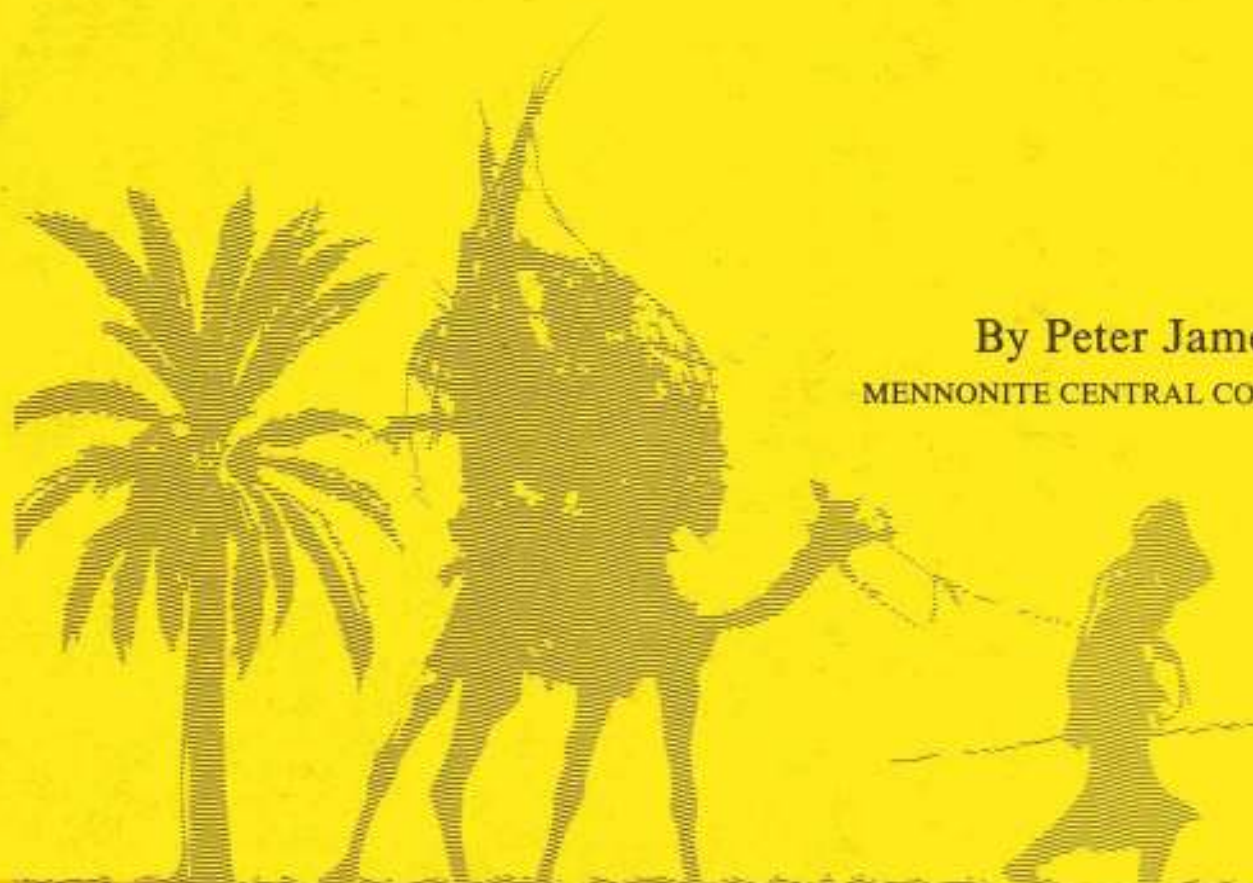


INTRODUCING THE CAMEL

BASIC CAMEL KEEPING FOR THE BEGINNER

By Peter James Grill
MENNONITE CENTRAL COMMITTEE



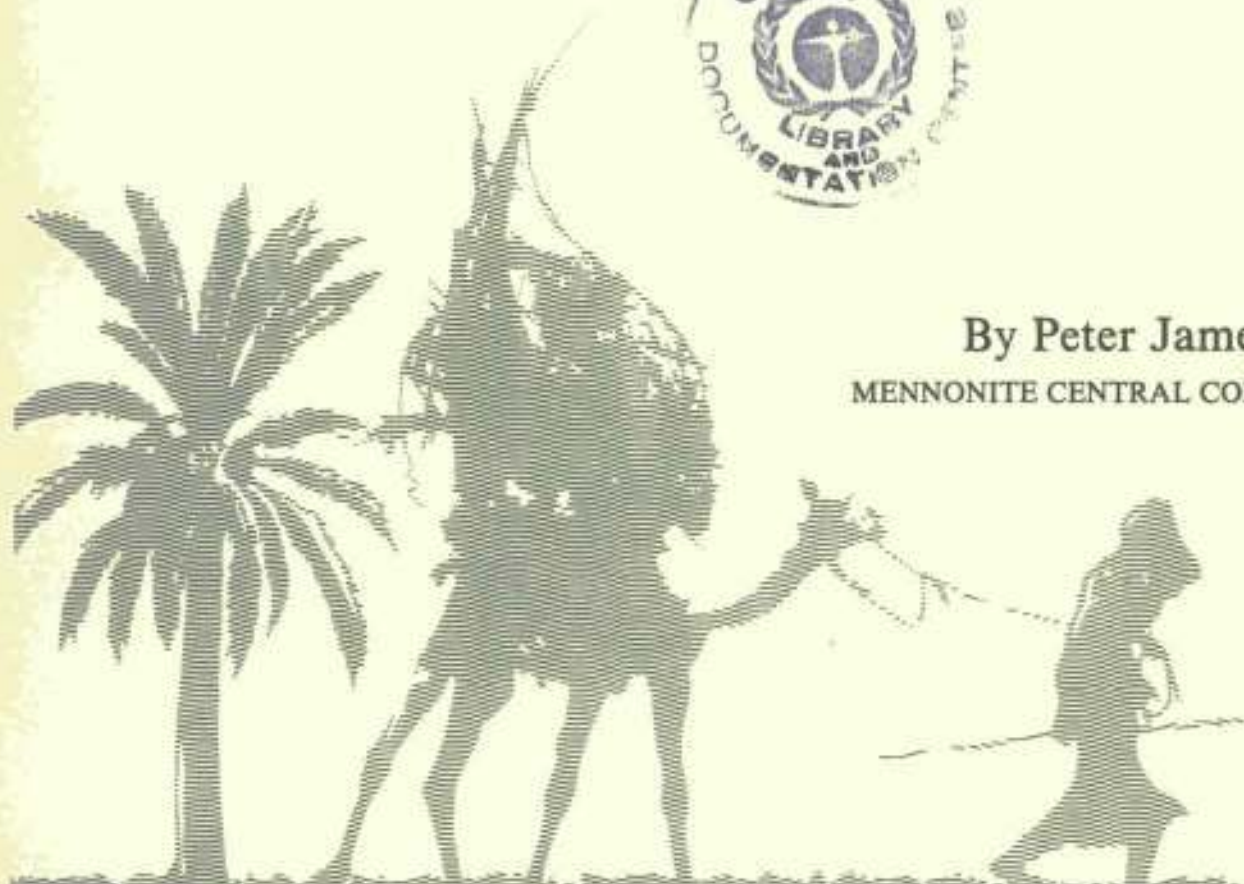
DESERTIFICATION CONTROL PROGRAMME ACTIVITY CENTRE
UNITED NATIONS ENVIRONMENT PROGRAMME

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ABSTRACT

Increasing droughts and desertification have struck Kenya with increasing frequency. This has put a severe burden on this country which receives less than 400 mm. of rain annually on over 70% of its area. Camel husbandry is perceived by many government and development strategists as a viable means of reducing the effects of drought and desertification. Livestock technicians and development agents are untrained in camel husbandry. The references available on camel husbandry are not designed with the field worker in mind. This handbook is meant to provide a concise yet basic resource on camel husbandry. It is designed to acquaint the field worker with a working knowledge of camels and camel husbandry in Kenya.

Various publications from the Kenya Ministry of Livestock were analyzed for form and content. The Dale-Chall Reading Test was applied to this text as well as the samples from Kenya to determine the reading level. The text was designed to reflect a twelfth grade reading level and sensitivity to the local culture. A glossary is provided to assist those who speak English as a second language or those who are unfamiliar with technical terms. Further testing will be done in the field before this manual is submitted for publication in Kenya. The present form represents a compromise between academic constraints and utility for the field worker.

The contents of this manual are designed to give a basic understanding in the historical importance and economic potential of Camelus dromedarius in Kenya. Various sections of this manual explore the ecosystem in which camels are found and how that ecosystem affects livestock production. It also explores the products provided by camels, and the work they can perform. Camel management is looked at from the context of health care, reproduction, and maintenance. Throughout the text the reader is exposed to traditional husbandry techniques as well as modern methods of camel husbandry. By referring to this resource, a person with basic skills in animal husbandry will be able to buy, feed, train, breed and provide basic health care for a herd of camels. The skills and knowledge of the local people should be used to supplement the material provided by this resource. This publication is intended to provide a practical rather than scientific contribution to the literature on camels. The addition of this resource to the literature will assist livestock keepers to cross-over from cattle and small stock to camel care.

ACKNOWLEDGEMENTS

The genesis for this project paper was the direct result of a vision held by one of those rare people who not only asks, "what if", but dares to follow it up. Thank you, Harold Miller, for thinking beyond the edge. The vision would have been lost if it had not been for the financial and spiritual support of the Mennonite Central Committee. Mr. Jasper Evans must also be acknowledged for the trust and patience he showed while sharing his camel knowledge with me.

