Africa, Kenya and other countries. Colour varies from deep chocolate brown to pale fawn and the coat is generally short and fine though longer coats are common.



Toggenburg goats

The Toggenburg has distinct white markings as follows:

- White ears with a dark spot in the middle
- Two white stripes down the face, above each eye, to the muzzle
- Hind legs are white from hocks to hooves
- Forelegs are white from the knee downward; a dark vertical stripe is acceptable below the knee.
- A white triangle on each side of the tail.
- A white spot may be present at the root of the wattles, or in that area if no wattles are present.
- Varying degrees of cream markings instead of pure white are acceptable but not desirable.
- Females weigh 40–45 kg while males weigh 60–65 kg. Mature does should be 66 cm at the withers and mature bucks should be 71 cm at the withers; however, most Toggenburgs exceed this height. On official testing, does of this breed produce an average of 915 kg of milk during a 305-day lactation.

The Toggenburg Doe

The does weigh about 55 kg. Toggenburgs do not generally produce as much milk (2-3 litres of milk per day) as the Saanen breed but have consistently good udders and are known for their persistent milk production over long periods.

Toggenburg milk butterfat content is 3 to 4%. The udder should be well developed, not fleshy, and have a collapsed appearance and a soft texture after milking. It should be round or globular, but not pendulous or 'split' between the halves. The udder should be carried high and well under the body. Good udder attachment is particularly important. The teats should be distinct from the udder and moderately sized. They should be squarely placed and point slightly forward. Does with abnormal teats and udders may prove difficult to milk and should not be used for breeding replacements.

The jaw should be square (not overshot or undershot) and the teeth should be sound. The muzzle and nostrils should be wide, the lips broad and the eyes set well apart. The neck should be long, slim, of good depth and connect evenly with the withers and shoulders.



Toggenburg doe

The Toggenburg Buck

The Toggenburg buck's ability should be gauged by his reproductive performance and the quality and performance of his offspring. The buck should have good conformation and depth of body, be masculine but not coarse in appearance, and have vigour. He should be strong though not heavily boned, and have good firm legs.



Toggenburg buck

The testicles should be of good size, well balanced and firm. The scrotum should be well placed, not divided, and allows the testes to hang away from the body (not excessively). Polled bucks are not generally used in breeding programs as offspring resulting from matings with polled does may be born as either intersex females or sterile males. If polled bucks are used, they should be mated only with horned does.

(5) Alpine Breed

The French-Alpine is a breed of goat that originates from the Alp region in Europe. The Alpine is a large and graceful goat, with milk production comparable to that of the Saanen. This breed was most likely derived from the French-Swiss and rock-Alpine ancestry and is now represented by several sub-breeds. The Alpine dairy goat is a medium- to large-sized goat and is the only breed with upright ears. They are hardy, adaptable animals that thrive in any climate. Their hair is short to medium in length. They have a straight face and a Roman nose is not desirable for conformation. The breed has good potential for both milk and meat production.



Alpine goats

The milk of Alpine goat is a good source of calcium, niacin and vitamin A. The animals have a good size and an enormous variety of colour of their coat, from black to white. Their weight is 60 kg and 65 kg respectively for females and males. Alpine goats are hardy, adaptable animals that thrive in any climate while maintaining good health and excellent production. Alpine goat gives 1 to 3 kids at a time and birth of twinning is common.

(6) South African Boer

These goats were developed in South Africa for their meat, hardiness, and brush-control abilities. They are large-framed animals and resemble Nubians; however, the two breeds differ in size.



Boer goat

Mature weights is 90 and 160 kg for males and 55–90 kg for females. Through extensive selection, growth rates have continued to increase, so average weight at weaning is 25–30 kg.

Boer goats are known for their excellent mothering ability, high prolificacy (1.93 kids per doe), and high fertility (98 percent of does bred have live kids). Boers are generally white with a reddish-brown head and they usually have a white blaze down the middle of their face. Their ears are long and hang down the sides of their faces. A Boer goat should have a deep chest, good back, strong and heavy shoulders, and heavy muscling in the rump.

(7) Local or Indigenous Breeds

These hardy goat breeds are commonly referred to as local or indigenous breeds in Uganda. They are characteristically slow in growth, have a low twinning rate (less than 30% chance of twinning) and yield little milk in comparison to exotic goats. They are, however, more resilient to environmental harshness and have shown marked resistance to some disease spreading parasites. They are reared for their meat and good quality skin. The Mubende goat breed is probably the biggest of the common local breeds.

(a) The Mubende Goat Breed

The Mubende goat breed is commonly found in the central region, the north and north-west of Lake Victoria.



Mubende goat breed

It is predominant in the former greater Mubende district. It is the largest local goat breed with a live weight of 30-35kgs in males and 25-30kgs in females. The breed has glossy fur with short straight hairs. The skins sell highly on the world market. This breed has shiny, straight hair that is normally black or a mixture of black and white. Its meat is of high quality, as is its skin, which is used as leather in the tanning industry. Adult males weight 25 – 35 kg, and females weigh 22 to 28 kg. It has a high twinning rate.

(b) Kigezi Breed

Kigezi goats are found mainly in south-western Uganda with some in Ankole and other bordering regions. The colour of this goat is black and the hair is long. Average live weight for adult males is 28.8 kg, castrates 30.0 kg and females 30.3 kg. It is smaller than the Mubende goat, weighing 25-30kg at maturity. They are characterised by a black and grey coat.



Kigezi goat breed

(c) The Small East African Goat Breed

The Small East African is the name given to a type of goat which is found throughout Eastern Africa from Zimbabwe and Malawi in the South through Tanzania to a large part of Kenya and Uganda. These goats are predominantly kept for meat. They grow slowly, but have a heavy-set conformation and are resistant to heart water (a tick-borne disease) and worms and possibly other diseases such as mange.



The Small East African goat

The hides give a good quality leather. An adult weighs between 25- 30kg and the age for first kidding is 18 months.

(c) Karamoja Goat Breed

This breed is adapted from the Karamoja region. It is suitable for the arid areas of Kotido, Moroto, Abim and Nakasongola districts. It is a short-haired, mainly white breed. It is a relative of the Galla goat breed of Kenya.



Karamoja goat breed

(1) Crossing Exotic With Local Goats

When a farmer crosses an exotic with a local breed, the kids will be 50% ($100\%/2$). If the kids (50%) are again crossed with a local, then those kids born will be 25% ($50\%/2$). If the kids (50%) are again crossed with the pure exotic breed, then the kids born will be ($100\%+50\%=150\%/2=75\%$). Gradually, you can build your stock into the pure bred using the formulae above. It is also important to note that crossed goats are more resilient to diseases compared to pure breeds.

SECTION 4: GOAT HOUSING

Suitable goat housing or shelter is very important for goat farming business. Goats need a house like other domestic animals for staying at night, security and protecting them from adverse weather. Some people keep their goats with other domestic animals such as cows. In some areas, people keep their goats under trees. But if you want to establish a profitable commercial goat farm, then you must build a suitable house for your goats. Before building house for goats, the following tips very important.

Features of a Good Goat Shed

- The goat housing area must be high enough to keep the goats safe from floods.
- Must have bright lighting and proper ventilation.
- Ensure that the floor is strong enough to hold the goats.
- Try to make the wall of the house with concrete or by using timber poles.
- The house must be comfortable.
- Accessible to food and clean water.
- It must have a space for storing feed, straw and other equipment required for goat farming business.
- If you are using wooden floors, the floor should be fitted together. This protects the goats from injury.
- Goat shelter sizes depend on the size of the herd or of the animals themselves.
- The house must have the facilities of cleaning well regularly.
- Goats are affected by extreme cold. So take extra care in rainy season. Otherwise they may caught by Pneumonia.
- A good goat house must provide protection from cold
- It should also provide protection against predators and thieves.
- Goats should stay outside as much as they can. They love the sun on their faces and the breeze in their beards. They only use their goat shelter to get out of the rain, snow, or wind.

- Pole barns and sheds are good for goat shelter because they're usually pre-built with lumber and screws, and sometimes floors. If you need space to milk and take care of baby goats all year round, then it would probably be wise to build goat housing that will last years.

Types of Housing

(1) Loose Housing

This is the most common type of housing due to labour and resource efficiencies. It also allows goats to freely socialize in their environment.

Advantages of loose housing:

- Goats are free to wander.
 - Goats can get more exercise.
 - Goats can easily socialize.
 - Feeders and waterers can be quickly filled.
 - Pens can be set up for cleaning with a tractor and loader.
 - Requires few dividers, so there is minimal cost and time spent setting up.
- Disadvantages of loose housing:
- Aggressive goats can bully shy goats.
 - Goats do not usually receive individual attention.
 - You cannot adjust feed for individual needs

(2) Individual Stalls

Goats are housed in individual stalls and can be turned out together for exercise. Individual stalls should be about 1.2 m wide and 1.5 m long for adult goats. Stalls should be a minimum of 1.2 m tall to prevent goats from jumping out. Slats of stall dividers should be vertical rather than horizontal to discourage goats from standing on the partitions. Stall doors should swing outwards, otherwise bedding can become piled up against the doors and make it difficult to open them. All latches should be "goat-proof." Use a heavy, sliding latch to fasten any doors so they can't be opened by the goat.

Advantages of Individual Stalls

- Goats usually receive more individual attention.
 - Goats can be fed individually.
 - Goats do not have to compete for food or living space.
- Disadvantages of individual stalls:
- Goats must be let out for exercise.
 - There is not as much opportunity for socialization.
 - Feeders and waterers must be individually filled, requiring more labour.
 - Stalls are usually cleaned out by hand with a pitchfork and wheelbarrow.
 - Individual stalls require more dividers, doors, feeders, and waterers, so the cost and time to build is greater compared to loose housing.

(3) Stall Floors

The best type of floor for a goat stall is an earth floor covered with clean sand. This provides a good base and sufficient drainage. An earth floor is usually warmer than concrete flooring, which traps dampness and odours. Wooden floors are not usually desirable because wood tends to rot.

Concrete is best used in aisles, milk rooms, and feed rooms because feed carts and wheelbarrows can be easily pushed across it. Also, concrete is rodent proof and it can be washed down and disinfected. Any room that will be washed down, such as the milk room, should be sloped and have some type of drain installed beneath.

(4) Stalls for Bucks

Bucks should be housed separately from does. During breeding season, bucks will try to escape from their stalls. A buck can easily damage partition walls, so think strong! Stalls should be made out of welded steel, strong planking, or thick plywood. Buck stalls should be at least 2.4 m x 1.5 m.

(5) Stalls for Pregnant Does

Pregnant does that are close to giving birth should be kept in a kidding pen. These pens should be 1.8 m x 2.4 m and be kept sanitary to protect the kids and doe from disease. Whitewashing pens and walls helps maintain sanitary conditions.

(6) Kid Housing

A 1.2 m x 1.2 m pen should provide enough room for four kids at two weeks of age. By the time the kids reach four months of age, their pens should be 1.5 square meter. However, the size could be reduced if they have access to an outdoor yard. It's a good idea to have no more than five kids per pen for management purposes. It is especially important for kids' stalls to be kept clean. Kids tend to soil bedding often and many diseases can occur when kids are in damp, unsanitary conditions.

(7) Feeders and Waterers

Feeders and waterers should be placed off the ground so it is difficult for goats to climb into or onto them. This is a safety measure, minimizes food waste, and prevents goats from contaminating their food and water. Feeders should be 38 to 46 cm for does and 20 to 25 cm for kids. Be sure to provide lots of feeder space so less-aggressive goats can always access feed and water. Goats require lots of clean water, especially milking does.

(8) Ventilation

Ventilation is the process of intentionally letting fresh outside air into an indoor space to control the air quality. Air quality is regulated by diluting and displacing pollutants such as dust, odours, or gases. Dust from grain, hay, and dried manure floats around in barns; this can cause respiratory problems and worsen allergies. It is important to be careful around enclosed areas containing manure as gases from the manure can kill people and animals.

Along with air quality, ventilation can also control the temperature and humidity to make the space more comfortable for you and your animal. Humidity is moisture in the air. Too much of it can

cause your animals' housing to become damp, which may result in sick goats. Goats are better off cool and dry versus warm and damp. Humidity can also be damaging to milking equipment and machinery. Goats naturally give off heat and moisture, so you need to make sure there is adequate ventilation to let excess heat and moisture escape the barn. Ideally, humidity levels in the barn should stay under 75 to 80 percent.

(9) Handling

Goats need to be handled for breeding, movement, veterinary care, shipping, milking, and other related activities. It is important that goats are familiar with you so handling is less stressful for both you and the animal.

Tips for Handling Your Goat

- Work calmly and consistently around goats.
- When catching a goat, use one arm around its neck and the other around its hindquarters.
- Move and guide goats by using one hand to grasp under their jaw and use the other hand to hold the back of their head.
- When carrying kids, lift their chest and abdomen and carry them horizontally.
- Never pick up a goat by its horn, neck, or legs.
- When moving a group of goats, encourage them to walk by standing in their flight zone just off to the side of their hindquarters. Do not use sticks or canes to prod the goat, nor should you bang on equipment to scare them into place.

(10) Transportation

Goats may need to be transported when they are bought or sold or being bred or slaughtered. Proper preparation for moving goats reduces stress and risk of physical injury. Finished goats being shipped directly for processing have been carefully raised

to ensure the best quality meat for processors and consumers. How goat meat is prepared, handled, and shipped to market is important to maintain meat quality after processing. Processors may require advanced notification of a shipment and a statement of any medication used along with withdrawal times. The following are best transportation practices:

- Perform a transport fitness assessment of all goats. Any goats that do not pass this exam should not be transported. For more information on fitness assessment, reference the goat code of practice.
- Allow goats to have access to water and feed up to the time of loading to reduce weight loss and meat shrinkage during handling and transport. Ensure the total transportation time without feed or water does not exceed 48 hours, including the period between transportation and slaughter.
- Provide bedding for the floor of the transport vehicle for absorption and to prevent slipping.
- Ensure the goats have adequate ventilation and protection from the elements inside the transportation vehicle.
- Do not transport live goats in the trunk of a car.
- Ensure all animals being transported are evenly distributed and there is no weight imbalance.
- Segregate animals based on size, gender, age, and temperament.

Materials for Constructing a Goat House

The materials you will need for the construction of a goat house will depend on the type of goat housing system you desire, labour and capital..

- Bamboo – This is good for making the flow of the shed. You can also use bamboo to cover the sides of the goat shed.
- Nails – You need nails for holding woods together and for fastening roofing materials over the shed.
- Straws – This provides bedding for the goats, absorbs urine and faeces and provides a more comfortable area on which goats can walk.

- Roofing materials – For roofing the goat shelter.
- Hammer – For driving in nails.
- Sacks of jute – To cover shed from cold weather
- Fencing materials – To make a wall fencing the shed.
- Hardwood – For making poles.
- Blocks – For securing the shelter
- Cement – for making concrete shelter

Types of Goat Houses

There are three main types of goat housing construction systems you can choose from for commercial goat farming.

- (1) Goat housing construction on the ground
- (2) Construction of goat housing on poles
- (3) Concrete goat house

(1) Goat Housing Construction on the Ground

Construction of goat shed on the ground is generally the most common house for goats. You can make the floor with bricks and cement or simply with soil. It will be better, if you can spread some dry straw over the floor in this housing system. But you must have to keep the house dry and clean always.



Goat shed constructed on the ground (Source: NET)

(2) Goat Housing Over Poles

For starters, this is probably the best type of goat shed you can think of because it is cheaper than concrete houses. Constructing goat

houses on poles keep the goats free from dampening conditions, flood water. To build this type of goat shelter, you need strong poles on which the shed will balance. The poles and floor in this housing system are usually made with bamboo or wood. The floor of the house heights about 1 to 1.5 meters from the ground. This type of house keeps the goat free from dampening condition, flood water etc.



Goat shed constructed on poles (Source: NET)

The poles and floor in this housing system are usually made with timber or bamboo. This type of house is very suitable for goat farming, because it is very easy to clean. And you can easily clean the closet and urine of goat form the house. Diseases are also less in this housing system.

(3) Concrete Goat House

If you want something long term, then go for concrete goat sheds. This type of goat house is fully made with concrete, and slightly expensive. But concrete house has many advantages. It is very easy to clean the house, and easy to always keep your goats safe from all types of predators. You can construct the house over ground or over concrete poles. Both types are easily maintained. Diseases are less in this housing system.

Recommended Space for Goat Houses

- Every adult goat needs about 0.75 meter x 4.5 meter x 4.8 meter housing space. Every billy goat needs 2.4 meter x 1.8 meter housing space. It will be better, if you can keep the nursing and pregnant goats separately.