Vision requires hard work and patience for its realization. Frances Weaver-Grill was both a patient supporter and active helper in this project. Also to be remembered for their active participation and assistance in this paper are my special committee members, Dr. Richard Tenney and Dr. Richard Hogue.

Finally I would like to thank the Weaver family for pointing me in the right direction. Keith and Joan Mousley deserve a note of appreciation for helping pave the way. My way has been blessed by having a port in every storm.

PROJECT PROBLEM

The perceived need for such a document is based upon requests I have received from government, non-government and private voluntary organizations for advice on implementing camel components in livestock development projects in Kenya. The need was also expressed by the Chief of Range Management in the Ministry of Agriculture and Livestock, Mr. L.J.Ayuko. At a conference held in March of 1984, at Marsabit, Kenya, on the significance and prospects of camel pastoralism, Mr. Ayuko said, "livestock extension workers are currently poorly equipped to deal with the development problems of camels. All of us who have some interest in arid rangelands...must do something towards camel development and soon" (Ayuko 1984). Hopefully, this paper will answer his call by providing readers with sufficient knowledge to begin working with local camel keepers. In the tradition of cooperative extension, this paper is intended to share existing knowledge found in the literature with the field workers and local livestock people. It is in no way intended to replace indigenous knowledge, merely to supplement and interpret it. It is perceived that this document should be both informational and instructive.

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PROLOGUE

As one travels across Northern Kenya they soon become aware of one of Kenya's overlooked resources. Vast herds of camels provide food and income for the nomadic livestock keepers who inhabit the arid and semi-arid regions of Kenya. Because of the camel's unique ability to withstand prolonged periods of drought, high temperatures and fierce dust storms it represents an important resource for Kenya's future.

Although these people are highly skilled at raising livestock under marginal conditions, the lack of veterinary inputs and improved husbandry techniques often limit their production potential. Assistance from livestock technicians, missionaries and development agents has been hampered by their unfamiliarity with camel husbandry.

This handbook is meant to help overcome this gap in livestock husbandry. This resource is designed to introduce camel husbandry to those people interested in expanding their livestock skills. Information was gathered from several sources on camel technology and put into one resource for easy reference. Hopefully its simple language and practical format will be of benefit to those people who want to expand Kenya's camel production to meet the future demands on Kenya's livestock sector. Those people interested in a more in-depth look at various aspects of camel production should look at the bibliography that follows the text.

1.0 - BACKGROUND INFORMATION

Livestock development planners have often failed to consider the importance of the dromedary when designing programs to improve the output of Kenya's livestock herds. One reason for this is the general misunderstanding of the importance of camels in Kenya's past and future. This chapter will:

- give a brief history of Camelus dromedarius
- identify the various ethnic groups that keep camels
- identify the areas in Kenya where camels are found
- describe the different types of camels in Kenya

1.1 - HISTORY

For the purpose of this paper, when referring to camels, it will be understood that the animal being talked about is Camelus dromedarius, also known as the Arabian or one-humped camel. The term bactrian will be used when referring to the two-humped camel, Camelus bactrianus.

It is believed that the earliest ancestors of today's African camels originated in North America in the Upper Eocene Period, about 40 million years ago. The early camelidae were probably the size of large rabbits. Later camels that migrated to other parts of the world, including Africa, were probably closer to the size and shape of today's camels. The earliest African camel stock is said by some authors to have been similar to today's Bactrian camels. The early stock eventually became extinct. When they migrated back to Africa they appeared more like the dromedaries found in Africa today.

The term dromedary comes from the Greek word "dromas" meaning "running".¹ It is a fitting name since many of the camels in Africa are fleet of foot and are used for racing.

About 4000 years ago the dromedary was domesticated in Southern Arabia. It is not known exactly when they were introduced into the horn of Africa. Today the largest concentrations of camels in the world are found in this region.

1.2 - CAMELS IN KENYA

There is some debate as to how the camel entered the Horn of Africa and ultimately into Kenya. One theory suggests that dromedaries spread West from Egypt and into the Horn. Another suggests that they came into the region from the Arabian Peninsula.² It is quite likely that the camel entered Kenya, in the modern era, from the North by way of the Gabbra people and the East from Somalia.

Historically speaking camels are a recent immigrant into Kenya. The Turkana are known to have had camels at the end of the 19th century. It is unclear whether they got them from trading with the Galla people or through conquests eastward as they drove the Merille and Samburu tribes out of their homelands. For an in-depth look at the camel's evolutionary beginnings, see The Camel, by R.T. Wilson (1984), or The Camel: Its Evolution, Ecology, Behavior, and Relationship to Man, by Hilde Gauthier-Pilters and Anne Dagg (1981).

1.3 - CAMEL POPULATIONS

It is difficult to say with certainty how many camels exist in Kenya because the camel keepers are primarily nomadic pastoralists who are constantly moving with their animals. They are no more willing to tell you how many camels they have than most Europeans would be to tell strangers how much money they have in the bank. This hesitancy to give a true herd count probably stems from the colonial days when they were taxed on their livestock numbers. Somalis have said that to count the numbers of camels is to wish destruction upon them. Camel surveys done by aerial photography and census reports give a range of herd numbers between 450,000 and 600,000.³

1.4 - CAMEL PEOPLE AND PLACES IN KENYA

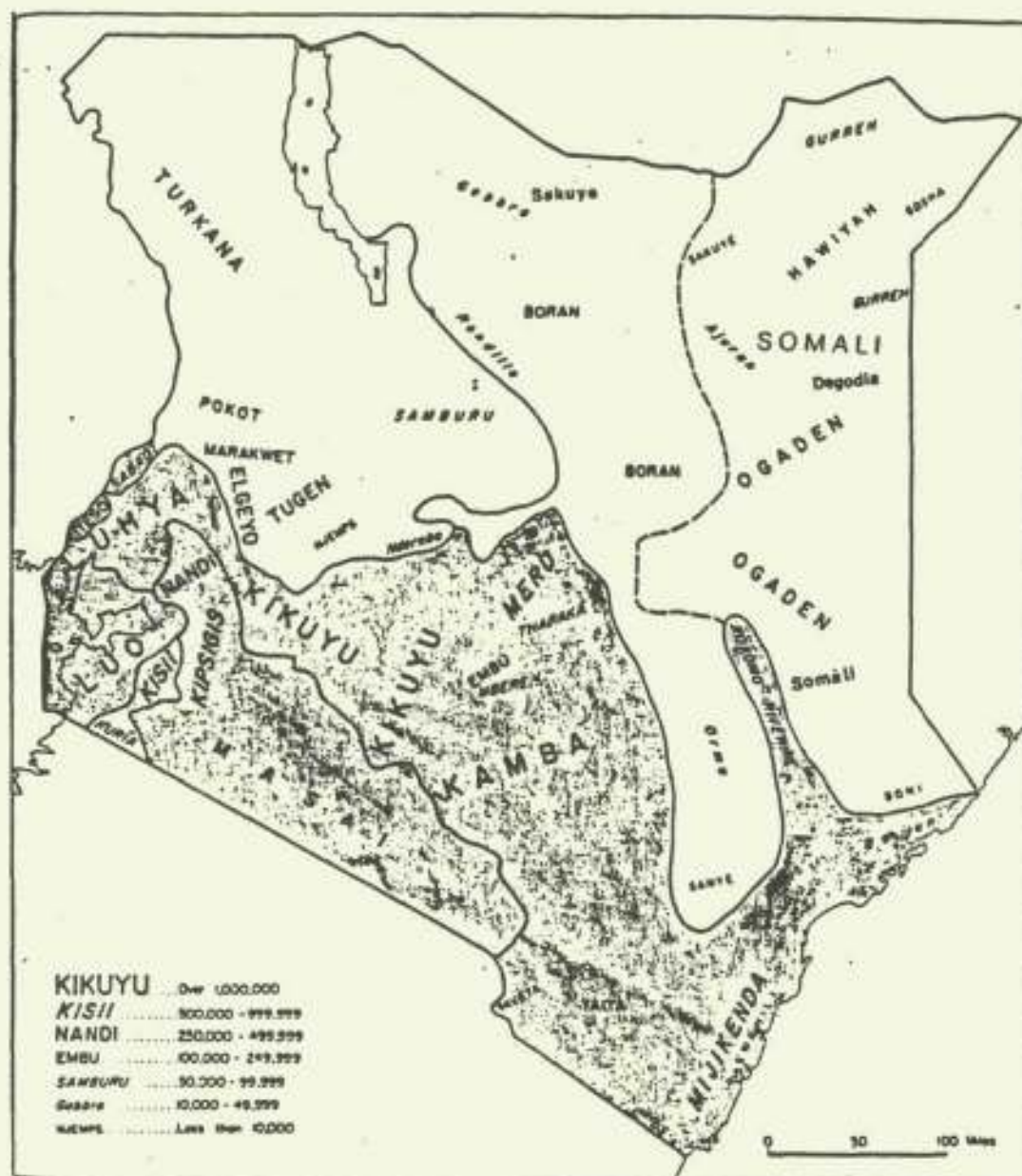
Districts Where Camels Are Found

The largest numbers of camels in Kenya are found in North-eastern and Eastern Provinces. The Kenya Rangelands Ecological Monitoring Unit (KREMU) estimates that North Eastern Province has about 50% of the camels in Kenya. The main camel areas in this province are found in the Districts of Wajir, Mandera, and Garissa. In Eastern Province, the Districts of Isiolo and Marsabit have about 30% of Kenya's camels. Rift Valley Province has about 14% of the camels. They are spread throughout the Districts of Turkana, Baringo, Samburu, and Laikipia. The remaining camel centers are Coast Province with about 5.4% of the population and Nairobi Province with less than 1% of Kenya's camels. These figures are averages taken from several years. See table 1.0 for a list of camel numbers by District. It is difficult to say exactly how many camels are present in Kenya because the majority of the camels are kept by nomads who move periodically. Camel keeping in Kenya is primarily a tribal activity. Although most of these tribes are nomadic, they do stay within the general areas where their language groups are located.