- A house of 1.8 meter x 1.8 meter x 2.5 meter is suitable enough for housing 10 small goats.
- You can extend or decrease the area of goat house according to the number of goats in your farm. But keep in mind that, every goat needs their required space for proper growing and better production (Table 1).

Table 1: Chart of required space for goats according to their age and nature

Goat	Required Space (Square meter)
Baby Goat	0.3
Adult Goat	1.5
Pregnant Goat	1.9
Billy Goat	2.8

Source: (NET)

While building house for your goats, emphasis should be on the comfort of your goats. Ensure that, your goats are living happily inside their house, and the house is suitable enough to keep them free from adverse weather and all types of predators.

(a) Flooring

Gravel floors are the best option for goats although some people prefer wood. The dirt in the gravel absorbs urine and when the gravel is covered with straw, it helps keep the goats warm. Sheds with mud floor may be suitable except in places where high rainfall is observed such as central and western Uganda. Farmers should therefore avoid concrete flooring because it is cold and hard on the goats' bodies even though it is easier to clean. Farmers should also remember to keep the floor of the shelter always dry because dampness can be a breeding place for various diseases among your goats. The shelter should be constructed in an elevated area or slightly slanting to prevent water and urine stagnation. This also helps with drainage in your shed which should be good, to counteract any build-up of smells and urine.

(b) Bedding

Regardless of type of floor, you need to use some sort of bedding for warmth and comfort. If you have to use a concrete floor, make sure to put down three to four inches of saw dust to insulate the goats with enough warmth while they sleep. Goats can be deep littered, with the bedding being topped up regularly then being mucked out completely every month. You need about 20 square feet per goat for sleeping space.

(c) Kidding Place

If you plan to breed your own goats, you will need kidding enclosures and the number of cages you will need depends on how many goats are kidding at a time. The kids may be left with their mother for the first three days but afterwards isolated into a special cage where they are bound to receive special attention. The same place should have bedding for the kids. Also, regardless of the breed, you need an area for doing routine care, such as hoof trimming or clipping. If you are keeping dairy goats, you can use the same space for milking.

(d) Feeding Facilities

Goats are ruminants with four stomachs, so they eat throughout the day in order to keep food moving through their systems. Water, minerals, fodder and concentrates are the key components to feeding goats.

- Supply a bucket of fresh water, a mineral block and a feeding trough full of fresh fodder, hay, pellets and other roughage. Plastic basins, drums or pails can serve the purpose. Place this outside of the pen to avoid contamination with urine or manure.
- A feeding trough keeps the feed off the ground so it doesn't get wet and helps reduce waste. Elevate the feeder 1 1/2 ft above the floor and attach it to the goat house from outside.
- A bamboo tube with 2 or more slits at the bottom can serve as mineral salt container for the ordinary table salt for the goats to lick. Hang the bamboo tube inside the house.
- Store the fodder/forage in hay rack under a shade or shed adjacent to the goat house.



Simple water (left) and feed (right) troughs at JM GRINTA FARM, Busunju, Mityana district

(e) Fencing as a Good Practice in Goat Management

Goats are notorious for getting out of enclosures, so you will need some tight shelter to protect them from bad climate but also a considerably strong fencing for them. Fencing is important for the safety and health of your goats. Fencing for goats needs to be secure, not just to keep them in, but to keep predators like dogs out.

You will need perimeter fencing around the entire goat area or your property boundary, and then cross fencing within the goat area to keep goats separated from each other. Fences are being used successfully to contain all breeds of goats in many environments. They are one of the first improvements intending goat owners should consider for without good fencing goats will roam. This not only upsets neighbours, but also disrupts stock breeding programs. Effective for disease control, as immediate isolation of sick animals in a herd can be easily done. Breeding herds can be isolated from none breeding stock, especially among stud breeders, in order to avoid inbreeding of closely related animals.



JM GRINTA goat farm in Busunju

(f) Biosafety Measures for Healthy Goat Business

Biosafety (biological safety and well-being) is the management practice that prevents infectious diseases from being carried into a herd or onto a premises. The goal of a **Biosafety** program is to prevent the transmission of disease-causing agents to animals by direct or indirect means. There are three simple rules when allowing visitors and workers to wear their own footwear in your production areas:

- Check all visitors and workers boots.
- Clean footwear with a brush to remove debris, and then wash with water to remove all visible plant material and soil.

Disinfect footwear using a **footbath** containing a strong disinfectant. You could also use a spray bottle to treat shoes with a disinfecting solution. Be sure to follow the use instructions on the

SECTION 5: GOAT NUTRITION

Among all the ruminants, goats are the only animals which can eat and consume almost all types of food. Proper nutrition is the cornerstone of a healthy goat herd. Goats' feeding requirements and diet preferences are different from other ruminants such as sheep and cattle. A goat's diet should center on fresh forage and/or good quality hay. Goats that have a higher energy need will greatly benefit from the addition of concentrates or grain as a supplement to their diet. Other important management practices such as maintaining an appropriate stocking density (number of animals per acre), preventing disease, and minimizing stressors are also crucial for a healthy herd. Work with your Veterinary officer to design a feeding strategy that works for your goat.

5.1. Factors Affecting Amount of Fodder a Goat Consumes

- If good quality forage is available, the goat will eat more and refuse very little, but if the feed is of low quality, the refusal rate will be high as will the wastage.
- For dairy goats, if the forage quality is low, milk production will be reduced drastically. This has a negative impact on the performance of the goat and its offspring.
- Zero grazed goats eat more fodder than goats on free range.
- It is always advisable to chop fodder to reduce waste and make it more palatable.
- A-45 kg dairy goat in milk should consume up to 7% of its body weight in dry matter daily and plenty of clean water.

5.2. Pastures for Goats and Implications for Pasture Management

Feeding may be one of the largest expense of any goat operation. Goats raised for meat need high quality feed in most situations and require an optimum balance of many different nutrients to achieve maximum profit potential. Because of their unique physiology, meat goats do not fatten like cattle or sheep, and rates of weight gain are smaller, ranging from 90 to 400 gms per

day. Therefore, profitable meat goat production can only be achieved by optimizing the use of high quality forages and browse and the strategic use of expensive concentrate feeds. This can be achieved by developing a year-round forage program allowing for as much grazing as possible throughout the year.

Many farmers still believe that goats eat and do well on low quality feed. Attempting to manage and feed goats in this way will **not** lead to successful meat goat production. Because of nimble lips, goats are selective feeders, capable of picking off the most nutritious plant parts. On pasture or rangeland, maximum goat gains or reproduction can be attained by combining access to large quantities of high quality forage that allow for selective feeding.

Considerations to Be Given to Goats for Pastures

Goats are very active foragers, able to cover a wide area in search of scarce plant materials. Their small mouth, narrow muzzle and split upper lips enable them to pick small leaves, flowers, fruits and other plant parts, thus choosing only the most nutritious available feed. As natural browsers, given the opportunity, goats will select over 60 percent of their daily diet from brush and woody perennials, and broadleaf plants over herbaceous species such as Bermuda grass. The ability to utilize browse species, which often have thorns and an upright growth habit with small leaves tucked among woody stems, is a unique characteristic of the goat, compared to heavier, less agile ruminants.

Goats have been observed to stand on their hind legs and stretch up to browse tree leaves or throw their bodies against saplings to bring the tops within reach.



Goats stand on their hind legs and stretch up to browse tree leaves (Source: NET)

Goats are more likely than other domesticated ruminant animals to select plant parts containing tannins. Goats even sometimes climb into trees or shrubs to consume the desired forage. In spite of their grazing preferences, goats can be grazed on pasture alone. The feeding strategy of goats appears to be to select grasses when the protein content and digestibility are high, but to switch to browse when the latter overall nutritive value may be higher. This ability is best utilized under conditions where there is a broad range in the digestibility of the available feeds. It is an advantage to an animal that is able to select highly digestible parts and reject those materials which are low in quality.

In a pasture, goats tend to graze from the top to the bottom of plants and do not like to graze near the soil surface. Therefore, goats will more uniformly graze a canopy than other ruminants will. This behaviour results in even grazing and favours a first grazer-last grazer system. This system might consist of using a goat herd as the first group and cattle as the last group. It is most appropriate with lactating does or growing kids whose nutrient requirements are high.

Goats have been observed to:

- Select young grass over clover;
- Prefer browsing over grazing pastures, and eat more browse than other domestic ruminants;
- Eat a wider range of plant species than sheep or cattle;
- Prefer foraging on rough and steep land over flat, smooth land;
- Graze along fence lines before grazing the center of a pasture;
- Graze the top of pasture canopy fairly uniformly before grazing close to the soil level;
- Travel longer distances in search of preferred forage than other domestic ruminants.

Factors Affecting Grazing Time By Goats

(1) The Season of The Year

The season of the year, with changes in intensity of sunlight, cause goats to graze in different patterns.

(2) The Temperature and Humidity

At mean temperatures above 50°F, some grazing time will occur at night; and when mean temperatures exceed 77°F, one or more grazing periods will occur at night. During hot weather, frequent movement of goats during the day will increase intake.

(3) The Topography of The Land

The topography and size of the pasture also will have an effect on grazing time, as will forage availability and ease of forage removal.

(4) The Nature of The Plant Canopy

Goats will not graze sites within the pasture where urination and defecation have taken place, and this can increase the time it takes to graze.

(5) Pasture Availability and Social Interaction Between Animals

Goats are generally sociable, so if one animal gets up to graze, others will follow.

5.2.1. Establishing and Managing Pastures for Goats

(1) Planting Time

Establishing a successful forage crop depends partly on weather conditions shortly before and after planting. Delaying planting until the last possible dates may reduce the chance of growing a good stand by 30 percent to 50 percent.

(2) Germination Rate

Germination generally declines with the age of the seeds, but if seeds are stored in a dry cool place, germination should not decrease more than 10 percent the first year. In general, seeds that have low germination levels also produce seedlings with poor vigour. Legume seeds are often hard-seeded and should be scarified to improve first-year germination.

(3) Forage Legume Seed Inoculation With Rhizobia

Forage legumes should be inoculated with specific rhizobia — or one that gets along with that particular species — prior to seeding. Rhizobia will establish nodules in the legume plant roots and fix nitrogen for the plant in exchange for nutrients. Inoculant should be kept cool and away from the sun. Without proper inoculation, legume seedlings will be weak and mature plants will be low in crude protein concentration.

(4) Seeding Rates

Seeding rates vary because of seed size, purity, percent germination and seedling vigour. Under adverse conditions, only 10 percent to 50 percent of the seeds planted will establish and develop successfully. Therefore, many seeds are needed to obtain a satisfactory stand.

Table 2 shows recommended seed rates of common pasture grasses and legumes.

Table 2: Recommended seed rates of common pasture species

Pasture type (Common name)	Scientific name	Seed rate (Unit/acre)
Pasture grasses		
Signal grass	<i>Brachiaria brizantha</i>	10-15 bags of splits
Napier grass	<i>Pennisetum purpureum</i>	18 bags of cuttings
Rhodes grass	<i>Chloris gayana</i>	10-15 kg
Guinea grass	<i>Panicum maximum</i>	10 kg
Guatemala	<i>Tripsicum laxum</i>	
Giant setaria	<i>Setaria sphacelata</i> variety <i>Splendida</i>	2-3 kg
Kikuyu grass	<i>Pennisetum clandestinum</i>	2-3 kg
Buffel grass or African foxtail grass	<i>Cenchrus ciliaris</i>	2-3 kg
Pasture legumes		
Greenleaf Desmodium	<i>Desmodium intortum</i>	1-2 kg
Centrosema seed	<i>Centrocema molle</i> (<i>pubescens</i>)	3-4 kg
Siratro	<i>Macroptilum atropurpureum</i>	2-4 kg
Lablab	<i>Lablab purpureus</i> cv Rongai	7-10 kg
Alfalfa	<i>Medicago sativa</i>	4kg
Stylo	<i>Stylosanthes guianensis</i> var. <i>Guianensis</i>)	1-2 kgs
Fodder trees and shrubs		
Calliandra	<i>Calliandra calothyrsus</i>	
Gliricidia	<i>Gliricidia Sepium</i>	
Sesbania	<i>Sesbania sesban</i>	
Leucaena	<i>Leucaena diversifolia</i>	
Pigeon peas	<i>Cajanus cajana</i>	
Mexican or wild sunflower	<i>Tithonia diversifolia</i>	
Mulberry	<i>Morus alba</i>	
Paulownia ("princess tree")	<i>Paulownia elongate</i>	

(5) Drill Versus Broadcast Plantings

Planting rates for drilling are 20 percent to 50 percent lower than for broadcasting. Because drilling concentrates the seeds within a furrow, they occupy a smaller area of the ground and are better able to break through the soil crust. Seed placement, soil contact and uniformity of stands are usually better with drilling than with broadcasting, especially when planting conditions are not optimum.

(6) Planting Depth

Seeds can be planted slightly deeper in sandy soils than in clay soils. Large-seeded grasses can usually be planted deeper than small-seeded legumes in similar soils. The smaller the seed, the shallower the seeding depth. On cultivated seedbeds, it is important to prepare a firm seedbed to conserve moisture and avoid variation in planting depth. Rolling to compact seedbeds after seeding will improve seed/soil contact and increase seedling survival. If the residue from the previous crop makes a mat on the ground, drag an implement such as a harrow or disk to cut and/or break the residue before sod-seeding. Then, make a furrow about three-fourths of an inch deep, and most seeds will be covered with one-half to one-fourth inch soil.

What is a Good Pasture Stand?

In general, a good pasture stand provides 90 percent to 100 percent ground cover and will produce high yields when managed properly. The clover part of mixtures should make up to 30 percent of the stand on a weight basis for it to significantly contribute to the mixtures and forgo nitrogen fertilization.

(7) Establishing Mixed-Plant Communities as Pastures

If given a choice, the daily ration of a goat should be made up of **20% pasture grasses, 20% forage legumes and 60% browse**. Thus, plant diversity needs to be optimized to provide goats the forage quality and quantity necessary to meet their nutritional requirements. One approach is to plant a community of high quality perennial

forages (a mix of grass, legume and fodder trees). Plant species selection is important as different nutrients (amino acids, fibre and sugars, minerals and vitamins) can be optimized when goats have access to a wider array of plants, and thus will be better able to mount an effective immune response when necessary. In addition, chemicals in certain plants such as condensed tannins have an effect on internal parasites. Goats should also have access to brush and shrubs during the hot and humid periods of the summer. Keep goats on browse as long as possible as the higher the goat grazes/browses, the lower the level of internal parasites will be. In addition, a browse or woodlot area will provide much needed shade during the summer months.

(8) Renovation of Pastures

Given that goats are the most versatile of livestock in terms of the variety of plants it consumes, many of them considered weeds although of extremely high quality, assessing the plant community and its productivity is a “must” before considering and investing the total renovation of a pasture. A pasture considered not sufficiently productive for beef cattle or horses because of “weeds” and brush invasion could be highly productive for goats. Therefore, total pasture renovation should be considered a last resort alternative. Drilling other forage species such as white clover, chicory, plantain or spreading crabgrass or prairie grass seeds on a very short stubble and incorporating them into the soil with a light implement should be sufficient in most cases to thicken a thin stand. In addition, soils samples should be taken to determine chemical composition and possible remediation. Under certain circumstances, adding lime to correct the pH is sufficient to alter the pasture plant community. In other cases, strategic nitrogen fertilization, grazing and or bush-hogging to allow other plants to grow will alter the plant community satisfactorily.

(9) Year-Round Grazing Systems

Goat farmers need to be aware that there is no one grazing plan that fits all situations, and many factors need to be considered. Factors such as:

- Soil types,
- Topography,

- Climatic conditions,
- Type of livestock operation,
- labour resources,
- Capital,
- Available machinery and,
- Specific objectives will define the grazing system to be implemented.

Other factors such as control of gastrointestinal parasites of goats will also influence the choice of some forages to incorporate into the grazing system.

(10) Pasture-Weed Management

Weed management is one of the important aspects for maintaining healthy, productive pastures. Any plant that emerges at an unwanted spot is called a **weed**. Whether a plant is considered a weed may differ from one production system to another. For example, a weed in a cattle grazing system may not necessarily be a weed in a goat grazing system, such as briars. Although goats eat a wide variety of plants that are generally discarded by large ruminants, weed infestation can be a serious problem in a goat grazing system as well.

Weeds emerge and develop voluntarily whenever and wherever they find suitable environment. Weeds compete with forage plants for nutrients, moisture, sunlight, and space, and they lower pasture productivity. Weeds are generally not eaten by grazing animals, but forages surrounding the weeds are utilized. This situation provides weeds with better growing conditions with no or minimum competition from the useful forage plants. When weeds are left on pastures, these get well established by developing strong roots and stems as well as food storage structures like rhizomes, tubers, stolons, and crowns.