The Somalis are the largest camel-keeping group in Kenya. Within the Somali tribal group are the Ogaden, Degodia, Ajuran, Aulia and Gurreh tribes. The Galla people who are made up of the Oromo, Borana and Sakuye tribes are also a large group of camel keepers. Eastern Province is the main tribal area for the Shangiilla, Gabbra and Rendille camel keepers. The Turkana, Samburu, Njemps, Tugen and Pokot are more recent camel keepers and have a greater reliance on cattle. See the map in figure 1.0 for Kenya's camel people.

Kenya is estimated to have the fifth largest camel population in Africa. Kenya, along with its neighbors Sudan, Ethiopia, and Somalia hold more than 57% of the world's camel population

and more than 80% of Africa's camels. See table 1.1 for the major camel producing countries. The importance of camels in this region is frequently overlooked when planning development strategies.



* grey areas represent those tribes that do not keep camels.

Source: KREMU, Nairobi, Kenya.

Figure 1.0 Location of Kenya's camel-keeping people and their relative population numbers.

Table 1.0 - Average camel populaton in Kenya's camel producing Districts.

<u>DISTRICT</u>	<u>YEAR SURVEYED</u>	<u>NUMBER OF CAMELS</u>
Wajir	1978 - 1978	159,485
Mandera	1977 - 1978	112,225
Isiolo	1977 - 1978	96,680
Marsabit	1977 - 1981	89,810
Turkana	1977 - 1983	75,992
Garissa	1977 - 1978	45,814
Tana River	1977 - 1983	33,964
Samburu	1977 - 1981	11,458
Baringo	1977 - 1982	1,630
Kitui	1977 - 1980	1,267
Laikipia	1981 - 1982	733
Total		628,050

Source: Government of Kenya

Table 1.1 - Major camel producing countries having 10,000 camels or more.

COUNTRY	NUMBERS OF CAMELS
SOMALIA	5,650,000
SUDAN	2,500,000
TUNISIA	1,750,000
INDIA	1,050,000
ETHIOPIA	1,010,000
PAKISTAN	900,000
MAURITANIA	750,000
KENYA	620,000
CHINA	610,000 *
MONGOLIA	570,000 *
CHAD	421,000
NIGER	410,000
AFGHANISTAN	250,000
IRAQ	250,000
MALI	240,000
MOROCCO	240,000
SAUDIA ARABIA	160,000
ALGERIA	154,000
LIBYA	135,000
YEMEN A. R.	108,000
YEMEN DEM.	100,000
WESTERN SAHARA	90,000
EGYPT	80,000
UNITED ARAB EMIRATES	70,000
DJIBOUTI	52,000
IRAN	27,000
NIGERIA	18,000
JORDEN	15,000
ISRAEL	11,000
TURKEY	10,000

1) FAO Production Yearbook, Vol. 37, 1983. Figures represent estimates of camel populations.

* these figures include bactrian camels as well.

1.5 - BREEDS OF CAMELS

It is often argued that there are three breeds of camels in Kenya. It would be more correct to classify these as types rather than as breeds. These camels are classified according to where they are found and by their size.

The largest camels in Kenya are the so-called "Somali" camels. Benadir camels found in Somalia have been brought into Kenya and may be found among the Degodia and Gurreh people. They are large-boned animals with thick necks, broad chests, slightly slab-sided, and have long legs. They are quite tall. Well-managed males may reach 2.5 meters at the shoulder. They have large feet and may reach weights greater than 550 kgs. Many camel breeders in Somalia have stated that the smaller Somali camels found throughout the interior of Somalia are better milk producers than the large Benadir camels associated with Northeastern Province in Kenya.

Somalis have their own classification based on color. They regard white camels as separate from all others. They have a distinction between white, off-white, tan and red camels. It is argued that red camels never give as much milk as white or off-white camels; therefore, they constitute a different type. Somali camels seem to prefer the flat, hard-packed earth of their home range and have a hard time working in the hilly or stonier terrain west of Northeastern Province.

Rendille camels, the second "type" of camels, are intermediate in size between the Somali and Turkana camels. They seem to be hardier than the Somali camels found in Kenya. They weigh about 350-450 kgs. Rendille camels also have tougher pads on their feet and are accustomed to traveling the lava strewn areas west of Marsabit.

The third type, the Turkana camels, are much shorter and stockier than the Somali camels. They have well-sprung ribs, large humps when in good condition, and seem to be well proportioned in terms of legs and feet. They are very agile, hard workers, and are able to carry as much weight as camels a foot taller. They weigh about 300-375 kgs. While on safari with both Somali and Turkana bulls of relatively equal ages carrying about 100 kgs., the Turkana camels appeared to be more agile and handled the steep hills with much less difficulty than the Somali bulls. Under identical feeding regimes, the Turkana cows gave less milk and were not as good as mothers.

In personal communication with other camel owners it was universally agreed that Somali camels had a much better disposition than the temperamental Turkana camels. This could easily be attributed to management attitudes. The Somalis consider camels

more than mere "livestock" unlike the Turkana who are less mystically involved with camels. This relationship the Somalis have with their camels tends to make them a bit more gentle when handling their animals. When nervous and timid Turkana camels were mixed into large herds with careful management they were just as docile as other camels, supporting the notion that their temperament is relative to care. As was stated earlier, there does seem to be a distinct difference in the appearance between the three alleged types, but there needs to be much more research done into the breeds of camels before a definitive statement can be made on the merits of various camel breeds in Kenya.

1.6 SUMMARY: INTRODUCTION TO CAMELS

The largest concentration of camels in the world is found in Africa. Kenya is reported to have the fifth largest number of camels in Africa. In Kenya, camels are primarily found north of the equator.

The camels found among the Somali people are the largest of the three types commonly occurring in Kenya. They weigh from 100-150 kgs. more than the smallest camels which are found among the Turkana people. Until further research is completed it would be difficult to say that there is a breed of camels that would provide superior production in Kenya.

Camels are found in North Eastern Province, Eastern Province, and Rift Valley Province in large numbers. They are also found in smaller concentrations in Coast and Nairobi Provinces. The major camel-keeping people in Kenya are the Somalis, Gabbra, Rendille and Turkana. The Samburu, and Pokot also keep camels in addition to large numbers of cattle.

** CHAPTER NOTES **

- 1) Gauthier-Filters, 1981.
- 2) For discussion about the origins of camels in Africa see Mikesell, 1955, Curasson, 1947, Epstien, 1971 in the bibliography.
- 3) Field, and Simpkin, 1984.
- 4) Much of this information on camel breeds is the result of discussions in the field with traditional camel keepers. It represents their impressions of the different camels they have seen.

2.0 - HABITAT OF CAMELS

The area in which an animal must live and produce is called its habitat. The habitat of camels places serious limitations on its performance. The main limitation is the effect of high temperatures which causes heat stress in most domestic animals.

In order to understand why camels are able to survive and produce in the desert areas, it is necessary to understand how heat stress affects livestock production. This chapter will:

- describe the habitat of camels in Kenya
- define heat stress and show how it can be recognised

2.1 - ECOLOGICAL ZONES OF CAMELS

Camels are usually found in those areas that have less than 500 mm. of rainfall per year. In Kenya camels are found in the arid and semi-arid lands (ASAL) where rainfall is 350 mm. or less each year. In some areas where camels are found in Northern Kenya rainfall may be as low as 100 mm. per year. Based on the ecological classification found in the Agro-Climatic Zone Maps of Kenya produced by the Kenya Soil Survey in 1983, camels occupy the driest portions of Zone V and Zone VI. These zones are characterized by low or uneven rainfall, high daytime temperatures and low nighttime temperatures. They frequently have high evaporation rates because of strong winds, low relative humidity and high temperatures.

The plants in these zones are mostly dwarf shrubs, perennial woody plants such as Acacia trees and herbs. Occasionally grasses are found but seldom during the dry season. Many of the plants in these areas are thorny. Some plants are HALOPHYTIC plants, or salt bushes. Grasses may be found in some of the low-lying areas around river beds where water can be found below the surface of the ground. Perennial grasses generally do not grow well in areas with less than 250 mm. of rain per year.

Because of the limited ground cover from grasses and leaf litter, daytime soil temperatures may be 15 C. higher than the air temperature in Northern Kenya. In the Chalbi Desert ground temperatures may reach 60 C. Air temperatures in zones V and VI are usually over 30 C. In the hottest months of January and February they may reach 40 C. Although the daytime temperatures are high, the nighttime temperatures are often 10-15 C. cooler. This allows the animal a chance to cool off. If the difference between the day and night temperatures (the day-night differential) is too great, the animals may get pneumonia.

The strong winds and high temperatures combine with low humidity to create an environment that has low RELATIVE HUMIDITY. In some areas the evaporation rate may be 10 times higher than rainfall. This is important because it will cause the plants to dry up or DESSICATE. If this happens at a fairly young age the plants will be more nutritious than if they mature. But this will also result in the plants not having as much total leaf available for the animals to eat.

The soils of Zone V, which would include Wajir, Isiolo and Garissa, are mostly fertile sand and sand loams. Zone VI and many camel areas of Zone V have lava rock out-croppings. The rocky terrain can be a serious problem for camels since they do not have hooves. Camels have soft pads on the soles of their feet which are easily cut by rocks.