Steps to Manage Pasture Weeds

(a) Identify Weeds

Identification is the first step in weed management. One must be able to identify weeds and useful forages present in pastures so that weeds can be removed without harming the useful plants.

(b) Be Watchful on Your Pastures

Take a walk on your pasture from time to time and inspect whether any weeds are emerging. Noticing weeds early gives the producer the opportunity to control them before it is too late — that is, before they are mature and before seeds are produced and spread to infest a larger area. This saves time, money, and the environment in the long run.

(c) Minimize Human- or Animal-Mediated Weed Spread

- Avoid spreading manure infested with weed seeds.
- Don't use manure from a weed-infested area in a weed-free area.
- Quarantine grazing animals after they are removed from weed-infested areas and before moving them to weed-free areas.
- Thoroughly clean choppers and mowers after using them in weed-infested areas to avoid spreading the weed seeds to new areas.

(d) Manage Weeds on Time

When you notice weed infestation in your pastures, you need to act on time — before they flower — to manage them appropriately. There are different methods of weed management that can be used singly or in combination, depending on the weed species, available resources, associated cost, and farm conditions.

Methods of Weed Management

(a) Cultural Practices

Pasture soils need to be tested for pH and nutrient contents while establishing new pastures or maintaining existing pastures. Based on soil test recommendations, add necessary lime and fertilizers to the pasture soils to provide appropriate pH and nutrient requirements for forage growth. Also, plant suitable forage species for the given soil types and climatic conditions so that forages grow well and remain competitive. Plant an appropriate quantity of seed to a proper depth to obtain a good forage stand. Using lower seed rates leaves spaces for weeds to grow, and overseeding results in too much competition among the desirable species so they cannot perform well and weeds may invade. Similarly, planting too deep or too shallow for the given size of the forage seed will hamper the germination, eventually resulting in poor forage stand. Poor forage stand means good opportunity for weeds to germinate and flourish.

(b) Crop Rotation

Weed problems can be minimized by crop rotation as weeds are removed along with the existing crops and weed roots are weakened or damaged by all the tilling operations involved in planting new crops. However, it may not be a practical option for permanent pastures.

(c) Grazing Management

Weeds can be managed better with rotational grazing than with a continuous grazing system. In a continuous grazing system, animals are left in pastures for a whole grazing season, and managers do not have any control over where the animals go and how long they graze. Animals overgraze palatable species and undergraze less palatable species. Overgrazing depletes the sod and exposes soil/bare ground. This allows sunlight to reach the ground, which facilitates weed emergence and development. Undergrazing leaves plants to grow tall and mature; this shades the short growing forages and depletes their growth, resulting in depletion of sward thickness and promotion of weed emergence and development.

In a rotational grazing system, pastures are divided into different sections, and animals are allowed to graze one section at a time until the desirable stubble height of forages is reached, then moved to the next section sequentially based on forage availability. In this system, there are few days of the grazing period when animals are allowed to graze any section and several days of resting period when animals are taken completely off that section. Confinement of animals in a smaller portion results in uniform utilization of all forages present in that portion, so the chances of overgrazing or undergrazing are minimized. With the provision of a resting period after each grazing, forages have a chance to recover and maintain a good sod. Consequently, there is less suitable environment for weed emergence and development in a rotational grazing system compared to a continuous grazing system.

Another useful grazing strategy for weed management is to practice mixed-species grazing. This involves including different species of grazing animals with different forage preferences. For example, most weeds can be managed well when cattle and goats are grazed in the same pastures. This is because cattle prefer grass, while goats prefer browsing on brush and shrubs and grazing on broad-leaf plants including weeds and briars.

(d) Mechanical

This method involves removing weeds by cutting, uprooting, or mowing. Weeds should be removed when they are still in the vegetative stage. One mowing in a growing season should be enough for managing annual weeds. For managing perennial weeds, multiple mowings in an interval that allows weeds to grow 8 to 12 inches tall are required until these are killed completely.

(e) Chemical

This method involves the application of appropriate herbicides at a suitable stage of weed growth.

(f) Integrated management

This involves the application of more than one method mentioned above.

NB: For details on establishment and management, refer to “Kabirizi J.M.L. 2023. *Unlocking the potential of feed production technologies, innovations and management practices of smallholder dairy cattle farmers in Uganda*. February 2023. ISBN. 9789970675951”

Goat Pasture Seed Mix

The context of your farm will help you determine your pasture seed mix. Here are a few recommendations to take into consideration on building your mix:

- Look at what works in your local environment and climate. It also can be helpful to look at what native plant species that are common in your area. This will give you more background on plant species that might have more success on your farm.
- Consider anti-parasitic species. These plants, such as chicory and birdsfoot trefoil, have natural tannins, which can help with managing parasite issues with small ruminants.
- Keep in mind pasture diversity.

Fencing Pasture Fields

Fencing is the most critical factor in raising goats on pasture. There is nothing more frustrating than having to constantly chase goats back into the pasture. Fencing will also be the greatest expense, other than the initial cost of the animals. The best permanent fencing is 4-foot woven wire with barbed wire along the top. Some graziers are also successfully using four or five strands of high-tensile electric wire. Goats may have to be trained to electric fences by placing them in a small paddock to “test” the wire. Once they have been trained to an electric fence, goats can usually be controlled with two strands of wire in a cross-fence. Electric netting is also an option for temporary or permanent fencing in management intensive grazing systems; however, several goat producers have lost animals that tangled their horns in the netting.

Shelter

Goats also need shelter. They can tolerate cold weather, but goats will get chilled by wet, cold conditions. The necessary shelter or shelters depend on the producer's operation. A dairy operation will usually have extensive barn and pen set-ups, while a large meat goat operation may use only trees in the pasture as shelter. Buildings used for shelter may be minimal, but they should be well-ventilated and clean. Barns and sheds are not the only options for shelter. There are portable shelters, moveable shades, and even old hog huts that can be used as shelters for your animals. Predators are a problem in most areas where goats are produced.

How much grass can a goat eat in a day?

Goats tend to graze about six hours a day on average. Their daily forage needs are about 2.5 kgs of dry matter for a does with two kids.

5.4. Indigenous Fodder Trees and Shrubs

Indigenous fodder trees and shrubs (IFTS) play an important role in bridging the gap in fodder supply during the critical dry months in Uganda. Being perennials, indigenous fodder trees and shrubs are able to withstand prolonged periods of moisture stress than exotic pasture grasses and herbaceous forage legumes such as Lablab. In many parts of Uganda, indigenous fodder trees and shrubs are the only source of green forage available during the dry season. In addition, many fodder trees and shrubs have high nutrient value that supplement the often-poor quality grasses and crop residues, the normal dry season feeds. The protein content of most IFTS is higher than 15%, compared to that of grasses (less than 12%). Table 3 shows examples of indigenous fodder trees and shrubs.

Table 3: Examples of indigenous fodder trees and shrubs fed to goats

Scientific name	Common name	Part used as fodder	Propagation
<i>Persea Americana</i>	Avocado pear	Leaves and seeds	Seed and commercially propagated by cleft or grafting or budding
<i>Moringa oleifera</i>	Horse-raddish tree	Leaves	Direct seedlings, seed and cuttings
<i>Cajanus cajana</i>	Pigeon peas	Leaves, twigs and seed	Seed
<i>Psidium guajava</i>	Guava	Leaves and fruits	Seed, wildings
<i>Morus alba</i>	Mulberry	Leaves and fruits	Seed and cuttings
<i>Ficus natalensis</i>	Fig tree, Back-cloth	Leaves	Cuttings and seedlings
<i>Albizia coriaria</i>	Albizia	Leaves	Seed, wildings
<i>Acacia spp.</i>	Acacia	Leaves and pods	Seed, direct sowing, wildings
<i>Tithonia diversifolia</i>	Mexican sunflower	Leaves and young shoots	Direct seedlings, seed and cuttings
<i>Vernonia amygdalina</i>	Bitter leaf tree	Leaves and young shoots	Seed
<i>Manihot spp</i>	Cassava	Leaves and young shoots	Cuttings and seed
<i>Sesbania sesban</i>	Sesbania, Riverbean	Leaves	Seed
<i>Artocarpus heterophyllus</i>	Jackfruit	Leaves, twigs and seeds	Seed
<i>Mimusops bagshawei</i>	Mimusops, Red milkwood	Leaves	Seed



Mimosops bagshawei



Back-cloth fig tree



Bitter leaf tree



Jackfruit leaves



Avocado pear



Mexican sunflower



Mulberry

5.5. Crop Residues

Crop residue is the portion of planted crops left over after harvesting human food crops or after processing of the main product. The quality of crop residues is generally poor since they are high in fibre

and low in digestibility and crude protein. However, they form a big proportion of dry season feed for goats in smallholder farms in Uganda. Major crop residues fed to goats include sweet potato vines, maize stover, cassava peels and leaves, banana peels, banana leaves, pineapple and bean residues etc.



Banana peels



Sweet potato vines



Bean residues



Pineapple residues



Maize stover



Banana flower



Water melon peels



Pumpkins

Most crop residues are low in protein and high in fibre content, which leads to their poor utilization by livestock. Crop residues must therefore be supplemented with a source of protein such as lablab. Intercropping cereal crops such as maize with forage legumes improves the quality of maize stover and maize grain yield.

Factors affecting crop residue quality

(a) Stage of Crop at Harvest

When a crop is harvested early—for instance, green maize harvested for roasting the resultant residue is of higher quality compared to stover, which is obtained after maize is harvested after drying in the field.

(b) Harvesting Method

Harvesting of cereal (maize and sorghum) stover and straws (rice and wheat) should minimize the loss of leaves as they are more nutritious than stems. It is preferable to harvest crop residues in the morning when leaf shattering is low because of the presence of morning dew. The quality of crop residue is reduced when some of the plant parts are lost through shattering or breakage.

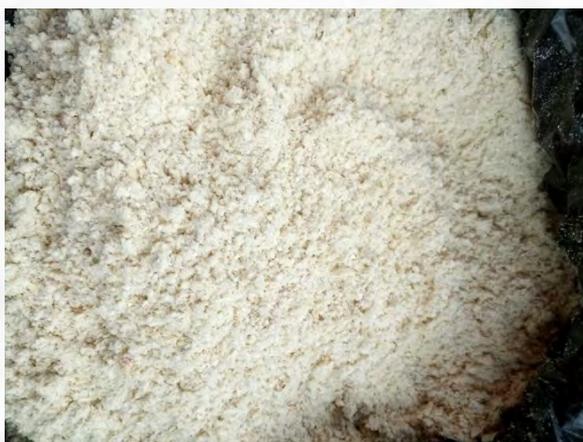
When crop residues are left in the field they are exposed to sun and rain, the nutrients are washed away, and they may decompose or be attacked by ants. Hence, the quality goes down. When stored for too long, the feed resource dries too much, loses colour and may decompose.

5.6. Agro-Industrial by Products

Agro-industrial by-products are mostly derived from agricultural processing industries such as cereal grain milling, oilseed extraction, cereal milling by-products (maize and rice bran) molasses, brewery, malt production, fruit and vegetable processing. These represent a vast potential source of energy and protein to the goats.



Molasses



Maize bran



Brewery spent grain

The major problems facing the use of agro-industrial by-products for animal feeding are their bulkiness and availability; high cost of transport; the general lack of understanding among goat owners about the feeding value and the relatively poor nutritive value of most agro-industrial by-products

5.7. Conserved fodder

Forages and crop residues can be conserved to feed dairy cattle during periods of feed shortage caused by limited pasture growth or inadequate pasture conditions or fed as a supplement. Conserved forages can take the form of **hay**, **haylage** and **silage**. It is important, to keep this fact in mind *“At best, conserved forages can rarely match the nutritive value of fresh forage because some losses of highly digestible nutrients (sugar, protein, and fat) are unavoidable during conservation and storage”*. The goal in forage conservation is to focus on minimizing losses, which start immediately after cutting.

How to make sweet potato vines silage

Over 60% of wastes in urban markets & on farms are sweet potato vines. **Silage** is a method used to conserve green fodder for future

use. Sweet potato vines silage is a high quality livestock feed. Silage production is an opportunity for youth groups to earn income.

1. Chop sweet potato vines into pieces of about 5 cm length using a forage chopper or a panga.
2. Wilt chopped vines for 2 hours to reduce moisture content. Weigh the vines.
3. Sprinkle 10 kgs of maize bran per 100 kgs of chopped vines. The bran improves silage quality and serves as a preservation.
4. Make a polythene tube bag (silo)
5. Cut a plastic tubing (gauge 600-800 microns thick) into pieces of 1.5 meters length.
6. Tie firmly with a sisal string at 30 cm distance from the cut edge.
7. Turn the bag inside-out and fold back the edge to produce a silage bag.
8. Fill the plastic tube with chopped vines & compact to remove the air.
9. Tie a plastic tube bag with a sisal string. Label (number & date) each bag.
10. Store silage bags in a well-ventilated place, free from rats. Silage is ready for feeding animals after 30 days. Silage can be stored for 3 years.



(5)



(6)



(7)



(8)



(9)



Sweet potato vines silage

Feeding Sweet Potato Vines Silage to Goats

- The silage has high (about 18 percent) protein content.
- Mix the silage with grass hay
- Provide clean water; mineral licks and control diseases.

Sweet Potato Silage Production as a Business For Youth and Women Groups

The International Potato Center (CIP) has trained and supported nine youth groups to produce sweet potato vines silage as a business. Table 4 shows **Costs** and **Income** from growing 1 acre/season of sweet potatoes.

Table 4: Costs and Income from Growing 1 Acre/Season of Sweet Potato Field

Activity	Ushs/acre
Land hire & clearing; planting, fertilizer application & weeding	1,355,000
Harvesting, chopping and making silage	550,000
Silo bags (100 kg bags)	800,000
Sisal strings	6,000
Tarpaulins (30 ft by 30ft)	150,000
Hiring 2 forage choppers	300,000
2 litres of petrol	130,000
1,000 kgs maize bran	800,000
Sub-total (Cost of production)	2,186,000
Average income (Ushs/acre)	
Silage (11,000 kgs/acre)	5,500,000
Sweet potato roots 30 bags/acre)	3,600,000
Sub-total (income)	9,100,000
Net income	6,914,000

5.8. Hydroponic green fodder

Inclusion of green fodder in a goat diet improves productivity and increases profit. Green fodder provides proteins, carbohydrates, minerals, vitamins and a source of water (about 15 to 25 percent water). Therefore, for economical and sustainable livestock farming, green fodder production round the year is highly essential. **Hydroponics**

green fodder is the livestock feed produced using hydroponics technology, "a method of growing plants without soil".



Hydroponics green fodder

Hydroponics farming is a solution to all animal feed challenges. Hydroponic fodder unlocks the energy potential of grains. It can be fed to all livestock; cattle (dairy and beef), goats, sheep, rabbits, pigs and chicken. Cereal crop grains that can be used to produce Hydroponic green fodder include: barley, oats, wheat, sorghum, millet, maize. The fodder is highly nutritious with 23-30 % crude protein. Inclusion of hydroponic maize fodder in goat nutrition improves performance and nutrient digestibility of weaned goats. Sole feeding of hydroponic maize fodder exerts negative effects on the performance of livestock.

Why grow hydroponics green fodder?

One of the best reasons for sprouting grains into fodder is that it helps stretch your animal feed budget. Fifty (50kgs) of whole grain can be transformed into as much as 300 kgs of fodder simply by sprouting it. Sprouting grains increase their nutritional content and boosts protein content slightly. And while it is great for goat feed, this fodder works as feed for other livestock as well.

How to grow fodder for goats

Sprouting grains into fodder requires a little bit of set up, but it's not difficult. You'll need a tray to get started. The essential thing is that you are able to drill drainage holes in the trays.

Requirements:

- Shallow trays — you can use plastic trays,
- Shelving or a rack on which to place the trays,
- Drill with a one-eighth-inch bit,
- Bulk whole grain – barley, wheat, maize, or oats work well,
- Bucket and,
- Water

Making the Hydroponic Fodder System

- Drill several drainage holes in the bottom each tray. Test to make sure water drains sufficiently.



**Metallic tray with holes
perforated plastic tray**



**Soaked seed on a
perforated plastic tray**

Where to Put Your Growing Fodder Trays

The fodder system can be set up outside near the goat house, making it easy to access and maintain.