Besides rocky areas, camels have a difficult time walking on clay soils that are wet or poorly drained. Camels are unable to grip the slippery soil and sometimes fall and injure themselves. Broken legs and jaw bones are not uncommon for camels who must walk on slippery surfaces. If their night enclosures or BOMAS get too wet the camels may try to escape.

2.2 - RELATIONSHIPS OF CAMELS TO HABITAT

One of the things that makes camels so well-adapted to their habitat is their ability to reduce the stress caused by high temperatures. The animals found in the hot, dry areas of Northern Kenya are constantly faced with a condition called HEAT STRESS. Heat stress occurs when an animal is unable to cool itself. A combination of factors such as high temperatures, high humidity, amount of solar radiation and high winds may work together to destroy the comfort zone of an animal.

It is said that a human works best when the temperature is between 20-25 C. This could be called the comfort zone. The comfort zone for cattle is between 13-18 C.¹ As the air temperature increases the animal will begin to feel less comfortable so it must adjust to the increased stress. Sweating is one way to make this adjustment. Cows begin to sweat when the temperature rises above its comfort zone. When the temperature rises above 25 C., sweating is not enough to cool it. It will then begin to breathe faster until it begins to pant. If it is unable to cool itself it will begin open mouth breathing. This will result in a loss of body water because open mouth breathing causes the cow to drool in an effort to increase its ability to cool itself through evaporation.

High temperatures also affect the animal by lowering its appetite. When the temperature reaches 40 C. cattle will stop eating. Heavy breathing makes it difficult for the animal to eat or RUMINATE. An animal under such stressful conditions will not be very productive. When an animal is suffering from heat stress, milk production, breeding, and movement such as walking to food, will be hindered. This loss of appetite can add months to the time it takes an animal to reach market weight.

2.3 - AIR TEMPERATURES

Solar Radiation

Air temperature is related to the amount of sunlight hitting an area. Clouds, dust in the air, and shade will affect the amount or intensity of the sun's rays. The sun may also be reflected off the ground to heat the animal. This is especially true in the ASAL areas where there is little ground cover such as

grass to absorb the sun's rays. Heat stress can be caused by both direct and indirect sunlight.

Wind Speed

The importance of high air temperatures is not how hot it reads on the thermometer but how hot it makes the animal feel. Sometimes the effects of high temperatures can be reduced. For example, the temperatures at the coast often reach 27 C., but people still holiday at the coast. The cool sea breezes make them feel cooler. In the ASAL areas there are also breezes, but they are moving hot air so that instead of cooling they may actually make the animal hotter.

The force of the wind is also a factor in the comfort of animals in the hot regions. Strong winds increase an animal's discomfort so that added stress is put on the animal. Just as there is a comfort zone for temperatures, there is also one for wind speed. The comfort zone for cattle is winds between 5-30 kph. Winds stronger than this add to the animal's stress, and winds less than this do little in the way of cooling.

RELATIVE HUMIDITY

Relative humidity also affects the animal's comfort level and its ability to produce or work. Relative humidity is the amount of water present in the air compared to how much water the air could actually hold if it was completely full or saturated. A relative humidity of 50% means that the air is only half as wet as it could be if it were saturated. When it is very humid, greater than 75%, it is difficult for the animal to cool itself by means of evaporating the sweat on the surface of the skin. This will put the animal under additional stress, and production will fall. If the relative humidity is too low, the animal may become dehydrated because it is losing water too rapidly from its system. High temperatures combined with low relative humidity may also lead to skin irritation from salt accumulation on the skin surface and irritation from dry skin.

2.4 - IDEAL PHYSICAL ENVIRONMENT

The ideal physical environment for most livestock is:²

- temperatures between 13-18 C.
- 60-70% relative humidity
- wind speed between 5-10 kph.
- medium solar radiation
- and a disease free environment

Unfortunately, most animals are faced with at least some periods of environmental stress. Those animals that will be most economical to keep will be those who are best able to combat or withstand a harsh environment and continue to produce.

2.5 - SUMMARY: CAMEL HABITAT

Camels in Kenya are raised in a very harsh environment. They are found where it is very hot in the daytime and cold at night. Because the rainfall is usually less than 500 mm. per year, the camel makes use of the trees, herbs, shrubs and seasonal grasses which it eats to survive. Due to the high temperatures, low relative humidity, and high evaporation rate in this region, many animals are exposed to a condition known as heat stress. Heat stress is the detrimental effect of heat on an animal. Some physical signs of heat stress are:

- sweating
- increased respiration rate
- drooling
- loss of appetite

The ideal environment in which to raise most domestic livestock is:

- temperatures between 13-18 C.
- a relative humidity of 60-70%
- wind speed between 5-30 kph.
- medium solar radiation
- a disease-free environment

** Chapter Notes **

- 1) McDowell, 1972.
- 2) McDowell, 1972.

3.0 - CAMEL ADAPTATIONS TO HEAT STRESS

Heat stress is a limiting factor of livestock production in the arid regions. Camels have the ability to withstand the effects of heat stress better than other domestic livestock. It is important to understand this ability if one is going to work with camels in Kenya. This chapter will:

- describe how camels relate to their environment
- show how camels prevent water loss in the dry periods

3.1 - HOW CAMELS ARE DIFFERENT

Review of Camels Habitat

The habitat of the camel in Kenya is hot, with a large difference between the day and night temperatures. The humidity is usually low. Solar radiation is direct because there is little cloud cover. Reflected radiation is high due to a lack of ground cover to absorb some of the sun's rays. The winds are often strong and hot. Dust or sand storms may occur which make it difficult for animals to breath, see, and eat.

The environment is not the only source of heat affecting livestock in the desert regions. Another source is the animal itself. All animals, humans included, must perform some activities just to stay alive. These activities produce heat. Some of the life functions that produce heat are:

- the beating of the heart
- respiration of breathing
- eating and digesting food

Many heat producing activities take place even when the body is at rest. If an animal does any work, walks, sits or stands, it produces even more heat. This heat that is produced inside the body must have some means of escaping or the animal will overheat and possibly die.

This combination of external heat and internal heat would stress most livestock, making profitable animal production risky. Camels have several unique ways of dealing with such a difficult environment.

Reflected Radiation

Camels have long legs which lift their bodies up off the desert floor and away from some of the reflected heat. It also allows wind to pass underneath the camel to modify the effects of the ground which may be 10-15 C. hotter than the air. Their large bodies allow a greater surface area for sweating and convection.

Convection

Convection makes use of the animal's blood supply to carry heat to the surface of the skin. It is able to do this because of the many small blood vessels under the skin. If there were a layer of body fat between the skin and the blood vessels, the fat would act as an insulator and the effects of convective

cooling would be less. The camel has most of its body fat concentrated in the hump rather than spread evenly over the whole body like most other livestock. This helps the camel to cool itself very well by convection.

Camel Hair

Like sheep wool, camel hair is covered with a layer of oil. This oily layer means that it will absorb less heat than non-oily hair. Also camel hair is erect rather than flat like the hair on cattle. This allows air to pass through it more easily to help cool the camel. The erect hairs also allow moisture to collect on the surface of the skin rather than on the hair. This increases the efficiency of evaporative cooling. The camel's hair has very good insulation value so it keeps some of the sun's rays away from the body. The temperature at the surface of a camel's coat may be 60-70 C. The temperature at the skin surface will only be in the 40 C. range due to the insulation from the hair.¹

In an experiment performed on camels, a camel's coat was cut until it was only 5-10 mm. long. The rate of water lost through sweating was 3 liters per 100 kg. of body weight. In an unshorn camel with a hair length averaging about 20mm, the water lost each day was about 2 liters per 100 kg. body weight. This shows that the camel's coat keeps it cooler, serves as an insulator, and reduces the amount of water lost as sweat.

Respiration and Heat Stress

Evaporation takes place on the skin surface, as well as in the respiratory tract when the animal breathes. When cattle are under heat stress their respiration rate will increase greatly, especially above temperatures of 29 C. An average breathing rate for cattle at 18-20 C. is 20 breaths per minute. If the temperature rises to 40 C., that cow would breath about 115 times each minute.² Eventually it would probably die. A camel has a normal respiratory rate of 6-11 breaths per minute under cool morning temperatures. In the heat of the day, when temperatures are near 40 C., their respiration rate increases to only 8-18 breaths each minute. This is important because heavy breathing uses up energy which makes the animal hotter. A high respiration rate also interferes with feeding, and rumination. An animal that is panting will lose large amounts of water from drooling and through evaporation. Because camels can control their respiration rate they are able to continue eating even when they are very hot, do not lose water through drooling or open mouth breathing and conserve water which many other animals lose through sweating and respiration.

3.2 - WATER LOSS IN HEAT STRESS

One of the demands upon livestock in Northern Kenya is related to water. From previous discussions on heat stress, it should be apparent that livestock are constantly faced with a water balance problem. On the one side, there is little water available, and on the other, there is a constant demand upon the body's water supply in the form of:

- water lost to evaporation by sweating, and respiration
- urinary water losses
- water lost as a component of feces

Water loss and the Circulatory System

The loss of water is a problem when it is hot because blood plasma levels of both man and camels contain 16% of the total body water. Through conduction the blood carries heat away from the body. If man loses 25% of his body weight in water, his blood will become thicker and unable to carry body heat to the skin surface. In this case heat will build up and the person will die. By contrast, if a camel loses 25% of his body weight in water, the total blood volume will only be reduced by 10%. Consequently, the blood will remain thin enough to carry heat away from the core of the camel's body.