Growing fodder

- Do not use seed treated with chemicals. Remove broken grains
- Soak grain in a bucket of water overnight.
- Cover the grains by about two inches of water. How much grain to soak depends on the size of your trays and how many you are filling. Aim for a half-inch depth for each tray. The grains have a tendency to mould if they are deeper than that.
- Drain grains and transfer to perforated trays. Spread evenly.
- Water each tray morning, midday and evening.
- In case of maize, germination starts on the 2nd day and the roots are clearly visible from 3rd day onwards.
- You will see roots within the first couple of days, followed by greens. It takes 8-10 days to have a nice solid block of fodder that you can lift out of each tray.
- Harvest on **Day 8**. One tray containing 1.0 kg maize seeds can produce 5 to 8 kg green fodder with fodder height of 20 to 25cm.
- Average protein content of hydroponic green maize fodder is 13 percent. Hydroponic green fodder looks like a mat consisting of roots, seeds and plants.



Goats feeding on hydroponic green fodder

5.9. Minerals Supplements

Goats need mineral supplements for good bones and teeth, appetite and weight gain and improve the hair coat appearance. Feeds provide some of mineral requirements but extra minerals in the form of commercial mineral mixtures should be provided the whole year round. Required mineral nutrients are mainly provided from commercial mineral mixtures. Phosphorous is very necessary for reproduction. Rock salt, though deficient in most of the essential mineral nutrients, should be provided in the goat house.

5.10. Concentrates

Whether they are kept for milk or meat production, goats deserve special attention. Energy has been identified as the most limiting nutrient for milk production in dairy goats. Concentrate feeds are valued for their energy and protein levels and their protein quality, which result in improved goat productivity. Concentrates or grain should be fed to goats with higher energy requirements. This includes goats that are still growing (i.e. weanlings), pregnant, or lactating.

- Feed a concentrate formulated for goats to ensure that it is adequately balanced to meet their specific needs.
- Feed concentrate once or twice per day. Smaller, more frequent meals help maintain rumen health and prevent ruminal acidosis, a potentially deadly condition.
- Separate goats based on production stage (i.e. pregnant, lactating, or growing) to allow time to consume an increased volume of feed without competition.
- A good place to start is 0.25-0.5 kgms of grain per goat/day of a 14-16% protein goat concentrate. Utilize stage of production and body condition scoring to further tailor the amount of grain for individuals.
- Small quantities (0.5-2 kg/goat/day) of concentrates can lead to an increase in the intake of low quality forages which in turn increases milk yield of dairy goats.
- Dry does, castrated goats, and non-breeding bucks can have a small handful of grain as a treat, but do not need concentrates to meet their nutritional needs. Excessive grain consumption can put castrated goats at an increased risk of urinary stones and should be avoided.
- A small quantity should be fed to the goat before kidding in order to build up the body reserves and help in the development of the unborn kids.
- If concentrates are fed, free-choice baking soda should be made available. Concentrates can make the rumen

more acidic leading to problems such as laminitis and liver abscesses. Baking soda will help offset ruminal acidosis by providing a buffer.

5.11. Water

Goats need access to fresh, clean water at all times. The amount of water needed by a goat varies with the breed, climate, the type of feed eaten and the purpose for which the goat needs water e.g. for milk and growth.

Normal recommendation: Goats consume 4 times as much water as Dry Matter but for lactating goats, provide 1.3 litres of water per litre of milk produced. Provide clean water all the time.

The best way to feed goats

- Feed only clean, fresh and/or dry fodder
- Clean the feeding trough and water bucket every day
- Give lots of different feeds such as grasses and legumes, tree leaves and fresh kitchen remains.
- Give chopped mixed feeds to make sure the goats eat everything and does not waste
- Feed.
- Feed goats at least 3 times a day and at the same time every day
- Put some feed in the feed trough or rack or hang up some feed to be eaten overnight
- If you use molasses to make feed taste better do not use too much it will make feed sticky
- Dusty feeds and concentrates should be wetted a little.
- Provide a Mineral Lick (block) always to all goats.
- Do not feed too much leguminous feed such as desmodium
- Mix feeds with grass, hay, straw or Napier to balance
- Only 1/3 of the day's feed can be legumes. Do not feed too much leguminous fodder. It can poison the goats due to high content of anti-nutrients.
- Give more feed two months before the buck has to serve the does this will improve the bucks sperm and make it more active
- When a buck is being used a lot to serve does, it should be separated from other goats for about 2-3 hours per day. This will allow it time to eat as well as serve the does
- Lots of fresh and clean water needed all the time
- Must be able to lick the mineral lick at any time

SECTION 6: GOAT BREEDING

The male goat is called a “**buck**” or “**billy.**” Male goats up to 12 months of age are sometimes referred to as “**bucklings.**” Adult male goats can weigh between 45 to 150 kgs depending on their breed, health and nutritional status. Although they can come into puberty and breed does as early as 4 months of age, waiting until a buck is a year of age to start using him for breeding is best. The number of does a buck can breed during the breeding season is often referred to as “Buck Power”.

At one year of age, the buck should service no more than 10 does at a time (in one month). When he is 2 years old, he should be able to service 25 does at a time. At the age of 3 and older, he can breed up to 40 does at one time, as long as his health and nutritional needs are met. The number of does a buck can service at one time also depends on individual sex drive of the buck, the terrain of the land and if he is managed by a hand- or pasture-mating system. The buck has the greatest genetic impact on the herd and should be well taken care of at all times.

6.1. Desired Characteristics of Male Goats

The buck or billy is half the herd, therefore it is very important to select the right male for reproduction.

(a)The Dairy Buck

- excellent health and sexually virile,
- a masculine body with medium-length head,
- a strong, broad muzzle with large open nostrils,
- bright eyes with pink mucosa,
- a strong, straight, smooth back,
- a long, wide and nearly level rump,
- strong, sturdy legs that are wide apart and squarely set,
- solid feet/hoooves,
- a pear shaped scrotum with 2 testicles of equal size and,
- a deep heart girth and wide chest floor.

(b)The Meat Buck

- Meat bucks should exhibit masculinity and adequate muscling.
- The head should have a broad strong muzzle and horns set far apart.
- The animal should demonstrate adequate muscling, particularly in the chest, back and hindquarters.

6.2. Time of Mating

Females should have at least 2 hard teeth at 10 months of age. Females mated when they are still young with a low body weight will produce kids will poor growth and the kid will be of little value. It is important that females are mated when there is plenty of good quality grass and leguminous forages. Mating during the rainy season will also ensure that the goats are in good body condition. If females are in good condition, they will readily come into heat and repeat services will not happen. Thus mating period of 45 days should be sufficient.

6.3. Signs of Heat

When on heat, the females become restless, bleat frequently and wag their tails. The vulva is swollen and discharges a clear mucus. Females on heat will also mount other females. The duration of a cycle is from 19-24 days.

6.4. Care of a Pregnant Doe

- As pregnancy progresses, the nutritional requirements of the female goat increases. Provide adequate nutrition, easily digestible and laxative diet
- It is important to get a cheap source but high quality feed.
- Keep pregnant animals separated from others
- Do not allow them to fight with each other
- Do not allow them to mix with recently aborted animals
- Shortly before the doe is due to freshen, clip hair around the udder, hind quarters and tail for greater cleanliness.
- If the goat continuous to produce milk, dry her off at least 6 to 8weeks before expected kidding.

On average a goat will kid 150 days (5 months) after she has been mated. Females carrying twins will kid a few days earlier. It is wise to be ready for kidding 145 days after the introduction of the buck in the breeding stock.

6.5. Signs of Kidding

The udder will become firm and the teats will enlarge. The female will become restless on the day of kidding, often pawing on the ground. She will have a discharge from the vulva.

6.6. Care of the Doe

The female should be left alone and not disturbed during labour time. If a female has not kidded within 3 hours after the start of labour, professional help should be sought. The placenta or afterbirth will normally be expelled within a few hours after birth. If this does not happen, do not attempt to remove it because it can result in excessive bleeding.

6.7. Rearing a New-Born Kid

Clean the nostrils and remove the placental membranes sticking on the kid, by gently rubbing with dry cotton or rags. Holding the kids up by hind legs with head downward for few seconds, will aid in clearing the respiratory tract. The kid will get up and start walking within half an hour. Allow the doe to lick the kids dry. Immerse the end portion of umbilical cord in tincture iodine. Repeat this after 12 hours. The kid should get its first drink of colostrum within 30 minutes of birth. If the kids do not suck properly, the teats should be held by the hand and pressed into their mouth. Once they have drawn a little of the milk, it will not be long before they take to the normal method of sucking.

- Take care of newborn kids by providing guard rails.
- Treat / disinfect the naval cord with tincture of iodine as soon as it is cut with a sharp knife.
- Protect the kids from extreme weather conditions, particularly during the first two months.
- Dehorn the kids during first two weeks of age.

The First Days: Right after birth the umbilical cord should be disinfected with a solution of iodine. A new-born kid does not have any resistance against diseases or parasites, so it needs good care, proper housing and adequate nutrition to prevent it from becoming ill. Preferably new-born kids should be housed in an individual kid pen; twins can be kept together in one pen. Assure a dry floor with bedding or a slatted floor and no draught of cold air. After 3 weeks, kids can be housed in a group.

Feeding Colostrum: The new-born kid needs colostrum as soon and as much as possible, preferably within half an hour, but at least within 2 hours after birth. '**Colostrum**' is the milk the dam produces during the first 3 days after kidding. Colostrum contains antibodies and it gives the kid the so-called 'maternal immunity', which is specific for the farm. Some farmers allow the kid(s) to stay with their dam for 2 or 3 days to get the maximum amount of colostrum. The problem is that it may be difficult to teach the kid to drink from a bucket thereafter; in such cases a bottle with a teat may be an option. In the case of twin or triplets make sure that all the kids get enough colostrum. This can be done by keeping them separate and hand feeding freshly milked colostrum. Some farmers milk the goat 3 to 5 times a day and feed the colostrum immediately to the kid(s), about 50 ml each time to a total of 0.2 litres colostrum a day, increasing to 0.6 – 0.8 litres of milk a day. This is important for building up immunity as quickly as possible. Maternal immunity lasts for some 2 to 3 months and within this period the kid has to build up its own immunity. Best is to allow the kid some light exposure to pathogenic organisms and parasites. **Caution:** make sure it is only a light exposure!

Feeding Till Weaning: Milk is a complete and natural feed for the young kid. During the first 3 to 4 months of its life it needs about 10% of its body weight in milk per day. Too little milk will hamper the development of the kid, too much may cause diarrhoea. Stick to the right amount and the kid will make a good start. To train the kid to drink from a bucket, let the kid suckle on a finger and lead it towards the milk in the bucket. After a few times it will drink all by itself. Some farmers prefer a bottle with a teat. Make sure the used equipment is cleaned properly (put it upside down in the sun) and strict hygiene is observed, otherwise the kid will get diarrhoea.

From the Second Week onwards a small portion of concentrates and some roughage should be offered. A special concentrate

is preferable, but any good concentrate will do, provided that it does not contain urea or cottonseed cake. At the beginning, the concentrate can be given in the same bucket as the milk. Once the kid starts eating it readily, it should be given in a special feed trough.

Roughage, preferably grass hay of a good quality, will stimulate rumen development. It can be tied with a piece of rope to the side of the pen so the kid can start eating it suckle-wise. Once the kid begins to really eat the roughage it may be given in a rack and ad libitum. Fresh roughage should be supplied, preferably twice a day. Make sure the kids have clean water available at all times and, at a later stage, some minerals.

Although very detailed feeding schedules exist, an effective and simple system is to give the kid some 0.2 litres of milk four times a day from the second week onwards, gradually reducing it to two times a day with an increased amount of concentrates, up to 0.2 kg a day. If the kids consume an adequate amount of concentrates, then a minimum of 25 litres of milk will suffice in the first six weeks. If concentrates are not available, more milk per day must be given for a longer period. At weaning, kids of improved breeds (50 kg mature weight or more) should weigh at least 7 kg and consume 0.2 g of concentrates per day.

After Weaning: the kid still needs good quality roughage and concentrates to continue its development. Often concentrates are considered too expensive for kids, but remember that the nutritive value of 1 kg of good quality concentrates is equal to that of 3 to 4 kg milk. The period after weaning is often the most difficult, especially if high quality feed is not available or is considered too expensive. Kid mortality is highest during the first 3 to 4 months.

Billy Kids: On most dairy goat farms billy kids are neither used nor needed. Rearing them costs money, so unless needed to stimulate their dams' milk let-down, sell or slaughter them as soon as possible. Otherwise, if they are crosses with meat type, they can be reared and fattened, when economically feasible. If young billy kids are kept for meat production, it is worthwhile to consider castrating them. This can best be done with an elastrator when (very) young. Ask the local veterinary or -assistant if in any doubt.

Suckling: Many local and crossbred goats will not let-down their milk without their kid being present. This does not necessarily mean

that the kid has to suckle first; often its close presence will do. If this is the case the goat will stop producing if her kid dies. Therefore try milking the goat without the kid. Some farmers allow the kid to suckle the last milk for 5 to 8 minutes. This may help to reduce mastitis, but as the last milk contains the most fat, the kid may get too much fat. It is better to leave (part of) one teat for the kid, but not always the same teat. In some areas goats are milked in the morning for home consumption or sale and thereafter the kid(s) join its dam and are allowed to suckle till midday or early evening. From then on until the next morning milking, kid(s) and dam remain separated.

Points to Bear in Mind When Rearing Kids

- Immediate provision of colostrum to the new-born kid is essential.
- Feed an adequate amount of milk from a clean bucket or bottle, right after milking the dam.
- Introduce special or good quality concentrates at about one week of age where possible.
- Start giving roughage during the second week, preferably good quality hay.
- Make sure the kid pen is dry, draught free with a slatted floor or adequate, tick free, bedding.
- Provide the kid with fresh and clean water from early age onwards.

Young Stock Rearing: The age of weaning is a point of discussion. With dairy goats one wants to have as much milk as possible for home consumption or sale, but the kid(s) also need milk. For meat goats milk is not a problem, the kid(s) can suckle all they need, there is no competition. When good quality concentrates and roughage are available dairy kid(s) can be weaned at about 6 weeks, or be fed artificial milk based on powder. Depending on the production orientation the farmer has to make a choice, but it always costs money, either through less income or by buying good concentrates. If goat milk fetches a much higher price, kids can be reared with cow milk.

After weaning many kids are fed on roughage alone, but (often) this is not enough for adequate growth. Generally, roughage needs to be supplemented with kid (calf) or young stock concentrates till the age of 1 year at least, though this depends on the roughage

quality and season. With good quality roughage, a growth of 20 to 50 grams per day is feasible. However, the required growth for a kid to conceive at about 7 months is 150 - 160 grams per day, necessitating that supplements of at least 0.25 kg of concentrates per day are provided.

Many farmers give the best quality roughage to their dairy goats and the young stock gets what is left. This hampers their development and they might remain stunted for the rest of their lives. Young animals need adequate nutrition and this investment will be repaid once the animal starts producing milk.

Once the young goat has kidded and started her productive life, rearing/ growth is not yet complete. She will continue growing and developing during the first lactation. The extra feed required, the 'youth allowance', is about 20% energy and protein above the daily maintenance requirements. This youth allowance must be taken into account to enable the goat to develop her production potential. Goats reach full maturity at 2 to 2.5 years of age, depending on the breed.

6.8. Artificial Insemination (AI)

Buck's semen can be successfully collected, frozen, and stored. There are hands-on courses available to teach Artificial Insemination (AI) skills so the goat owner can perform it themselves. Achieving good conception rates with AI may be difficult because of inaccurate timing of insemination and incorrect placement of semen. However, Artificial Insemination does offer some benefits.

- You do not need to own a buck.
- AI may increase the rate of genetic improvement.
- You have a greater variety of bucks to breed to.
- It reduces the possibility of transmitting a disease or parasite to your doe.
- You can carefully regulate the time of breeding and kidding.
- It promotes good record keeping of dates, heat, breeding, pedigrees, etc

6.9. Breeding Problems

There can be various reasons as to why a doe may not conceive once it has been serviced:

- Doe was bred at the wrong time
- Infertile buck or doe
- Ovary problems
- Infection in the uterus or cervix
- Health problems other than reproductive
- Nutritional problems in does

6.10. Castration of male kids

It is the removal or destruction of the testes, epididymis and a portion of each spermatic cord from a buck. Castration should ideally be done at less than three weeks of age. The importance of castrating male kids:

- To maintain and control the breeding programme
- To successfully carry out breed improvement
- To improve on farm safety for animals and handlers because castrated buck is usually less aggressive and easier to manage.
- To lessen goat smell: meat from castrated male has less smell than tainted odour in the meat from intact bucks.
- For improvement of carcass composition and weight development.

Note: It is important to let an experienced animal health practitioner show you how to do the castrations correctly before you do it yourself.