Water Conservation

Camels have an advantage over other domestic stock in the arid regions because they do not lose as much body water. Contrary to popular myth, camels do not store water in their humps or anywhere else. It may seem that way since a thirsty camel may drink over 100 liters of water in one watering. Rather than store water, camels reduce the amount of water that they lose by sweating. One way they are able to do this is by allowing their body temperature to rise 60 C. This means that the camel will not begin to sweat until the body temperature reaches 40 C. A rise in temperature of 60 C. in a 500 kg. camel will result in a savings of 5 liters of water. This savings would not be available to some other animals because they begin sweating at a lower temperature.³

3.3 - KIDNEY FUNCTION IN WATER CONSERVATION

Salt Concentration in Urine

The kidneys of the camel play an important role in conserving water. The camel is able to recycle urine until it becomes extremely concentrated. It is able to do this because it has a

very long series of loops in the kidneys, called LOOPS OF HENLE, where water is reabsorbed. Although all animals, including man, have these loops, they are especially efficient in the camel. The ability to concentrate and refilter urine also allows the camel to drink water that has a very high salt concentration. Camels can drink water with a salt concentration greater than sea water and eat salt bushes or halophytic plants that would be inedible by most other livestock. This is an important advantage in Northern Kenya where being able to make use of poor quality water and plants may be the difference between life and death.

Reduced Urination by Camels

Camels conserve water by urinating less often and in smaller amounts than many other domestic animals. Camels lose ten times less water in urine per kg. of body weight than sheep sharing the same habitat. During rainy season when there are greener feeds available camels may urinate 4-6 liters per day. In the dry season when the camel's state of dehydration is greater, it decreases its urine output to about 3/4 of a liter. That amounts to just over 3 cups of urine each day.

Water Losses in Feces

Another way that camels conserve water is by reducing the amount of water in feces. A cow may lose 20-40 liters of water each day in feces. Camels eating or browsing on green plants lose about 6-7 liters of water in their feces. Camels browsing during the dry season yield about 1.3-2 liters of fecal water daily. Because they can conserve water they are able to search for food much farther from water sources than other stock. A camel can travel four times farther looking for food than a cow.

3.4 - SUMMARY: CAMEL ADAPTATIONS TO HEAT STRESS

Camels occupy habitat that is very difficult to live in. Due to the high temperatures, strong winds, and a high day and night time temperature difference, the camel is often under a condition known as heat stress. The environment is not the only source of heat. The daily functions such as eating, breathing, standing, walking or trying to produce milk can also produce heat. The camel is especially well-suited to its environment because it is able to withstand heat stress better than many other domestic animals.

Camels are particularly well-adapted to their habitat for several reasons. Some of these are:

- type of hair coat

- fat deposited in the hump
- ability to allow its body temperature to rise 60 C.
- size and shape of their bodies
- low respiratory rate
- ability to conserve water normally lost through sweating, urination, defecation, and respiration
- complex kidney system that is able to recycle and concentrate urine and process water and plants with a high salt content

Although camels are unable to store water they are able to control the amount of water they lose. This reduces their need to drink water so they can go longer between waterings than many other kinds of livestock.

** CHAPTER NOTES **

- 1) Schmidt-Nielson, 1964.
- 2) Mc Dowell, 1972.
- 3) Schmidt-Nielson, 1964.

4.0 - REPRODUCTION

The reproductive behavior of the dromedary limits many of the management practices used with other domestic animals. Before a breeding program can be started with camels one must understand these reproductive differences. The needs and cultural habits of the traditional livestock keepers are a further limitation to camel husbandry practices. This chapter will:

- describe the reproductive behavior of male and female camels
- describe the birthing process in dromedaries
- list some management points in camel breeding

4.1 - REPRODUCTIVE HABITS OF CAMELS

Sexual Maturity

The age at which camels are bred is more of a management factor than a physiological limitation. Puberty is the age at which an animal may become pregnant. As with other animals puberty can begin at an early age if the animal is getting enough food for good nutrition. Knowledge of and access to the best grazing areas and good health care can make the female camel breedable at 3 years of age. This does not mean that she is sexually mature, nor does it mean that she should be bred at that age, only that it is possible. Sexual maturity refers to the age at which reproductive capability is the greatest. For camels in Kenya, sexual maturity occurs at about 4-6 years of age. A camel bred at the end of her 4th year will conceive 370-390 days later, in her 5th year.

A female camel usually is able to have offspring into its 20th year. There are instances of camels over 25 years old giving birth.¹ If a female is well cared for one can expect 10-13 calves in the female's productive life.

A male camel may reach puberty in his 4th year, but is not considered sexually mature until he is 6-8 years old. In a mixed herd of male and female camels, only one male will go to STUD, or begin mating. If other males come into RUT, the aggressiveness of the dominant male will serve to overpower the sexual desire of weaker males in the herd. Consequently, puberty is of minor consequence in most cases because the younger bulls have little chance of becoming the herd stud. Once reaching sexual maturity, the male can be of good breeding service for 10 years.

Herd Ratio of Males to Females

A bull camel in good condition may be able to SERVICE 50-80 females. Unless conditions demand it, there is no advantage to using one male for so many females. Some conditions that might affect the male-female ratio would be:

- number of sexually mature males in the herd
- physical condition of the males
- labor demands which would prohibit how small one could make the herds
- the cultural and economic needs of the owner
- the LIBIDO of the male

When camels have intercourse they may be coupled for an hour. During this time the male may have several EJACULATIONS. It would be extremely exhausting for the male to service large numbers of females. His physical condition would worsen after a few months of this kind of work. Nomads frequently use one bull for breeding 15-20 females.² Another reason to keep more bulls than are needed for breeding reasons is the fact that during the rut, the bull will be useless for working because of his excited state. The bull will also lose weight because of his lack of appetite. Caution should be used in working the bull during the rut. Overwork may cause him to lose interest in mating.

4.2 - RUTTING BEHAVIOR

Seasonal Breeding

The male camel is generally considered to be a seasonal breeder, becoming active as the rains approach. In a herd of 15 camels in Laikipia District in 1984, the males began to show signs of RUT as the long rains approached. But when the rains failed the rut receded and the males became sexually inactive until the short rains came. This is important because it means that the conception rate will go down during a drought. This could seriously affect the milk supply in the year to come because no calves would be born that year.

Signs of the Rut in Males

Once the male has begun to rut, it may last for 3-5 months. During this time, the male will become quite excited and aggressive towards men and other camels. Fights may occur between rutting males causing death or injury to them. Rutting males will attempt to mate with any female whether she is in heat or not.

When the male is in rut he will become quite protective of his territory. Frequently, he will urinate on his tail and whip it around covering everything nearby with his scent. There is also a gland on the back of his neck, just below his head that puts out a black foul-smelling substance. He will rub this on trees and female camels so that his scent will mark the territory which he considers his breeding grounds. See Figure 4.0 for the location of this gland on the male camel.

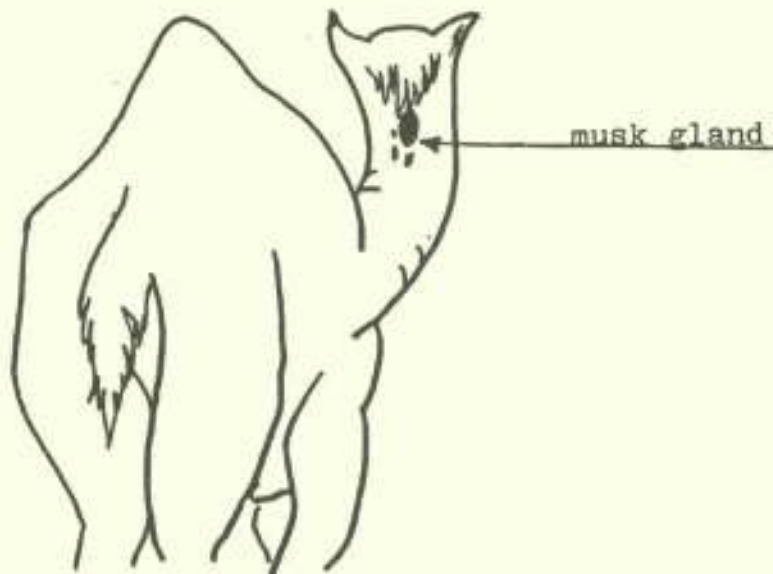


Figure. 4.0 Location of musk gland on a male camel.

4.3 - SIGNS OF OESTRUS IN FEMALES

When the female wants the male for breeding purposes it is said that she is "in heat". During this time she is undergoing hormonal changes that cannot easily be observed. However, some of the observable signs that she is in heat are:

- she will appear to be nervous and cry out for no apparent reason
- she will seek out the company of males in the herd
- her vulva will swell and drip a foul-smelling discharge that is very noticeable to male camels
- she will urinate much more frequently and in smaller amounts
- if carrying a load she acts nervous and may show signs of sexual excitement from the pressure of the load on her flanks
- the female may lie down in the mating position in front of the males occasionally

4.4 - THE OESTRUS CYCLE

Another name for the heat period, when the female will accept the male for breeding, is the Oestrus Cycle. This is due to higher levels of the hormone ESTROGEN in the blood. Oestrus lasts until the ovum, or egg, passes into the uterine tube in the reproductive tract of the female. This is called ovulation and in most animals happens spontaneously. In the camel, the egg passes only when the female gets sexually excited from the act of intercourse, or COITUS. This is called induced ovulation because the act of mating induces or causes the female to ovulate. Cats and rabbits are also induced ovulators. In camels, ovulation occurs 30-48 hours after intercourse. If coitus does not occur, the egg will not be released.