SECTION 7: DAIRY GOAT PRODUCTION

7.1. Dairy Goat Farming in Uganda

Dairy goat production is an alternative livestock enterprise suitable for many small-scale or part-time livestock operations. Some dairy goat farmers have been successful in pasteurizing goat milk and building an on-farm jugging business, while others have ventured into processed milk products for retail distribution, especially specialty cheeses, yogurt, soap, and lotions. The potential also exists for selling milk to processors, usually on a regional basis. Although fluid milk and processed products are important markets, dairy goat producers should also consider the potential for selling animals to hobbyists and youth involved in vocational agriculture dairy projects.



Dairy goats (Source: NET)

According to the Dairy Development Authority (DDA), the dairy sector has over time, experienced a rapid growth from 1.5 billion litres in 2008 to 2.81 billion litres in 2020 earning the country foreign exchange valued at \$139.5 million in 2019. This is attributed to the dairy cattle with the contribution of the goat industry to the overall dairy industry unknown and not quantified. However, dairy goat farming in the country has been under developed and non-regulated overtime yet it has an enormous potential for improved

health wellbeing.

7.2. Importance of Goat Milk in Human Nutrition

- Goat milk provides many nutritional and health benefits that cows' milk may not (Table 5).

Table 5: Comparison of average milk composition

Nutrient	Human	Cow	Goat
Energy (kcal/100 ml)	68	69	70
Lactose (%)	7.3	4.7	4.1
Protein (%)	1.1	3.5	3.2
Fat (%)	4	3.6	3.8
Cholesterol (mg/100 ml)	20	15	12
Ash (%)	0.2	0.7	0.8
Calcium (%)	0.04	0.18	0.19
Phosphorus (%)	0.06	0.23	0.27
Iron (%)	0.2	0.06	0.07
Vitamin A (IU/g fat)	32	21	39
Vitamin D (IU/g fat)	0.3	0.7	0.7
Vitamin C (mg/100 ml)	3	2	2
Thiamin (μg /100 ml)	17	45	68
Riboflavin (μg /100 ml)	26	159	210

Source: Robert J. Van Saun. 2022; kcal/100 ml is a measure of energy content. 1 kcal = 1,000 calories; IU = international unit, a measure of vitamin potency; μg = microgram, 1/1000 milligram

- Goat milk is more nutritious and has medicinal value over that of the cow.
- It has smaller fat globules size which is more digestible compared to cow milk.
- Studies have shown that goat milk can help reduce cholesterol in the arteries and gall bladder. This can help people with high cholesterol control their cholesterol more efficiently.
- While goats are much smaller than cows, a good dairy goat can provide around 3 litres of milk per day while they're lactating.
- Goat milk proteins are more digestible and their amino acids are absorbed more efficiently, than those of cow milk.

- Goat milk is similar in composition to cow milk, but some important differences exist in the protein structure.
- Goat and cow butter may have a similar consistency, but the flavours are different, the melting points are dissimilar, and the nutritional benefits differ. Additionally, goat milk butter is white or translucent compared to cow's milk. Some say goat butter has a grassier flavour than what they're used to with cow butter.
- One of the most incredible things about goat butter is its lower melting point. This means it takes less heat to melt the butter, making it more spreadable right out of the fridge. When used for frying, or cooking in general, the flavour difference between goat butter and cow disappears. When used for baking, goat milk butter may provide a different texture to cookies and cakes.
- One thing that most agree on is the texture of goat milk ice cream. It's intense and thick compared to cow's milk. And more often than not, goat milk gelato is considered a luxury ice cream.
- Goat cheese, often called chevre, is a decadent, full-flavored cheese with a deep, creamy texture. Aside from chevre, you can also make different cheeses, like cheddar!
- It has particular benefits in the diet of children and adults who show sensitivity or allergic reactions to cow's milk.
- Often, goat milk cheese is mixed with other milk cheeses, like cow's milk, to reduce some of the "goaty" flavours that are usually identifiable in whole goat milk cheese. Chevre has the consistency of cream cheese and pairs well with crackers, bagels, and wine.
- Goat milk soap is touted as more moisturizing than regular bars of soap and more natural.
- Goat milk lotion is a fantastic type of lotion because the chemical process to make the lotion is nothing like the one used to make soap. This is why the benefits of goat milk remain intact. Goat milk lotion is typically less greasy than other kinds of cream, and it's not as harsh on the skin. In other words, goat milk lotion is quite gentle.
- According to information published in the Monitor Newspaper, Uganda (17th March 2021), goat milk contains calcium, potassium, highly-soluble less-allergenic proteins,

digestible fats and energy-producing substances, all of which are essential in boosting the immunity of the people living with HIV/AIDS.

- Some people with allergies to cow milk may find that goat milk doesn't trigger their allergies.
- *“On the recommendation of our scientists and researchers, we are bringing the Toggenburg breed, a dairy goat that has been found to withstand conditions here,”* said Dr. Beine, Executive Director, National Animal Genetic Resources Centre and Databank (NAGRC&DB). He further said that a study by a Turkey's scientists Nazli Turkmen, which was published in a scientific journal Science Direct in 2017, shows that goat milk has high amounts of important substances called conjugated linoleic acids, which cause immune stimulation, growth promotion, and disease prevention.
- Many hospitals in Uganda recommend consumption of goat milk to HIV/AIDS patients because it has high protein molecules; are better absorbed than other proteins, therefore they are known to strengthen their antibodies. Scientists at the National Animal Genetic Resources Centre and Databank in Entebbe will start making HIV/AIDS treatment tablets from goat milk.
- Currently, goat milk is more expensive (US\$ 5,000 to 8,000 per litre) compared to cow milk (about US\$ 1,000 to 2500 per litre) due to urbanization.
- Non-dairy breeds of goats in Uganda have daily milk yield up to 0.5 litres while specialized dairy goat breeds, including the Nubian, Saanen, Alpine and Toggenburg under good management could give over 3 litres per day.
- Goat milk products are; cheese, flavoured goat milk powder, goat milk yoghurt, goat milk colostrum, pasteurized goat milk, yoghurt and bottled juice of milk.

7.3. Nutrition of Dairy Goats

To maintain milk production and good health, goats should be fed a diet balanced for energy, protein, minerals, and vitamins. To reduce costs, forages such as hay, silage, and pasture should constitute most of the daily diet. Goats are efficient browsers and can select a high-quality diet from lower-quality forages, especially

when consuming nontraditional pasture plants (e.g., weeds, shrubs). Available forages should be evaluated based on plant species and maturity, with the highest-quality forages reserved for pregnant, lactating, and growing animals.

Supplementing the diet with grain mixes to provide additional energy and protein is important, especially during lactation (Tables 6 to 8).

Table 6. Example of grain mixes with varying protein content for goats (Concentrate Protein Content (% of mix))

Ingredient	14.0% protein content	16.0% protein content	18.0% protein content	20.0% protein content
Cracked or rolled corn	40.0	35.0	29.0	24.0
Rolled oats	20.0	20.0	20.0	20.0
Soybean meal (44%)	17.0	22.0	28.0	33.0
Beet or citrus pulp	10.0	10.0	10.0	10.0
Molasses	10.0	10.0	10.0	10.0
Trace mineral salt ¹	1.0	1.0	1.0	1.0
Limestone ²	1.0	1.0	1.0	1.0
Dicalcium phosphate ²	0.7	0.7	0.7	0.7
Magnesium oxide	0.2	0.2	0.2	0.2
Vitamin premix ³	0.1	0.1	0.1	0.1

Source: <file:///C:/Users/dell/Downloads/ua447.pdf>

¹Must contain adequate selenium in deficient areas.

²Amounts can be varied to adjust to legume or grass forages.

Tables 7 and 8 show examples of concentrate mixtures for dairy goats.

Table 7: Suggested dairy meal rations to be fed daily

Type	Quantity per day
Dry female	0.5 kg
Female milking 1 litre	1.0 kg
Female milking 2 litres	1.5 kg
Female milking 3 litres	2.0 kg
Female milking 4 litres	2.5 kg
Female milking 5 litres	3.0

Table 8: Examples of a concentrate mixtures for dairy goats

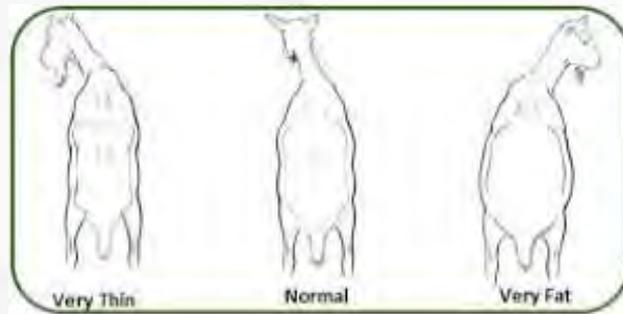
Ingredient	Concentrate mixture 1	Concentrate mixture 2
	Quantity (kgs)	
Maize bran	7	7.5
Soyabean meal	0	1.5
Meat bone meal	1.5	0
Cotton seed cake	1.5	5.0
Salt	0	3.0

Grain mixes may also contain supplemental minerals and vitamins. Feeding grain should be limited because a high-grain diet with low fibre intake can lead to rumen health problems (e.g., indigestion, acidosis) and lower milk fat content. Availability of dietary energy is important for high milk yields, while protein and fiber affect milk quality. High-producing does require quality forages and supplemental grain at a rate of 0.5 kgs per 2.5 to 3 litres of milk.

Forages generally do not contain sufficient minerals to meet dietary requirements, so supplements are usually required. Mineral mixes of salt with calcium, phosphorus, and trace minerals are typically used. Legume forages (e.g., alfalfa, clover) contain sufficient calcium and will only require phosphorus with a trace mineral supplement.

If pasture is the predominant source of forage, then vitamin supplements are not critical. If only hay or silage is used, then supplemental vitamins A, D, and E will be required. Vitamins can be supplied in a free-choice mineral source or the grain mix. Commercial cow rations or custom grain mixes varying from 14 to 20 percent protein can be fed to goats (Table 6). Most products formulated for sheep will not contain enough copper for goats.

It is important to routinely use a technique called “**body condition scoring**” to evaluate the adequacy of the nutritional program you use. Body condition scoring for goats uses a range from 1.0 to 5.0, with 0.5 increments. Healthy goats should have a body condition scoring between 2.5 to 4.0. Goats with a body condition scoring of 1.0, 1.5 or 2.0 indicate a management or health problem.



Body condition scoring

Does should have adequate (score 3) body reserves in late pregnancy as they enter lactation. High-producing does lose significant body condition during early lactation, but they should regain it again during late lactation and early pregnancy.

7.4. Good Quality Milk

- Good quality milk is produced by healthy goats;
- It is not contaminated with water, dirt, antibiotics, detergents and bacteria during or after milking;
- It does not smell or taste bad;
- It is not deliberately adulterated with water, sugar, salt or flour (addition of water, in particular, may cause contamination by microorganisms and pose a threat to human health);
- It is stored and transported in a proper way;
- It is a healthy food.
- Clean milk

7.5. Factors Affecting Milk Quality

Clean milk production depends on:

- (a) The milker,
- (b) The goat,
- (c) The milking utensils and equipment used,
- (d) The shed including the milking place and,
- (e) The handling of milk.

(a)The Milker

The milker should be healthy, clean, have clean hands with short fingernails and wear clean clothes. He or she should milk the goat paying full attention to the task and not smoke, spit or cough while milking. The goat should be milked as quickly and completely as possible, and preferably always be milked by the same person. By calm and gentle handling, touching the goat, talking to her and maintaining routine actions during milking, she will feel at ease. Provide the goat with concentrates during milking.

(b)The Goat

To prevent dirt from dropping into the bucket during milking it is advisable to shave the hairs of the udder twice a year, especially around the teats. Brush the hair on the flank of the goat on the side of the milker frequently. The goat should be without diseases. Milk from goats with mastitis is not suitable for human consumption.

(c)Milking Utensils and Equipment

Buckets, milk cans and cloths for cleaning the udder and cloths used for straining the milk are frequently the source of bacterial contamination of the milk. The surface of the milk utensils like the buckets and cans should be smooth and without seams and have rounded edges to make them easy to clean. Stainless steel is the best material but it is expensive. Good plastic buckets can be used if well taken care of. Aluminium milk cans are often used for transport. Special care should be given to cleanliness of the cans, including the lid.

Udder and straining cloths need careful cleaning too. Paper towels for udder cleaning and disposable cotton pads for straining the milk are recommended, but may be expensive or not available. A strip cup for routine mastitis testing can be made from an empty tin and a piece of black inner tube.



A strip cup

It is essential to use clean water for utensil cleaning. The procedure is as follows:

- Immediately after milking, rinse all the utensils with cool water to remove milk residues. It is rather difficult to clean utensils after the milk has dried and sticks to them. Use cool water, as hot water for rinsing will make the butterfat stick to the utensils. Rinse the milk can with cool and clean water immediately after milk delivery.
- Brush all utensils thoroughly with hot water and detergent or soap. Keep separate brushes for the inside and outside of the utensils.
- Rinse all utensils with clean, cool water to remove dissolved dirt and detergent.
- A second rinsing with a disinfectant may be considered.
- If no disinfectant is used or available, the milk cans and buckets should be left drying upside down on a rack in the sun. The sun kills bacteria and acts as a disinfectant. Rinse again with cool water before use to remove dust. If a disinfectant is used the utensils can be stored inside, upside down. Never dry utensils with a towel or cloth.
- Rinse the cloths after milking and hang them outside, if possible in the sun to dry. Once a week the clothes should be washed or boiled with hot water and soap, rinsed and left to hang drying outdoors, exposed to the sun.

(d)The Shed and The Milking Place

Cleanliness is important within the goat house, also important for fly control. Special attention should be given to the resting place

(slatted floor/ clean and dry bedding materials), but watch out for tick infestation in the bedding materials. Maintain high standards of hygiene in and around the shed with proper drainage and facility for storage of manure. Use insect sticky traps to control flies in the shed.

(e) Milking and Milk Let Down

Milking deserves full attention, because it affects the yield, lactation period, butterfat percentage of the milk and the health of the udder. Milking should take place in a quiet place without shouting and yelling so that the goats feel at ease. This is achieved through a routine process with the usual milker who talks and acts quietly.

Feeding of fresh roughage or concentrates will trigger milk let down. A good cleaning and massage of the udder is necessary for the goat to feel at ease and stimulate milk let-down. The swelling of the teats is the sign to start milking. Sometimes the presence or even the suckling of a kid is necessary to stimulate milk let-down. Milking should not start before let-down has occurred. The let-down lasts for about 5 to 10 minutes and milking should be completed within that period. If the goat experiences pain or is stressed, this process will be disturbed and milk let-down will not occur.

(f) Preparation

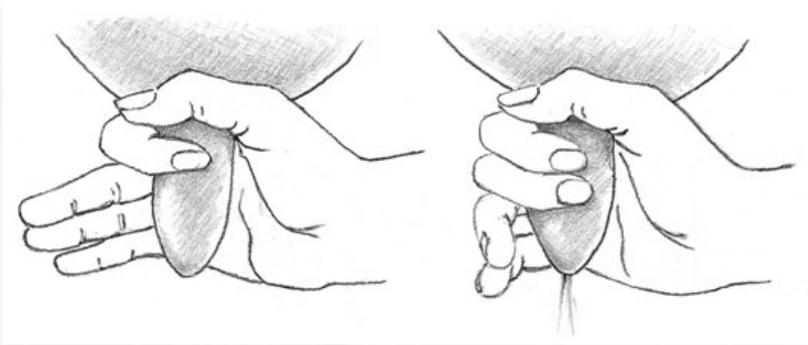
Inspect each part of the udder for mastitis before milking starts, by squirting the first 2 draws of milk of each teat in a strip cup. Some watery first milk is normal, the trained eye can recognise abnormal milk, which may show discoloration, flakes, clots or wateriness. The colostrum may contain some blood or blood clots.

It is best to sit on a stool, preferably on the right side of the goat. This will give the milker a stable position and prevents the goat from kicking the bucket, or dirt falling into it. For ease of milking a raised platform will be convenient. With a feeding rack they can be easily constrained. The platform enables the milker to milk the goat more comfortably (prevents “hanging” on the teats).

(g) Proper Milking

Full hand milking is recommended. Stripping is slower than the ‘full-hand’ method and may cause damage to the teat and udder tissue and hence increase the risk of mastitis. In ‘full-hand’ milking you close your thumb and index finger around the teat and extract the milk by squeezing progressively with each finger in turn, starting

with the index finger and using minimum pulling on the teat. In this way the milk is squeezed out of the teat.



How to hand milk a goat (Source: NET)

If the udder is not milked out completely, the drying-off process will be accelerated. This means that the milk production of the goat will gradually drop and the length of the lactation will shorten. The goat is thus 'milked dry' as she adjusts her production to the amount of milk removed during milking. It is better to use the dry method when milking. This means that during milking the milker should not dip the fingers in the milk in order to wet the teats. This is unhygienic. Although udder cream is frequently used to make the teats supple, it is better to apply it after milking.