One reason that artificial insemination has not been successful with camels is that the female needs to be excited by the male so that she will ovulate and release the egg which will join with the sperm to form the calf. There have been attempts by scientists to stimulate ovulation using injections of hormones, but at the present time this technology is not applicable to camel breeders in Kenya.

There is some debate whether the camel goes into heat all year long on a regular cycle, or if oestrus is seasonal.³ It is believed that length of day, altitude, humidity, and the physical condition of the female camel help in bringing on oestrus. Heat periods last for 3-6 days with a cycle occurring on a 20-25 day period. Like most other livestock, chances for conception are lower later in the heat period. Therefore if the male can breed the female early in the oestrus cycle the chances of her becoming pregnant are better.⁴

4.5 - COITUS

Generally, coitus is preceded by the male sniffing and biting the female, frequently in the vulva area. The male may sniff her urine, put his head back and role his eyes. This will often be accompanied a deep gurgling sound and inflation of the soft palate called the palatal flap. See Figure 4.1 for an example of the palatal flap inflated. It will appear that the male has a pink balloon coming out of his mouth. When bulls fight during rutting season they sometimes injure the soft palate if it is inflated while they are fighting.

If the female is unwilling to mate with the male, he may force her to the ground by butting or by laying his neck over her until she is forced down. If she is in heat, force will not be necessary.



Figure 4.1 Palatal flap

The male approaches her from behind with his front legs on either side of her front flanks. He will enter her from the sitting position. See Figure 4.2. for the mating position. If he seems to be having trouble entering her, the herdsman may help the bull by directing the bull's penis into the vagina. Copulation may last for 15-60 minutes, with the male frothing at the mouth and the female bellowing her opinion of the proceedings. Several ejaculations occur during each mating. This is an important point because the activity of the SPERMATOZOA and volume of SEMEN increases with each successive ejaculation. This in turn helps to improve the chances of her becoming pregnant.

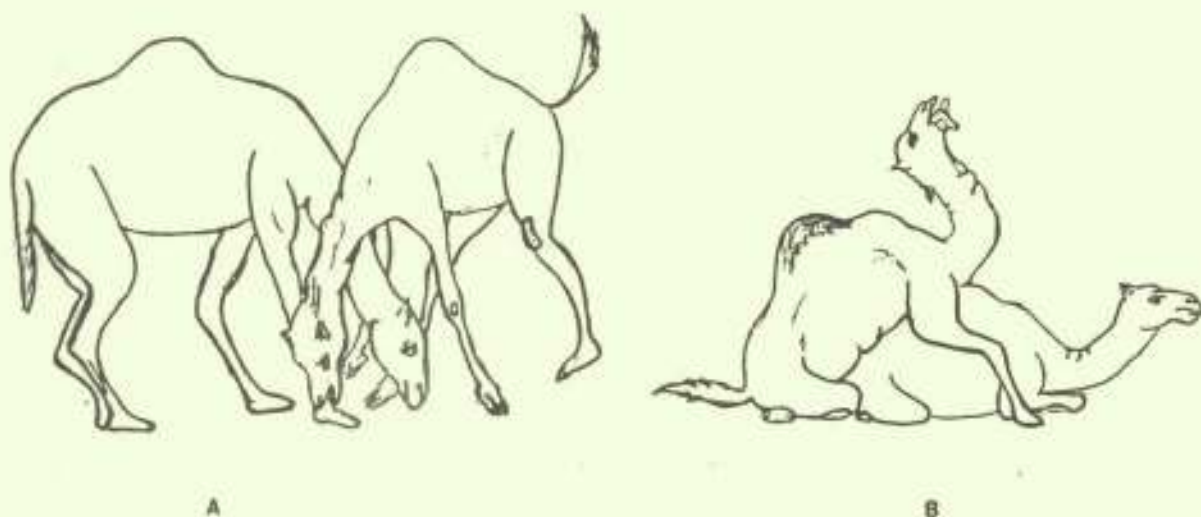


Figure 4.2 A: male forcing female to the ground B: position of camels when copulating

4.6 - PREGNANCY TESTING

The most reliable means of pregnancy diagnosis is through RECTAL PALPITATION as performed on cattle. Old-time camel keepers report that a pregnant female will curl up her tail when men or bull camels come near.⁵ There is some doubt among scientists about the dependability of this system. It is also believed that female camels will refuse a male if she is pregnant. In a test of this method of pregnancy checking, it was found that nearly 5% of pregnant females in the test sample returned to oestrus showing that they had not been bred successfully despite their refusal of the male.⁶ In Northern Kenya, the end of lactation 4-8 weeks after conception was used as a sign of pregnancy. This method was also reported to be used in other camel-keeping areas.

In cases where it is impractical to wait for a veterinarian to diagnose pregnancies, the traditional methods of watching which females refused to mate combined with end of lactation would be sufficient indicators of pregnancy.

4.7 - PARTURITION

The GESTATION period of the camel is between 370-390 days. Bactrian camels have a gestation period of 400-410 days. It is important to know how long the gestation period is because there may be some changes in management one will want to make if the parturition or birthing day is near. In large herds, if help is available, it might be better to put those camels who are in their last month of pregnancy into a separate herd where they can be watched more closely.

Some signs of approaching parturition are:

- by the 11th month the udder should show signs of EDEMA or swelling
- in the last 2-3 weeks, the sacrosciatic ligaments located on either side of the spine near the tailhead will relax allowing a sunken area or depression to be formed when pressure is applied. See Figure 4.3 A.
- when she is in her last few days, the teats will be swollen and inflamed where they attach to the udder, and may begin dripping milk. See Figure 4.3 B.
- the vulva will begin to appear swollen and red 5-8 days before parturition as in Figure 4.3 B.
- in the last 24 hours before parturition she will start acting restless, refusing to eat, separating herself from the rest of the herd, either from a desire to be

alone or because it is difficult for her to keep up with the rest of the herd.

- in the last few hours of pregnancy she will spend a lot of time lying down then getting up again because it is difficult for her to get comfortable
- if she is in a night enclosure, she will find a corner off by herself. Other camels may come over to smell her or to see what is going on.

If you are nearby when the calf is born it would be safer for the calf if you would put up a small fence to keep the other camels from stepping on the calf if they get excited or too near to the newborn before it can walk.

fig. A

sacrosciatic depressions



fig. B

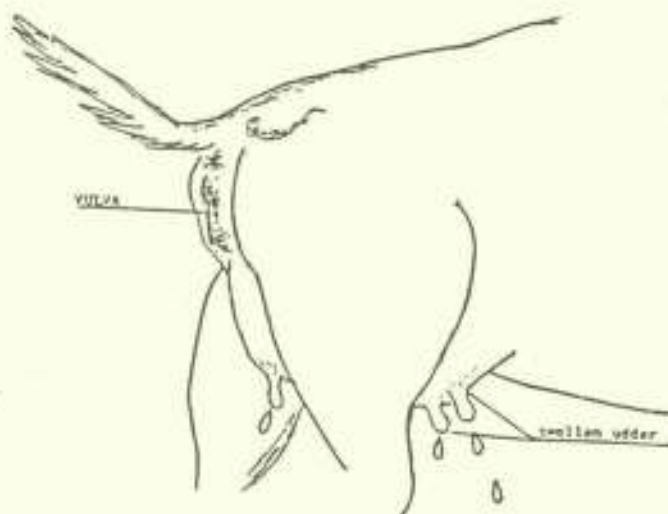


Figure 4.3 Signs of approaching parturition. A: sacrosciatic depressions. B: edema of udder and vulva.

Length of Labor Period

Unless there are problems with calving, labor should last from 2-7 hours. Once the female camel begins the birth process it will be about 1-2 hours before the calf is born. Camels seldom have trouble calving, but it is wise to check on her once in awhile. Camels usually give birth sitting or lying on their side. Sometimes a camel will give birth standing.

Stages of Parturition

Calving takes place in three stages. In the first stage, dilation, the CERVIX relaxes and the forefeet of the calf and the AMNION are forced into the VAGINA. The first stage may take from 2-5 hours. The second stage, delivery, should only take 5-10 minutes. The feet and amnion will appear, then the head and body are quickly forced out. The PLACENTA is expelled in the third stage, about 10-20 minutes after the calf is born.

The FETUS is surrounded by an extra fetal membrane with openings at the body orifices such as the ANUS, vulva, lips, teats, hooves, UMBILICUS and PREPUCE, where amniotic fluid can enter.⁷ The UMBILICAL CORD is usually broken when the female stands up after calving and the calf is still lying down.

The Normal Birth Position of the Calf

The normal position for the calf to be born is with both front feet coming first followed by the head. Occasionally, the rear feet will come first. This is usually not a problem delivery. If it appears that there is a problem birth, such as the head turned backwards or one leg turned back, be prepared to reach into the birth canal and turn the calf until it is in position to can pass through the birth canal without injury to the calf or the mother. See Fig. 4.4 for examples of different birth positions. Be sure to clean your hands as well as possible before putting them into the camel's uterus, or you may cause an infection.

If you are out in the bush, get someone to stay with the mother and calf. Once the mother has begun calving, she is in the most danger of being attacked by predators such as lions or hyena because she is unable to run or defend herself. If you are alone with the herd, try to keep the rest of the herd eating nearby so you can check on the mother and calf.

The camel calf should be able to stand in a few hours. If she gave birth standing, it might be well to make sure that the calf was not injured when it fell. If possible leave the mother and baby in a separate herd for 5-6 days until they are able to keep up with the rest of the camels.

It is very unlikely that a camel will have twins. The fertility rate for camels is low in comparison to other domestic animals. In Kenya it is reported to be between 35-50% depending on the care the camels have received.

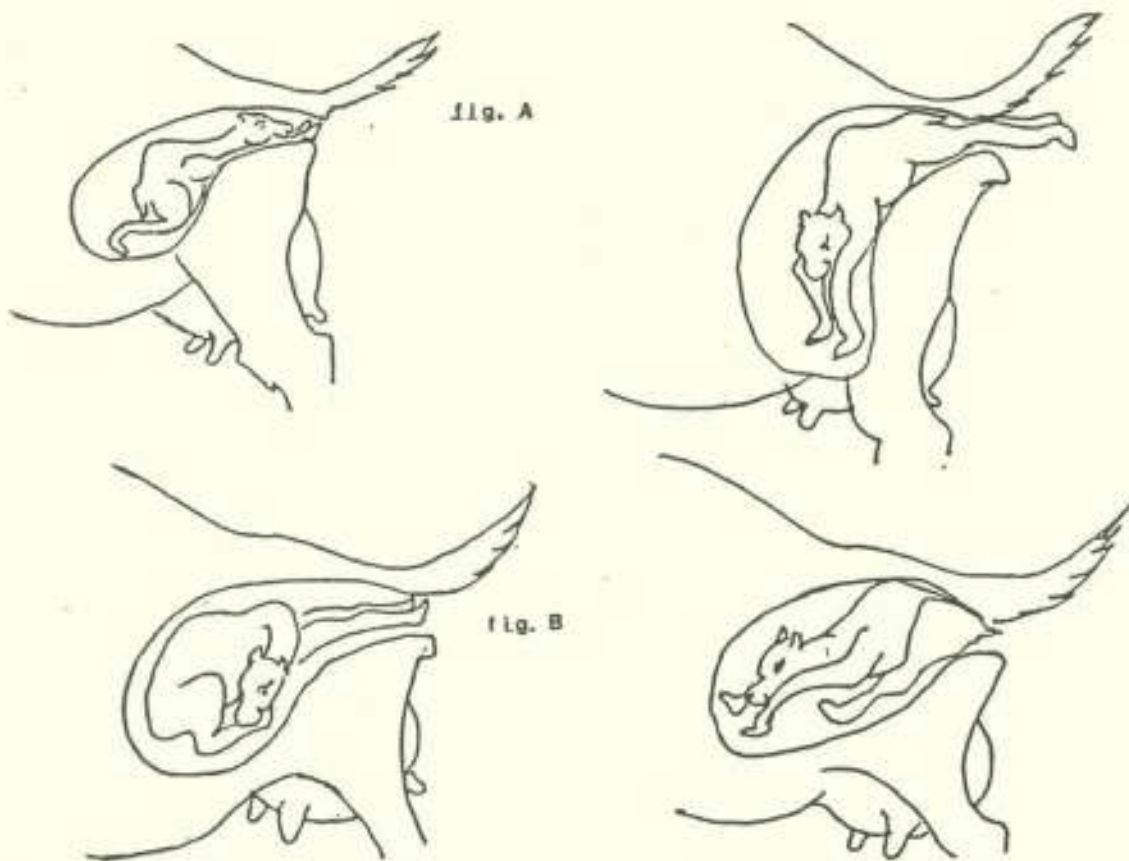


Figure 4.4 Various presentation positions of camel calves
A: normal positions B: abnormal positions

4.8 - SUMMARY: REPRODUCTION

Camels are seasonal breeders. They become sexually active as rainy season nears. Males will fight to determine who will be the main herd stud. One male for every twenty females would be a good way of dividing the breeding herd to make sure that all the females get serviced without tiring the male. If economic conditions will not allow such a ratio, one male to fifty females will do. Males go into rut for three to five months. Females are in heat for three to six days every twenty to twenty five days. Males meant for castration should not be cut before their fifth year.

Camels are induced ovulators so they must COPULATE before ovulation can take place. Ovulation takes place about forty eight hours after intercourse. Camels will mate even if the female is not in heat. If a veterinarian is not available to do a pregnancy check, it may be assumed that the female is pregnant when the male no longer services her.

The gestation period of a camel in Kenya is about 380 days. Labor, if trouble free, lasts two to seven hours. Camels rarely twin. A calving interval of eighteen months should be a management goal. Camels seldom need help when birthing. They have a low fertility rate of about forty five percent in Kenya.

** Chapter Notes **

- 1) Gauthier-Pilters, 1981.
- 2) Leese, 1927, and Wasin, 1957.
- 3) Nawito, et al, 1967.
- 4) Wilson, 1978, and Frandson, 1975.
- 5) Mares, 1959.
- 6) Shalash and Nawito, 1963.
- 7) Musa, 1979.

5.0 - RAISING CAMEL CALVES

Camel calves raised in the harsh environment of Kenya's arid regions face many problems in reaching maturity. The calf is under constant competition with the household for its mother's milk. There are also many predators that kill camel calves. These and other factors result in a high death loss.

This chapter will:

- explain the growth process for camel calves
- list some problems faced in calf rearing
- identify some management methods for reducing calf loss

5.1 - THE CAMEL CALF

In Kenya, camel calves weigh about 30 kg. at birth. There is no significant difference between the birth weights of male and female calves. Their height depends upon the size of the parents, the physical condition of the mother, and the food supply. They are about 75 cm. from toe to shoulder. They are capable of standing within 2 hours after birth. Within 5 hours they should be able to walk. If they are born out in the bush the calf may have to be loaded on to the mother's back to get it back home in the evening. Within 48 hours the calf should be able to follow the mother out to feed. Even though they are unable to digest solid food, they may smell the different plants or nibble on them within the first week. When not sleeping near the mother they can be seen jumping around and playing.

Colostrum

The first milk the mother produces after having a calf is called COLOSTRUM. This milk is different because it is very rich in vitamins, minerals and the antibodies the calf needs to fight disease. Colostrum is present in the milk for about the first week, then the milk becomes less rich. Traditional camel keepers in various places in the world as well as in Kenya milk the colostrum out on the ground rather than giving it to the calf. They claim that it will make the calf sick because it is too rich. In some places the people give the colostrum to the old or sick members of the family because they are aware of its medicinal properties. It is a mistake to deny the calf colostrum. The calf stands a much greater chance of getting sick and dying without the antibodies present in the first milk. If there is some fear that this milk is too rich then it can be mixed with boiled water and fed with a bottle. This water must be boiled to kill germs and then allowed to cool before feeding to the calf. This should only be done if there is an obvious reaction by the calf (i.e., diarrhea) to the first milk. Calf mortality is often as high as 50% in traditional herds. Some of these deaths could be avoided if the calf were allowed to get the colostrum. It is curious why this practice of denying the first milk is practiced in so many different camel cultures.

5.2 - THE NURSING CALF

The camel will begin eating plants the first few weeks after it is born. After about 2 months it will be able to forage for food on its own. The growth rate of a calf depends on the quality and quantity of feed available, health of both the calf and the mother, and the management system used in raising it. If the calf is being raised on an intensive system where it is carefully looked after, a short lactation can be used. The calf can be weaned in 3 months and the mother will

usually return to heat in 4-8 weeks after the calf is weaned. Early weaning is not recommended where the feed supply has been poor and the calf must compete with the household for the mother's milk. Early weaning can result in stunted growth or weakness in the calf. The calf will be weaned on a traditional system naturally in 12-18 months. Males usually grow faster than females.

Intensive Calf Raising

If the mother's milk is not needed for household use, a greater part can go for the calf. This will help the calf grow faster because it will be allowed to feed all day with the mother and nurse whenever it chooses. At night the calf can be kept with the mother for all or part of the night. This is called an intensive system because the calf is always able to nurse from its mother. This management system will put serious limitations on the milk supply available for human use as well as a strain on the mother if the feed supply available for the mother is poor.

Traditional System of Calf Raising

A traditional system would allow the calf to suckle all or part of the night but it would be put into a separate herd during the day. If labor is in short supply the calf can be denied access to the mother's milk by mechanical means. Some of these methods are:

- a string tied around the teats to keep all or some of them from being sucked. These quarters of the udder would then be available to the family for milk.
- a leather bag can be tied around the udder so that the calf cannot get at the teats.

The main purpose of the traditional system is to keep a milk supply for the household which often leaves the calf underfed. It is unwise to deny the calf access to milk until it is at least 5 or six months old to ensure that it has enough to eat so that it will grow quickly and healthfully.

5.3 - FOSTER MOTHERS

Generally the calf needs to be present to stimulate the camel to let down her milk. If the calf dies, the mother may stop giving milk. Often the family is in need of this milk for their survival, especially during the dry season. If this happens the traditional camel keepers may try to keep her in milk by taking the calf from another camel, covering it with the skin of the dead calf, and presenting it to the

mother so that she will think it is her calf and still keep milking.

During dry season when feed supplies are very limited it may become necessary to sacrifice a bull calf so that the mother's milk can be used for a female calf or for the family. If so they will kill the bull and cover a female calf with his skin so that the mother will smell it and think it is her calf. The calf will be able to nurse from both the foster mother and its real mother so it can grow faster and still leave milk for the family. This means that the female calf will not only have more milk to drink, but the bull calf will not be eating forage that could be helping out the more valuable female.

Occasionally a female camel will not have very good mothering instincts and will refuse its calf. One way to get her to accept her calf is to make her sit down or CROUCH. Then bring the calf over to her and cover it with a blanket so that the calf will get frightened. The herdsman will beat the ground around the calf and the mother with a stick and yell at both of them to make the calf call out to its mother. This makes the mother feel sorry for the calf so she will try to protect it. After 10-20 minutes of this type of training the mother will usually accept the calf.