(h) Milking Time

High yielding goats are milked twice a day and the interval should be as regular as possible, for instance, 6 am and 5 pm. If milk can be sold, sell it as soon as possible after milking and if it is for home consumption, boil it and let it cool down.

(i) Milking Procedure

Before milking, rinse the utensils and drain them properly. The noises will already stimulate the goat.

- Offer some tasty concentrates or roughage just before milking. Dry meal concentrates can be mixed with some water to make it easier to eat and prevent dust.
- If really necessary, tie the hind legs of the goat, but prevent wounds.
- Wash hands.
- Clean the udder and the teats, preferably by rubbing gently with a dry coarse cloth. Only use water if the udder and teats are very dirty and take care to dry well with a

cloth. If available, some udder disinfectant may be added to the water for cleaning. Follow the instructions for dilution carefully.

- Check the first squirts of milk of each teat in the strip cup for mastitis.
- Milk quickly paying full attention.
- Massage udder and extract the last milk.
- After milking, if possible, dip teats in a teat dip solution to prevent mastitis.
- Record the milk yield and pour milk into the can.
- Offer some roughage to the goat immediately after milking to keep her standing for about one hour. The opening of the teat will then dry and close and largely prevent the entry of mastitis-causing bacteria and dirt.
- After milking all the goats, rinse and clean the utensils.
- Clean the dairy shed and milking place.
- Deliver the milk as quickly as possible or boil and cool it.

Other Important Dairy Goat Precautions during Milking

- Always house/pen the doe and the serving buck in different pens to prevent smell in the milk.
- Make the milking parlour far from the buck pen.
- Wind direction should be from milking parlour to the buck pen and not vice versa.
- Always be calm, friendly to the doe and milk at the same time every day.
- Maintain similar milking position (Back position or side position).
- The nails on the hand of the milker should be short.
- Measure and record your milk immediately.
- Wash milk equipment with hot water.
- Rinse and dry on a rack immediately after milking.
- Avoid giving feeds with strong smells just before milking and during milking e.g. silage, pineapple, waste, etc. to avoid tainting the milk.
- The hair on the flanks and around the udder should be trimmed regularly and the goat brushed occasionally.
- Use of sprays/oils/soaps with smell by milker will taint the milk

After Milking Tips

- Irregular milking can lead to low yields and increased chance of mastitis.
- The kid should be allowed to suck the milked teat after milking for proper emptying of teat canal.
- After milking use a teat dip containing a suitable antiseptic e.g. tincture of iodine
- If possible same person should milk always.

Mastitis

- Goats with mastitis should be milked last to prevent the spread of the infection to other goats.
- Mastitis can reduce yields by at least 10 percent.
- Milk from sick goats, especially goats with mastitis should not be sold but be discarded.
- Isolate the goat with mastitis.
- Sick animals must be treated

Dry Off a Doe

If a doe has been served and is pregnant -special care is required during the 4th and

5th month as the embryo's gains weight rapidly.

- The does should be housed alone to avoid disturbance by the other goats.
- The doe is dried gradually, i.e milking is done normally, but the amount milked at every subsequent milking is reduced gradually until finally stopping.
- This prevents development of milk clots.

Milk Production

The lactation period for dairy goats averages 284 days, with peak production usually occurring four to six weeks after kidding. Volume and composition of milk produced are primarily controlled by the goat's genetics, but they are also greatly influenced by the diet consumed.

Dairy goats reach sexual maturity at four to five months of age. Young does should be bred at a body weight ranging from 32 to 37 kgs, which is usually at an age of seven to 10 months. The gestation period ranges from 145 to 155 days with an average length of 149

days. Does normally produce between one and three kids per year (single-born kids weigh approximately 3kgs at birth). Birth weights generally decline with multiple births and are often associated with increased mortality.

Quality of nutrition during pregnancy influences birth weight and kid survivability. Pregnancy nutrition becomes an important part of good management as twin births are desired in an effort to improve productive efficiency. Does giving birth to twins produce more milk and have greater total kid weight per maintenance doe unit. Daily weight gains after birth range from 50 to 150 grams per day, but meat goat crosses can exceed 250 grams per day. Rate of gain will be determined by diet and the end product desired (e.g., replacement or various weights depending on the meat market).

The three most important management recommendations to ensure efficiency and productivity of a dairy goat enterprise are as follows:

- Manage young does to have them ready for breeding at seven months of age. This increases the total lifetime herd production of milk and meat and reduces the number of nonproducing animals in the herd at any one time.
- Encourage freshening of the does over as wide a time span as possible. This provides your customers with a year-round source of milk.
- Cull animals to eliminate low producers. This can increase the herd productivity if animals are culled for genetic reasons.

Raw Goat Milk Downsides

The potential downsides and dangers outweigh the possible benefits of raw goat milk.

Because if it is not pasteurized, raw goat milk may contain harmful bacteria such as *Listeria*, *E. coli*, and *Salmonella*. Bacteria can get into milk through any of these mechanisms:

- A blood or udder infection in the animal
- Contamination with faecal matter during or after milking
- Contamination from humans handling the milk

Even raw milk from animals that appear healthy and live on farms with sanitary practices may be contaminated. Contaminated raw milk may lead to foodborne illness with symptoms such as vomiting, diarrhoea, and stomach cramping, as well as larger complications. While some people have mild symptoms after exposure, others may experience a serious illness that may require hospitalization and

even lead to death. Certain populations are at an increased risk of serious illness and death if they consume raw milk that contains harmful bacteria. These include:

- Infants and young children
- Pregnant and breastfeeding people
- Older adults
- People with compromised immune systems, such as those with cancer, organ transplants, or HIV

In other words, unpasteurized dairy has been linked to 840 times as many illnesses as pasteurized products. Therefore, as an unpasteurized dairy product, raw goat milk comes with the possible downside of causing foodborne illness. Consider the potentially serious consequences before you consume raw goat milk.

7.6. Raw goat milk vs. raw cow milk

The fat and protein content in goat milk have different compositions than those in cow milk (Table 9).

Table 9: Comparison of composition of goat and cow milk

Parameter	Whole goat milk	Whole cow milk
Calories	168	146
Protein	8.7 grams	8 grams
Fat	10.1 grams	7.81 grams
Calcium	25% of the Daily Value (DV)	23% of the DV
Potassium	11% of the DV	8% of the DV
Vitamin B12	7% of the DV	55% of the DV

Source: Michael Metzger (2022)

As a result, you may find that goat milk is easier to digest if you have trouble with cow milk. However, if you have an allergy to cow milk, you should not consider goat milk as an alternative. Most people with this allergy will also react to goat milk. Differences in digestibility aside, goat and cow milk boast similar nutritional profiles. Below is a side-by-side comparison of the nutrients in 1 cup (240 mL) of each milk.

Goat milk has more calories and fat, slightly more protein, and more calcium and potassium. Cow milk, on the other hand, packs more vitamin B12. Keep in mind that these are the nutritional values for pasteurized goat and cow milk. Nutritional info for raw varieties is not available but should look similar.

SECTION 8: ADDING VALUE TO GOAT MILK

Traditional Farmers kept a dairy goat for milk production only, however today with the introduction of different processing methods farmers can add value to the milk. Selling milk alone can be a challenge as fluctuation of milk prices affects a farmer's income. Milk can be added value to many products example Yoghurt, cheese, ghee and butter. Different processes are undertaken to add value to milk as will be described in this unit. In adding value farmers fetch more value-added products therefore increasing their net income.

8.1. Home Pasteurization of Raw Milk

Raw milk can be a source of dangerous microorganisms that pose serious health risks. Several foodborne illness outbreaks have been traced to drinking raw milk. Home pasteurization is a good safeguard against possible risk of illness. The heat of pasteurization kills harmful bacteria such as Salmonella, Listeria, and *E. coli*. These disease-causing bacteria can even be in raw milk that is produced with good sanitation practices. It important to pasteurize raw milk that will be consumed by people who are susceptible to foodborne illness. That includes pregnant women, young children, older adults, and those with cancer, HIV/AIDS, and other immune system diseases. For best quality, raw milk must be heated slowly during pasteurization. Use a double boiler or place a small saucepan inside a large pan or slow cooker.

- Put water in the bottom pan and bring it to boiling.
- Pour the raw milk into the top pan. Heat it over the boiling water, stirring constantly.
- Use a meat or candy thermometer to determine when the temperature reaches 165° F. and keep it at this temperature for 15 seconds.
- Set the pan of hot milk in a container of cold water. Keep the water cold by adding ice.
- Continue to stir until the milk is cold, then store in the refrigerator. Raw milk can also be pasteurized in a microwave oven. Heat to 165°F using a thermometer or temperature probe. Stir the milk once or twice during the heating period to equalize the temperature throughout. Cool as directed.

Pasteurization doesn't destroy the nutritional value of milk. The milk is still an excellent source of calcium as well as protein.

8.2. Basic Steps of How to Make Cheese

Ingredients

- About 4 litres of whole milk
- ¼ cup white or cider vinegar
- 1 pinch salt

STEP 1: Pour the milk into a large pot, and heat until the temperature reaches 195 degrees F (90 degrees C), or almost boiling. Stir constantly to prevent scorching on the bottom of the pot. When the milk reaches the temperature, remove from the heat, and stir in the vinegar. Let stand for 10 minutes.

STEP 2: Line a strainer with cheesecloth, and set over the sink or a large pot or bowl. The milk should separate into a white solid part, and a yellowish liquid (whey). Stir the salt into the milk, then pour through the cloth-lined strainer. Let the curds continue to drain in the strainer for 1 hour. Discard the whey or give it to pigs.

STEP 3: After the cheese has finished draining, pat into a ball, and remove from the cheese cloth. Wrap in plastic and store in the refrigerator until ready to use. Fresh cheese will usually last about a week.

8.3. Basic Steps to Making Homemade Yogurt

STEP 1: Heat the milk to 180 degrees Fahrenheit. This kills whatever unsavoury microbes may be lurking in your milk and ensures you've got no remnant bacteria, pathogens, mould, or spores. When you create an environment for bacteria to multiply, you only want the good bacteria (which you introduce to the milk) to multiply. Heating the milk also creates a thicker yogurt by changing the protein structure.

STEP 2: Cool the milk to 112-115 degrees Fahrenheit. After you've made the milk inhospitable for the bad stuff, you want to make it hospitable for the good bacteria – your starter mix. Use the same instant read thermometer you used when heating your milk, to know when it's cooled to 112-115 degrees.

STEP 3: Add your yogurt starter – the good bacteria. Pour out one cup of warm milk and stir in either a yogurt starter or 3 tablespoons of pre-made yogurt. For a good starter, look for lactic acid forming bacteria. At a minimum you want *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.

STEP 4: Stir the yogurt starter with the rest of the milk. This spreads the good bacteria throughout all the milk.

STEP 5: Pour the milk into jars and incubate for 7-9 hours. A consistent, luke-warm temperature is paradise for all your good bacteria and promotes their growth. The longer you incubate your yogurt the thicker and tangier it'll be. And after about 8 hours, you'll have delicious, healthy, thick and creamy yogurt.

STEP 6: Place the jars in the fridge to cool and set. Cool the yogurt in the refrigerator for a couple of hours. As the yogurt cools it will get even thicker.

It should go without saying that starting with the best quality ingredients ensures you'll have the best quality end product.

Dairy goats reach sexual maturity at four to five months of age. Young does should be bred at a body weight ranging from 70 to 80 pounds, which is usually at an age of seven to 10 months. The gestation period ranges from 145 to 155 days with an average length of 149 days. Does normally produce between one and three kids per year (single-born kids weigh approximately 6 to 6.5 pounds at birth). Birth weights generally decline with multiple births and are often associated with increased mortality. Quality of nutrition during pregnancy influences birth weight and kid survivability. Pregnancy nutrition becomes an important part of good management as twin births are desired in an effort to improve productive efficiency. Does giving birth to twins produce more milk and have greater total kid weight per maintenance doe unit. Daily weight gains after birth range from 50 to 150 grams per day (0.1 to 0.33 pound per day), but meat goat crosses can exceed 250 grams per day (0.55 pound per day). Rate of gain will be determined by diet and the end product desired (e.g., replacement doeing or various weights depending on the meat market).

The three most important management recommendations to ensure efficiency and productivity of a dairy goat enterprise are as follows:

- Manage young does to have them ready for breeding at seven months of age. This increases the total lifetime herd production of milk and meat and reduces the number of nonproducing animals in the herd at any one time.
- Encourage freshening of the does over as wide a time span as possible. This provides your customers with a year-round source of milk.
- Cull animals to eliminate low producers. This can increase the herd productivity if animals are culled for genetic reasons.

8.4. Goat Milk Ghee

Goat Milk Ghee is rich in proteins and calcium that helps bone and muscular growth, boosts energy levels and promotes overall health and wellness. Goat milk ghee also contains a lot of probiotics and nutrients that improves digestion and bowel movement.

How to Make Ghee

- First, start with butter. Or, if you own dairy animals, start by gathering fresh milk. Once you separate the cream and churn the butter, thoroughly wash it in cold water then let it drain. If you don't remove all the water, don't worry. It will evaporate within the cooking process.
- Next, heat the ghee on medium-low for at least 10 minutes. It's not the time that matters; it's the physical change, no matter how long that takes. First the butter will simmer and foam. Let it keep cooking until all the solids sink to the bottom then become crispy so you can drain them off. Let the ghee cool enough that it's easy to handle but not solid. Pour it through a fine mesh sieve into sanitized, dry canning jars.

8.5. Goat Milk Lotion Recipe

This easy goat milk lotion recipe is amazing for the skin, super moisturizing, and creamy. Made with raw goat's milk, shea butter, and coconut oil, this lotion is great for all skin types.

Ingredients

- Goat's milk
- Distilled water

- Coconut oil
- Shea butter
- Wax Emulsifier
- Citric Acid
- Linatural preservative
- Rosemary Extract (used as a preservative)

Tools

- Double boiler or a saucepan with a glass bowl
- Digital Scale
- Mixing bowl or half-gallon mason jar
- Immersion blender
- Kitchen thermometer
- Storage jars, I use wide mouth mason jars with airtight lids, or you can use a lotion dispenser with a pump.

Goat Milk Lotion Benefits

To make goat milk lotion, you obviously need goat milk. You can use any type of goat milk for this lotion. You will also need distilled water. The minerals found in tap water can throw the recipe off, causing it to spoil quicker.

For this recipe, you will need a fat such as butter or oil. Other options include sweet almond oil, a combination of shea butter and coconut oil, or cocoa butter.

To make this goat's milk lotion recipe work with a lotion pump, we are going to have to thin it out with water. As a result, we also will also need a preservative and an emulsifier. I am using rosemary extract and a wax emulsifier.

Just like making cold-process soap, making lotion needs to be precise, but it isn't hard once you get the hang of it. You will definitely need a kitchen digital scale to make sure all of your measurements are correct.

- Start off by measuring out your fats with a digital scale and adding them to a double boiler.
- Add in the emulsifier wax. Once the wax is melted, remove the pot from heat.
- While the ingredients are melting, add the liquid to a half-gallon mason jar. Place the mason jar in a pot of warm water to warm it up slightly.
- Mix the oils and liquid together. Blend for several minutes with an immersion blender.

- Using a kitchen thermometer, check that the ingredients are below 140 degrees before going on to the next step.
- Add in the citric acid, rosemary extract, and essential oils if using. Blend for an additional minute.
- Pour lotion into storage containers. Allow it to cool completely before putting on the lid and storing it in the fridge.

Recipe Notes

- The lotion will thicken as it cools back down to room temperature.
- If made correctly, the lotion will last 1-3 months.
- The recipe will make about 680 g of lotion.
- Goats milk lotion must be stored in fridge.

Best Essential Oils for Homemade Lotion

If you decide to add essential oils to your goat milk lotion, you will only need about 15-20 drops. Essential oils are very concentrated and it doesn't take much to scent your lotion. You can add in a blend of oils or use a single oil. A few of my favourite oils to add to lotion or whipped body butter are lavender, frankincense, chamomile, and geranium.

Do I Need a Preservative?

If you plan to use the lotion within one week, then you don't need a preservative. However, because this recipe contains goat milk and water, it is important to add a preservative if you plan to make a large batch and use it for a while.

Best Natural Preservatives

You can use Rosemary antioxidant extract as a preservative as it is a great natural option. Other preservatives you can use are Linatural. It protects against yeast, mould, and other bacteria. Salt, lemon juice, grapefruit seed extract, and citric acid are other popular natural preservatives. Goats milk lotion in decorative pumpable container.

Wax Emulsifier for Lotion Making

Emulsifiers are binding agents that mix the water and oils together. They are often found in face moisturizers, cosmetics, and lotions. The added wax emulsifier will help the lotion last longer as the oil and water will not separate and mould. You can use beeswax, but I find it to be too thick for this lotion. I prefer to stick to lighter waxes to keep that smooth, creamy texture.

Goats, for the most part, are a hardy species that require only basic necessities to survive and produce a quality product. Most herd problems are related to nutrition and reproduction, but a few diseases are of concern. Some goat diseases can also infect people, so handlers must be careful. Seek the services of a veterinarian to help you develop an appropriate herd health program.

Just as in human health care, the rule applies “**It is better to prevent than to cure**”. It saves a lot of money and problems if goats are and remain healthy, because of good care:

- Provide adequate, well ventilated housing and clean the housing frequently, maintain a strict hygiene.
- Provide adequate (quality and quantity) feed and water. Insufficient or incorrect feeding weakens the animals.
- Allow sufficient time for grazing. Avoid that the goats graze too often successively on the same pasture because this increases the contamination of the pasture with parasites like worms and ticks.
- It is impossible to remain completely free of diseases and parasites. Your goats may come in contact with other animals or their excrement during grazing. Therefore, the most commonly occurring diseases and parasites are mentioned.

9.1. Signs of a Healthy Goat

You can recognize a healthy animal by its behaviour, appearance and the correct functioning of its body processes:

- Goats are generally energetic animals and walk at a good pace. They are curious and have a bright look in their eyes. They have a good appetite and chew their cud when they have eaten enough.
- Their coat should be smooth and shiny, and the animal should not be skinny.
- If you look more closely at the appearance, start with the mucus membranes. These are good indicators of the general condition. A healthy animal has pink mucus membranes of the eye, mouth, nose and vulva.
- One of the most important life functions is the good consumption and digestion of feed and water. A good intake can be judged on the basis of the eating habits of the goat. A healthy goat also ruminates regularly while resting. A

healthy goat with a good digestion produces dung of many round and firm droppings.

- Other important body functions are good blood circulation, breathing and urination, related with heart, lung and kidney processes. The heartbeat of a healthy resting animal is, respectively for a young, yearling and mature goat, 110-120, 80-120 and 70-80 times a minute. The heartbeat is raised by high production levels or in highly pregnant animals. Calm breathing is a sign of good functioning of the lungs: for young, mature and old animals respectively 12-20, 12-15 and 9-12 times a minute. The proper functioning of the kidneys is seen by clear, yellow urine
- A practical indicator of the health is the body temperature. By holding a thermometer for at least one minute in the anus of an animal, its temperature can be measured. Young goats have a higher temperature, up to 39.0 °C = 102.2 °F. Mature goats have a temperature of about 38.5°C (101.3°F).
- The milk production, finally, is a characteristic life function of female goats. A healthy udder is soft and supple. Just before kidding it can swell up and harden without in fact being infected. The milk should have a homogenous consistency and must not smell strange. A decrease in the daily milk production is a sign that something is wrong. However, when a female goat goes into heat, its milk production may become somewhat less.

9.2. Diagnosis of a Sick Goat

- A sick goat can be noticed when it differs in behaviour from the rest of the herd. Especially for acute (quickly developing) diseases, the symptoms are often obvious.
- The sick animal may lose weight rapidly.
- Fast declining body condition.
- If the disease is contagious, other animals in the herd are in danger too, so immediate action is required.
- With chronic (long-term) diseases the symptoms are not as obvious. Sometimes you will only notice that a goat is losing weight and produces less. Such diseases are therefore difficult to detect.
- By comparing with other goats within the herd and of neighbouring herds, you should be able to see whether or not you are dealing with a chronic disease.
- Keeping up-to-date records will help you to detect health problems too.

9.3. Common Goat Diseases and Parasites

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
1. Peste des Petits Ruminants (PPR)	The disease resembles rinderpest. It is caused by a virus. Infection takes place by inhaling the virus which is released together with the nasal mucus of sick animals.	After an incubation period of 4-5 days, 6-8 days of high fever follow. Lesions of tissue in the mouth, inflammation of the mucous membranes with excessive nasal mucus production, diarrhoea. High death rate within one week. Secondary lung infections may occur. Affects mostly young animals.	Vaccination is effective. Limit the movement of sick animals to prevent the disease from spreading.	Treatment of sick animals is very costly but possible in an early phase. Killing them is better. Secondary lung infection can be treated with drugs.
2. Contagious Caprine Pleuro-Pneumonia (CCPP)	This form of contagious lung infection, is caused by <i>Mycoplasma mycoides</i> . It spreads by drops of nasal mucus. When kept permanently housed, the entire herd can be infected. Death rate can rise to 100%.	Rapid breathing with coughing. The animal groans when breathing out and usually secretes much nasal fluid. High fever.	A well-ventilated shed and vaccination	Arsenic preparations and antibiotics

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
3. Haemorrhagic septicaemia	Caused by Pasteurella bacteria. All ruminants can fall victim to it, especially in humid lowland areas or at the start of the wet season. Spreads through drops of nasal mucus. After having passed through a number of victims, the bacteria gets more aggressive. Stressed animals are more susceptible. Death rate: 80-90 % of the animals infected.	Incubation period 2 days, after that high fever, no appetite, rapid breathing, strong saliva production, rapidly developing eye infection, mucus membranes red and swollen. If the disease is less acute, symptoms are: infection of throat and tongue. Suffocation is possible. Bloody diarrhoea in later phase of the disease.	Preventive vaccinations are available, to be given 1-2 months before the hot/wet season when the disease manifests itself strongly.	With sulphonamides and/or antibiotics
4. Foot-and-mouth disease (FMD)	This viral disease affects, mouth and hooves but also the udder and the teats of goats. The disease is transmitted by direct contact, via contaminated food, by vaginal discharge, by placenta, through the wind or by birds.	Incubation time 3-8 days, followed by excessive saliva production and frothing at the mouth. Small blisters are formed in the mouth and on the legs. The goat has difficulty walking and limits its own movements. Animals do not die from the disease, but their production of milk and growth decreases or stops during the illness.	Vaccination is possible. If only isolated groups of goats are affected, slaughtering those animals is an effective way of limiting further spreading of the disease. Quarantine of sick animals, disinfection of all animals (foot baths) and prohibiting transport of animals at district or provincial level may limit the outbreak.	Keep them eating by offering tasty soft feeds.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
5. Anthrax	Anthrax is sporadically found among goats. Cattle, sheep, pigs, horses and humans are susceptible to this disease. The organism causing the disease is the bacterium <i>Bacillus anthracis</i> . Transmission via water and food which is contaminated with blood and excrement.	Incubation time 1-3 days or more. Initial symptoms are very high fever and sudden death. After death, blood flows from the body openings	Annual vaccination campaigns are very effective. To avoid the spreading of the disease, carcasses of dead animals must be completely burnt or buried in unslaked lime (quicklime) 2 meters underground. This is to prevent possible spreading via scavengers (also dogs). Do not open the body, autopsy to determine cause of death should be done only by highly specialized personnel because of high risk of infection. It is safer to assume that the sudden death of animals was caused by Anthrax (if there is reason to suspect this) and to dispose of the cadaver as described. Consumption of this meat is very dangerous!	Antibiotics (curative) are effective, but due to the rapid development of the disease, treatment is often too late.
6. Ecthyma or Orf	Especially in the humid tropics, this disease often occurs among goats but is usually not very serious. The disease is highly contagious through direct contact.	Sores in and around the lips. Due to sores growing and merging, at a certain moment goats can no longer eat and rapidly get very thin.	Provide adequate housing. Vaccination is recommended for young animals in infected pens, by brushing the vaccine on a small, lightly scarified skin area.	Isolation of contaminated animals and frequent disinfection of the sores. Provide some tasty and "soft" feeds. Kids after weaning very vulnerable, especially when in the phase of changing their front teeth.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
7. Brucellosis	This form of infectious abortion frequently found among goats is especially well known as it can be transmitted to human beings causing Malta fever. It is caused by bacteria.	Abortion takes place in goats as a result of Brucellosis. However, the goat is not always obviously sick. The infection does, however persist and the carrier does not get pregnant again. There is a danger that the Malta fever is transmitted to humans if they drink contaminated un-boiled milk or consume fresh goat cheese.	Vaccination. Always consider the possibility of Brucellosis if abortion occurs in a goat. If possible, let a milk sample be tested for the presence of the bacteria. For your own protection, boil the milk before use.	Kill infected animals.
8. Blue tongue	This disease is caused by a virus that is transmitted by midges, which are most found in warm and wet condition	Fever and/or high temperature, tongue and gum ulcers, blue tongue	Use of midges repellent, Vaccination is available - consult animal health practitioners	Animals with blue tongue disease are susceptible to pneumonia and they must be treated. Use oxytetracyclines products only if indicated Bluetongue is a Notifiable animal disease and must be reported to either an animal health technician or a state veterinarian

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
9. Heartwater	This is a tickborne disease. The organisms that cause heartwater are called <i>Ehrlichia ruminantium</i> . The organisms are transmitted by Bont ticks, which are mainly found in hot, dry bush areas. Heartwater can result in death within 24 hours, but some cases survive two to five days.	High temperature and nervous signs which include high stepping jerky gait, shivering, walking in circles. Later, jerky, paddling movements with the legs and the head pulled backwards when the animal goes down. The dead animal's post mortem will show excessive fluid in the heart sac, lungs, chest cavity and abdominal cavity.	Try to maintain the animals' immunity by letting a small number of ticks stay on the animals all the time. However, when there are visibly many ticks on the goats, dipping about once a month may be necessary. For vaccination, animal health practitioners must be consulted	Treat the animal early before nervous symptoms show Use oxytetracyclines product
10. Mastitis	Mastitis or udder infection is a disease found all over the world. Both acute and chronic forms exist. Bacteria are usually the cause. In particular poor hygienic conditions in the shed, unhygienic and improper milking provokes the disease. Production decreases among affected animals and the milk is not suitable for human consumption.	Sick animals have a swollen udder, sometimes it is only partially affected. The milk can become lumpy and stinking. The goat does not permit its young to drink and does not like to be milked.	Hygiene during milking and proper milking technique. Use a strip cup for early detection, look for flakes in the milk.	Milk the infected udder empty as often as possible and massage it, at least 4 times per day. Inject antibiotics into the udder via the teat opening and canal after milking it empty.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
11.Pneumonia	Pneumonia is a disease of the lungs which occurs frequently in young goats. Cold and wet weather and cold draughts increase the risks of this disease. It can be caused by virus, bacteria, lung worms or fungus.	Loss of appetite, cough, dullness in appearance, nasal discharge, breathing difficulties and fever. The kids may die.	Good housing (ventilation), proper management and good feeding. Provide a good goat shed which should not contain too many animals. Deworm the goats when necessary and feed them well.	Keep the sick animal warm and separate, giving it good feed. Treatment with antibiotics may help.
12.Bloat	Bloat can be caused by a physical obstruction in the throat but more often an excessive intake of feed which quickly starts to ferment in the rumen causing a sudden accumulation of frothy gasses in the rumen of the goat. Especially fresh wet green fodder which has been heating up for some time on a heap can have this effect. Excessive consumption of fresh forage legumes like alfalfa often causes this problem. Tuber crops which are no longer very fresh and sour grasses can have the same effect.	Sudden and rapid swelling of the rear of the body, especially in the left flank. Loss of appetite. They are frightened, jumpy, breath rapidly and become dazed when short of breath. They wobble and finally collapse, after which they often quickly die due to suffocation or heart dislocation.	Goats should slowly get used to a new kind of feed. Before grazing green and wet pastures, feed the animals some dry feeds (straw and hay) or put them out for grazing later in the day.	Rapid handling is essential. If this is due to the accumulation of gasses in the rumen, position the animal so that the front of its body is raised and get rid of the gasses (make the animal burp) by pushing on and rubbing the left flank. You can also try to insert a firm hose into the rumen via the gullet so that the gas can escape. Make sure that the hose does not enter the windpipe! Let the animal drink at least 0.5 litres of vegetable oil as an alternative. In serious cases, make an opening in the left flank through the skin and the wall of the rumen. Use a trocar (thick, hollow needle) or scissors which you turn a bit. Leave the trocar or scissors in the flank until the gas has escaped. Disinfect the wound.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
13.Ketosis (Pregnancy Toxemia)	When goats are in late pregnancy and are unable to consume enough food to keep up with the extra demand for energy, they metabolize fat from their body stores and produce ketones.	Doe may be depressed, weak, or uninterested in food, doe has poor muscle control and balance, urine tests positive for ketone bodies, if untreated, death occurs within a few days.	Proper feeding of does throughout pregnancy	Consult a veterinarian
14.Caprine Arthritis Encephalitis (CAE)	Virus present in milk and colostrum of infected does	Kids experience paralysis, adults have swollen joints, paralysis, difficulty breathing difficulty and hard udders. Many does carry CAE but do not show it	Feed kids pasteurized milk and heat treated colostrum, when purchasing new goats, make sure that they are CAE free, test does for CAE before breeding and lower milk production	Consult your veterinary officer
15.Diarrhoea	Liquid faeces can be caused by a sudden switch from one kind of feed to another, from dry roughage to fresh, wet, young grass for example. Worms, liver fluke or a disease called Coccidiosis can also cause diarrhoea. Young and weak animals are most sensitive.	Liquid faeces. The animals become listless and eat little or not at all. They drink a lot and can be feverish. Due to dehydration they may die within several days. In case of worm infections and Coccidiosis it is possible to detect blood in the faeces. Anaemic symptoms (look at the mucus membranes) also indicate worms or Coccidiosis. A laboratory can confirm the diagnosis by checking the excrements	Good hygiene and preventing overcrowding are the best ways to avoid the disease. Provide forage in a rack or net. If possible, allow the animals to graze in the same place only 2-3 days in a row so that they do not become infected by eggs of internal parasites.	Let the animals fast for a day, keep them warm and dry. Give them unrestricted access to clean fresh drinking water, preferably boiled when used for kids. If the animals are too weak to drink, you must force them to do so! One tablespoon of salt and a handful of sugar per litre of water have a positive effect. Mash up some active carbon and give a teaspoon twice a day. In case of Coccidiosis treat all animals with sulphonamides, treat also animals that are not (yet) sick. Coccidiosis is very contagious.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
16.White Muscle Disease	A shortage of vitamin E and selenium.	Kids are born weak or dead, healthy kids suddenly become weak and die, digestive problems in young kids and respiratory problems in young kids	Give vitamin E-selenium injections to pregnant does at three to four weeks before kidding, inject newborn kids with vitamin E-selenium when they are one or two days old and consult your veterinarian	
17.Johne's Disease (Wasting Disease)	Bacteria infects young goats before they are seven to eight months old. The infection thickens the intestines and interferes with the animal's ability to absorb nutrients.	Seen in animals 3 to 5 years old; older animals may be susceptible but do not show symptoms. Affected goats slowly lose weight while temperature and appetite remain normal. Diarrhoea may develop during the last few days before death occur.	Purchase new or replacement animals from disease-free herds; isolate young stock from mature animals and provide good sanitation	Diagnosis can be made by blood sample or faecal culture. The disease is fatal and there is no known cure.
18.Coccidiosis	Goat ingests infected faeces that contain intestinal parasites called coccidian	Kids can look and feel fine while the damage is being done. Stunted growth, usually in kids less than seven months old. Occasional diarrhoea, dull and dry coat. reduced weight gain and sudden death	Prevent faecal contamination of feed and water. Ensure all housing is sanitary, clean;	A veterinarian can check a stool sample for coccidian and sulphadiazine or Amprolium
19.Scours	Kids not fed colostrum soon enough after birth, dirty environment, May be caused by bacteria, viruses, or protozoa and over-feeding.	Watery or discoloured faeces, loss of appetite, fever, rough coat, weight loss and dehydration	Feed colostrum within an hour after birth, disinfect navel in tincture of iodine right after birth, avoid overfeeding milk and ensure all pens are kept clean and dry	Reduce the amount of milk given, oral antibiotics may be necessary, isolate infected kids and feed electrolytes to replace lost body fluids

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
20.Sore Mouth	Contact with virus or scabs	Small pimples that turn to scabs or blisters at the corner of the mouth, lips, or on the gums.	Difficult to prevent unless you keep a closed herd, Wash hands thoroughly after handling and do not allow children to cuddle goats because this is a zoonotic disease and can spread to humans.	Iodine can be rubbed into the lesions after the scabs have been removed to dry out the area and reduce infection and sanitary precautions to prevent further infection.
21.Abscess	This is a swelling due to accumulated pus inside the thick wall capsule. This is caused by bacteria entering the wound or injury caused by ticks, grass seeds or thorns	Hot, red swelling and painful to touch. Middle soft spot and falling hair when swelling is at the bursting point	If an animal is affected badly and gets affected more often, culling is recommended Corynebacterium may be vaccinated for. Note that this organism is very contagious and may cause abscesses to spread (through equipment and facilities) within a herd	Cut, open and drain the abscess when it softens. Then syringe warm (boiled and cooled) water with a lot of salt (1 tablespoon of salt in a cup of water) or iodine into the wound. Spray daily with a wound aerosol. The wound must be kept opened and it must be flushed daily with warm (boiled and cooled) salt water to remove pus. Clean and disinfect the syringe after each use. The goat can also be injected with an antibiotic if it shows other signs of illness. Consult with your animal health practitioner NB: Bury or burn the material used to wipe the pus to prevent the spread of infection to other animals and people.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
22.Internal parasites	Infection with worms is a common occurrence. Worms can be found in the lungs, stomach, intestines and liver	Production and growth may decline even while no specific symptoms of disease show. Only if the infection is severe the animals will show it. Well-fed and cared for animals suffer less from parasites. Contamination with a few worms is unavoidable, should not cause worry and can even be useful in building up resistance against those parasites. However, too many worms weaken a goat. The goat gets more susceptible to diseases and may even die.	Avoid continual grazing by large herds. Otherwise a high level of contamination of grazing areas by worms will occur due to many larvae in the faeces. Management practices, such as rotational grazing and regular treatment of the animals against worms can prevent damage. As many parasitic worms are host specific, alternating the grazing of horses and/ or cattle with goats and/ or sheep can lower the extent of contamination of a pasture. Cattle eat the larva of the species which have the goat as host but which cannot harm the cattle and vice versa. De-worm both nanny and kids at weaning and keep the weaned kids separate from the rest of herd, if possible on a clean pasture. The presence of worm larvae in the field builds up during the rainy season. This is the most important time to protect your animals against worms or to de-worm.	Please note: when treating animals with de-worming medicines, the prescribed dose and method of administering it must be strictly followed. Overdosing is harmful for the animal. Especially young, weak and pregnant animals are sensitive. There is often local knowledge about medicinal plants which can be applied to help get rid of worms.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
23.Liver fluke (Fascioliasis)	The liver fluke causes much damage. It can grow to at least 3 cm long and 1.3 cm wide. The liver fluke lives in and damages the liver. By sucking blood, anaemia is caused.	The acute form, which occurs rarely, is an infection by very many flukes. The liver and stomach get badly damaged. Moisture enters the chest and stomach cavity as seen by the increased girth. The goat becomes sluggish, has difficulty breathing and can die within a few days. The chronic form leads to anaemia, sluggishness and thinning. Only rarely does death occur, in which case dozens of liver flukes are found in the liver.	Treat the entire herd. Prevent infection by avoiding swampy places when grazing. Ensure good drainage around the water troughs. Do not use any snail-killing chemicals as they are also very poisonous for other animals! Preventive regular dosing may be justified in some areas.	Apply worm cures which are also effective against young liver flukes. If re-infection might occur, in the wet season or in boggy pasture, repeat the cure every 6 weeks
24.Roundworms and tapeworms	These worms attach themselves to the stomach or intestinal wall and live off the tissue or blood. The larvae also migrate through these tissues, therefore these worms can cause severe damage to the goat's health. They cause anaemia, infections and poor functioning of the digestion. Tapeworms which are found in goats cannot be transmitted to humans, which is possible for those tapeworms found in pigs and cattle. By properly cooking or frying the meat, infection is prevented.	Decreased appetite, less lively, a coarse dry coat, anaemia and diarrhoea or constipation because of too many worms.	De-worming and rotation of grazing areas. Avoid contact with dogs.	Using worm medication for the entire herd.

Diseases/Pests	Causes	Symptoms	Prevention	Treatment
25.Lungworms	These are found at the mature stage in the lungs. They cause irritation of the bronchial tubes and possibly lung infection if present in large numbers. The eggs are coughed up, swallowed and get onto the land via the manure. Within one week there are already contagious larvae which are ingested with the feed. Via the intestines and blood they get to the lungs, where they mature further.	Coughing, los of weight and possibly lung infection.	See roundworms	See roundworms
26.External parasites	Certain kinds of flies, mosquitoes, fleas, lice, mites and ticks can, at some point of their life cycle, parasitize on goats.	They cause irritation of the skin which may lead to wounds. Furthermore, some of them can transfer diseases or internal parasites. A general characteristic of these kinds of organisms is that they multiply phenomenally fast.	General hygiene in the shed is the most important measure to avoid problems. Keep the immediate surroundings of the shed free of manure and other organic waste.	There are o numerous kinds of acaricides (for the mites and ticks) and insecticide (for the others) available to keep the parasites under control.
<p>Note: It is important to read the product label for dosage and instructions before administering any medication, wear protective clothing when handling animals (e.g. during treatment or vaccination) and disinfect equipment that are reusable. For prevention and treatment of diseases and conditions always consult animal health technicians and veterinarians</p>				

9.4: Biosecurity for Goat Production

Biosecurity is the protection of people, animals, and the environment from infectious disease, pests, and other biological threats. It refers to the proactive measures taken to exclude threats from farms that are disease free, and preventing spread of pathogens to other herds or flocks if/when a disease does occur. The ultimate goal of a good biosecurity plan is to implement easily attainable protocols that reduce problems to inexpensive and manageable occasions. The following are the key components of any biosecurity plan.

1. **Fences:** Good fences keep livestock in and wildlife out. Inspect boundary fences regularly and repair as needed. Stray stock may spread disease and feral animals introduce new pathogens to your farm.
2. **Housing, Equipment, and Yard Maintenance**
 - Pens should be completely emptied, cleaned, and disinfected at least annually.
 - All equipment that comes into direct contact with livestock or poultry should be cleaned and disinfected periodically, including feed and water troughs.
 - If sharing equipment with other farms, be sure to disinfect the equipment before using on your farm. Use your best judgement and weigh the risks carefully.
 - Prevent pests and rodents by:
 - ✓ Keeping area around pens free of debris.
 - ✓ Cutting the grass short around pens and enclosures.
 - ✓ Keeping feed in tightly closed containers and cleaning up spilled feed.
 - ✓ Using traps and bait as necessary.
 - ✓ Standing water should be drained.
3. **Introducing New Stock**
 - Do not bring new stock to your property if they appear unhealthy.
 - Avoid purchasing goats from markets and auctions.
 - Obtain a health certificate if possible.
 - Birds, eggs, and livestock should be sourced from farms with a solid herd or flock health program.

4. Quarantine

- Have a quarantine area available for animals new to the farm and for sick or injured animals. This should be a separate area or building to prevent bird-to-bird or animal-to-animal contact.
- Three weeks will allow time for a proper assessment of health, condition, and recuperation from transport or illness.
- Observe animals for any abnormal behaviour and signs/symptoms of disease. Presence of unusual behaviour or symptoms calls for veterinary inspection or tests.

5. Water and Feed

- Water should be tested at source to ensure its suitability for livestock production at least annually.
- Design and position water bowls, troughs, and waterers to prevent fecal contamination.
- Feed or ingredients should be purchased from sources that verify its safe origin.
- Keep feed pest-free and dry, cover feed bins and feed systems to reduce the chance of contamination.

6. Work Flow

- Farm owners and workers should have separate clothing and footwear for working around various animal species. These should be kept at the barn entrance.
- Use hand sanitizer or wash hands with soap and warm water before entering and after leaving livestock areas.
- Work with the youngest and most susceptible animals first.

7. Manure

- Manure should be removed from the production area regularly.
- Farms should have a manure management plan that includes collection, storage, moving, and disposing of manure to minimize chance of spreading disease.
- Tools and equipment used for manure handling should not be used for feed or bedding.

8. Herd or Flock Health

- Contact your Veterinary officer when livestock appear sick, mortalities are high, or production drops off without

apparent reason. Low numbers of mortality should be examined by a vet if the cause of death is unknown.

- Mortality should be disposed of in a timely manner to prevent contamination of the farm environment, reduce risk of spreading disease to other livestock and humans, and prevent attraction of pests.
- When animals are stressed from parasites, weather extremes, etc., natural treatments may be less effective. Monitor carefully and resort to other options as necessary. As well, remember that sick animals benefit from remedial care.
- Vaccinate as required (keeping the necessary records).
- Pay attention to parasites. Fecal egg counts are useful in determining if treatment is necessary.
- Keep records of treatments and veterinary care.

9. Visitors

- Discourage unannounced visitors.
- All visitors must follow biosecurity protocol.
- Designate a parking area for visitors.
- Visitors should be accompanied by farm staff.
- A visitor log is recommended.
- Post **“Biosecurity”** and **“No Entry without Permission”** signs on entrance doors.
- Keep extra footwear and outerwear (coveralls, smocks, etc.) for visitors.

Biosecurity is not limited to large-scale farms. Regardless of size or production philosophy, all farms, even hobby farms, have a responsibility to prevent an outbreak or spread of animal (or plant) disease or pests. Stay on top of industry association news. Be aware of local conditions or issues as they arise. If there is a serious disease outbreak don't be the last to know!

SECTION 10: ANIMAL IDENTIFICATION

All livestock must be marked or identified. There are two basic types of identification: permanent and non-permanent. Permanent identification includes tattooing, ear notches or microchips. Non-permanent identification includes paint, chalk and tags. Tattooing is one method of identification that is permanent if properly done.

Tattooing is considered to be the safest and lawful way of identifying goats so far especially when your goats are lost or stolen and are found. A disadvantage about this method is that one can cut off the tattooed ears. Other methods of identifying animals such as ear tagging and ear notching can be used together with tattooing.

10.1. Tattooing

Like a brand on a cow, a tattoo in the ear or on the tail web of a goat is the identification of the owner of the goat and what goat it is. In the right ear of the goat, the farm tattoo is placed and in the left ear is the letter of the year and the birth order number.

How to Tattoo Goats

- Put your goat in a stand and give them some grain. Have a partner to hold up the tail and restrain the goat if necessary, when you apply the tattoo pliers.
- Clean the inner part of the ear lobe thoroughly so that the ink can easily fill the holes made by the tattoo pliers.
- Apply or smear the tattoo ink on the area to be tattooed.
- Make sure that the sequence of the tattooing characters is correct according to the certificate of registration.
- Press the tattooing pliers until holes appear on the skin and then release.
- Rub the ink in to the holes.
- The excess ink can be cleaned and the characters should be easily readable as black dots in the ear.

10.2. Ear Tags

Ear tags are an easy way to permanently identify each goat in the herd. Unlike tattoos, they can be read without actually having to catch the goat.



Ear tag

Unfortunately, unlike tattoos, they can break or be ripped out of the goat's ear. Many farmers use two ear tags because of this problem.

Goats that are shipped are required to have a scrapie ear tag and these can be used for animal identification. Before putting in the ear tag, it is important to record what ear tag number is assigned to the goat. Ensure the ear tags are inserted between the cartilage ribs on the ears. The producer whose goats have been ear tagged will have an easy-to-read identification number which can be used for herd records.

10.3. Microchip

The insertion of a microchip in the base of the ear or tail web of the animal is another form of permanent identification. After insertion, the microchip should be scanned to ensure that it is reading correctly. Care should be taken in recording the microchip number against the tag number of the animal to ensure the integrity of the microchip identification. Exhibitors are required to provide their own reader at many livestock shows.

10.4. Ear Notching

Ear notching is commonly practiced in identifying goats. It has the advantage of being visible from a distance allowing identification without the necessity of catching the animal and can accommodate numbers up to 9999. An ear notching pliers are used to put "V"-shaped notches in the edges of the ear and a hole punch is used to punch holes in the middle of the ear, if necessary. The animal is restrained and notches and holes may be treated with iodine. As this process results in bleeding, the notching pliers should be disinfected between animals to prevent transmission of any blood-borne diseases

SECTION 11: RECORD KEEPING

Record keeping only makes sense if the information is used to evaluate the performance of the goat farm and as a basis for decision-making. The local extension officer can help with the analysis of the records and the economics of it. An annual cost-benefit analysis can be obtained by subtracting the total cost from the total income of the dairy. All of this can help plans for further developments of the dairy farm.

Technical information, like amount of concentrates fed, gives important management information when combined with prices and costs. Records about fertility, kidding interval and disease are the basis for management decisions. Technical and economic records can be combined and provide both the farmer and the extension officer with the required information about the actual situation on the farm and possible developments.

(1) Daily Records

In the daily routine of work it is convenient to use a diary to make note of all the events in order to transfer the information to the proper records at a more appropriate time. Recorded data should include:

- Purchase of inputs and sales,
- Price per unit and,
- Total value.

Examples are: feeds, fertilizers, equipment, animals, hired labour, veterinary (and reproductive) services. Dates of events should also be recorded. Most important are milk yield, heat period, services, births, diseases and treatments of animals as well as harvests and yields of crops. Be as precise as possible with such basic data.

(2) Animal Records

On a dairy goat farm the animals are the most important so relevant information about them should be collected. This information will help you with taking action like servicing and drying off and making decisions about whether to keep the animal or dispose of it. The best thing is to keep individual records of each animal. A card is used to record: births, services, and production data, drying off dates, kidding intervals, vaccinations and treatments.

(3) Financial Records

All activities on a farm are geared to raising an income for the farmer and his family. It is crucial to keep track of the money coming in and going out, so a simple system of income and expenditure will give much insight into the situation and will enable the farmer to make the right decisions.

The information from the diary can best be transferred to the records weekly and analysed at the end of each month. This will often give enough details and missing pieces of the jigsaw may still be remembered. The monthly overview provides good information for a situation analysis. Moreover, this can be used later for the yearly records and analysis.

To be able to calculate the cost price of the milk, all the direct cost have to be taken into account. These include; concentrates, fertilizers used for fodder, chemicals, drugs, minerals and hired labour. The cost of kid rearing is often offset against the income from culled goats. The cost of long-term investments, like building and fodder improvement can be estimated. This total cost can be divided by the total amount of milk produced thus arriving at the cost price per kg of the milk. The difference between the cost price and the received price is the reward for farmer.

Examples of Record Keeping Cards

(a) Herd Record

Name	Tattoo	Sex	Sire: Dam:	DOB (Date of birth)	Colour	Date Sold	Comments

(b) Inventory Record

Animal ID (Name/#)	Registra- tion #/ Tattoo	Descrip- tion (Breed, colour, marking, etc	DOB	Sex	Ownership Information	Purchase Price	Value
					Raised Purchased Date if purchased		
					Raised or Purchased Date if purchased		
					Raised or Purchased Date if purchased		

(c) Breeding record

Dam	Sire	Date Bred	Date Birthed	No. Born Alive	No. Dead at Birth	Comments

(d) Health Record

Name/#	Breed	Sex	Age	Illness/ Symptoms	Treatment	Date Treated	Cost of Treatment	Recovered from illness/ successful treatment

(e) Death record

Name/#	Breed	Sex	Age	Date Death	of	Cause

(f) Feed record

Situation Description	Method of Feeding	Amount of Feed
-	-	-
-	-	-
-	-	-
-	-	-

(g) Nutritional value of feed

Name of Feed	Type of Feed	Cost of Feed	Amount fed per day	Protein %	Fat %	Fiber %

SECTION 12: MARKETING

The main marketing issue for prospective dairy goat producers is market entry for their product. There are few commercial processors to whom raw goat milk can be shipped, so many dairy goat producers build on-farm processing plants to produce products such as pasteurized bottled milk, yogurt, ice cream, cheese, and kefir. Selling processed products directly on the farm or in the store does require additional management and marketing skills; however, profit margins tend to be higher per unit sold compared to selling to a commercial processor.

Some alternative uses for goat milk include creating health care products such as soap and lotion or as an on-farm substitute for milk replacer in lamb, veal, and pig diets. To use goat milk as an alternative feed source requires the dairy goat producer to buy and market lambs, veal calves, or piglets. Experience in managing and marketing these other livestock is also required, but it allows for the use of goat milk without state inspection.

Dairy goat producers must also realize that income from the kid goat crop is important. In addition to marketing the milk, the producer must also have a kid goat marketing strategy. It may be beneficial to raise kid goats to different market weights for different market seasons. Many ethnic groups are interested in purchasing kid goats, but producers must be aware of the desired weights and times when demand is greatest in such markets.

SECTION 13: RISK MANAGEMENT

You should carefully consider how to manage risk on your farm. First, you should insure your facilities and equipment. This may be accomplished by consulting your insurance agent or broker. It is especially important to have adequate levels of property, vehicle, and liability insurance. You will also need workers compensation insurance if you have any employees. You may also want to consider your needs for life and health insurance and if you need coverage for business interruption or employee dishonesty.

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