Post Partem Care

Unlike many domesticated animals, the female camel does not lick its young. They also will not eat the afterbirth. The mother usually goes over to the calf and smells it. This may imprint the calf's smell on her memory since the mother camel is able to recognize her calf among all the other calves by just smelling it.

If someone is present they should help the calf by cleaning out its nose and mouth and making sure that it is not having any trouble breathing. Dry the calf off with a cloth or some grass so it will not get cold. Check the calf to make sure that it has not been injured. Some old camel herders say that you should blow smoke on the camel's face to get it breathing. A gentle pat on the back should be enough.

The camel calf should be able to stand in a few hours. If the mother gave birth standing make sure that the calf was not injured when it fell. If possible leave the mother and baby in a separate herd for 5 or 6 days until they are able to keep up with the rest of the camels.

5.4 - GROWTH

The growth rate of a camel calf depends upon many things. Management is probably the greatest controllable factor affect-

ting camel growth. In a traditional management system, the calf is only allowed a small amount of the mother's milk. The family uses most of the milk for the household needs. In an intensive system the calf is allowed as much as 75% of the mother's milk. This allows the calf to grow faster and fight disease better.

A study done in Northern Kenya among the Gabbra and Rendille people shows how much difference there can be in the growth rates of calves raised under both intensive and traditional management systems. The calves that were allowed the most milk gained approximately 2.5 times more weight per day than those on a limited supply of milk.¹

5.5 - WEANING THE CALF

Another thing that affects growth is how suddenly the calf is weaned. If the calf is allowed the mother's milk for several months and then is abruptly removed from the mother, the rate of gain following weaning can be lowered by as much as 100g./day during the 6-month period following weaning.² Calves weaned gradually do not seem to experience this drop in growth rate. So a good management system would allow the calf free access to the mother's milk and gradual weaning. Some methods used for weaning are:

- covering the udder to deny the calf access to the mother's teats
- placing a leather cap or strap on the calf's head or the bridge of its nose. This cap has a large thorn sticking out of it so that when it tries to nurse the thorn will prick the mother and she will not let the calf suck.
- a thorn or stick is put into the calf's lip or tongue so that when it tries to suckle the mother will not let it.
- shearing the calf is reported to cause the mother to refuse it milk.

Whatever system is used, the calf should not be weaned or denied milk if it is thin or making poor weight gains. Traditionally calves are weaned after about a year.

5.6 - DEATH LOSS

In Kenya, death loss among camel calves during the first three years may reach as high as 50%. Once the calf makes it past this trouble period, the death rate drops dramatically.

Male calves in Northern Kenya may have death rates as high as 70-80%. One reason for this is the fact that if feed supplies are short, the female calves will be favored because the survival of the family depends upon the number of camels they can get in milk. The males are expendable.

Another problem in Kenya is the lack of veterinary services available to the camel keepers. In a comparison between herds using veterinary care and those without, the treated herds grew 14-53% faster in their first year and 41% faster in their 4th year. Faster growth rates allow the camels to mature more quickly so they can be bred sooner and is a reflection of their overall good physical condition. Some of the major causes of death among camel calves are:

- diseases such as Trypanosomiasis, Rift Valley Fever, Pasteurella, Salmonella, and Brucellosis, which cause death by stillbirth in the affected mother or may affect the calf directly. Other calf diseases include Camel Pox and Pneumonia.
- Internal Parasites such as worms, and external parasites such as ticks and mange.
- In some areas of Kenya predators such as hyenas, lions and cheetah kill calves.
- Poor nutrition due to competition for milk from the household and lack of sufficient feed due to drought.

Death losses are either direct or indirect. Indirect causes may be the result of anemia or loss of condition resulting from internal parasites or from ticks. Direct causes are the diseases mentioned previously. These problems will be covered more fully in the section on Health Care.

5.7 - SUMMARY: RAISING CAMEL CALVES

In Kenya camels weigh about 30kg. at birth and stand 75cm. tall at the shoulder. They are able to stand about 2 hours after birth and should be ready to graze with the herd in about 48 hours. The calf should be watched closely for the first two weeks. This means that labor needs will be greater during the breeding season. A good manager will plan accordingly. Some of the things to watch for in this period are:

- be sure that the calf gets some of the colostrum, especially during the first 4-5 days so that it will get enough antibodies to fight disease

- watch to see if the calf gets diarrhea from the colostrum and if it does dilute the colostrum with an equal amount of water (boiled to kill germs and then cooled)
- help the calf to keep up with the rest of the herd

Camel calves can be weaned at 3-12 months of age depending on the household's need for milk or the need to return the mother to oestrus so that she can be bred again. Growth of the calf will be faster and death loss will not be as great if the calf is allowed a greater proportion of the mother's milk and a sound health care program is instituted.

**** Chapter Notes ****

- 1) Field, 1979.
- 2) Field, 1979.

6.0 ESTABLISHING A CAMEL BREEDING HERD

One way of improving the production performance of any kind of livestock enterprise is to improve the genetic potential of the breeding stock. Currently in Kenya there are attempts to upgrade the camel stock through selection from local stock and by importing superior stock from other countries. If the attempt to upgrade the local camels is to be successful, there must be some effort to develop an extension education system to prepare the people for the proposed consequences of the new system.

This chapter will:

- discuss factors that should be considered when starting a breeding program for camels
- determine some management activities involved in such a program
- identify some of the priorities of the traditional camel husbandary system in Kenya

6.1 - DETERMINING NEEDS

Before any breeding program can start it should be decided what your resources are in terms of:

- camel stock available
- labor available for herding and milking
- economic needs of the camel owner.

If you are choosing between only a small number of camels, then you may have to accept a lesser bull as your breeding bull until you can upgrade your herd. If possible you may want to consider borrowing a bull so that you are able to upgrade your herd more quickly. This is a fairly common practice in camel keeping communities. When deciding which characteristics to breed for consider whether you want to breed for high milk production or large herd size.

Breeding for High Milk Production

Select those camels which had a good milk production record, stayed in milk even if the calf died, milked easily without having to be tied, have a history of being free from disease such as brucellosis, have not had stillbirths or abortions, and showed a good mothering instinct.

Breeding for Large Herd Size

Be mainly concerned with how many calves of a particular camel lived past weaning age. Some camels are not very good mothers and must be taught how to care for their offspring. You must also be concerned with how quickly they return to oestrus after calving. This will shorten the calving interval and you will be able to produce more calves in a shorter period of time. It will also mean that they will be lactating for a shorter time so you will have to sacrifice milk production.

Whenever possible, try to find out if the breeding stock available will produce the kind of offspring that meets your production needs. If all things are equal, it is always wise to have a camel who produces plenty of milk. The higher milk production can help the family milk supply while still leaving enough for the calf to grow quickly and as free from disease as possible.

6.2 - SELECTION CRITERIA FOR MALES

Physical Characteristics

If unfamiliar with the herd, and there are no records, then you will have to choose from those bulls who look like they will be productive. The first thing to look for is their ability to walk. Do they have sound feet? Do their feet turn in so that there will be extra pressure on their joints? Do their elbows rub against their ribs when they walk? Are they going to produce offspring able to walk as much as 80 km. some days in search of food and water?

Then you have to decide if they have capacity for production. The stomach of a camel is a food factory. If they have a small barrel, narrow chest, straight slab-sided ribs, then they are going to have problems. They will not have the capacity to digest large quantities of food and they will not have the heart or lung capacity to work well. Breadth is far more important than height and can be seen by standing in front of the bull to see if he has a broad chest and well-sprung ribs. He should also show good muscular development so that he can pass along strength and body size. Unless records are available it is difficult to tell if he has produced good milking camels. Traditional camel keepers claim that a bull who is capable of producing good milking offspring will have an especially long penis. If you have no other way of knowing, this is as good a criteria as any.

Attitude

Bull camels are usually very docile and easy to handle, but a mean bull weighing 500 kg. or more can hurt the people who must work with them as well as injure other camels. During the rut period they are especially dangerous. Try to select those bulls who are easy to handle, unafraid of people, not easily excited, but still fearless enough to help protect the herd from predators if necessary. When working around camels, especially males, it is wise to carry a light stick to discourage any unfriendly camels.

Grouping the Stock

All those camels who are not going to be used for breeding should be divided into separate groups for ease of management. Examples of grouping possibilities are:

- Those camels that are physically unfit, have little interest in females, poor walkers, history of poor health, genetically inferior offspring, and a bad disposition making them dangerous or difficult to handle.

These should be cut from the herd or culled if there is a herd size of sufficient stock to allow it.

- Those bulls that are not the best in the herd, but are sound physically. These should be castrated so that they cannot breed into the herd accidentally or injure themselves or others when fighting during mating season.
- Those bulls that show potential as sires, young bulls who have not reached maturity but may be used when they are older, and reserve studs to be used as replacements for the main breeding bulls. These should be put into a bachelor herd separate from the females. Possibly they can be worked heavily during mating season so they will be less likely to create problems for the breeding herds. If labor is in short supply they can graze with the herd in the daytime but should be put into a separate boma at night.
- The bull that has been selected as genetically superior. should be allowed to roam with the females in the herd and put with them at night in the boma. Remember that only one breeding bull should be with a group of females to prevent fighting and the serious injuries which can result.

6.3 - SELECTION CRITERIA FOR FEMALES

Physical Characteristics

If no records are available, look for capacity. A strong milk vein should be evident, well-spread hips, good gait that will allow her to walk for food, well-formed udder with good attachment, teats small enough so that they will not get cut by the thorns, but long enough for hand milking. Somali camel people say that if a female camel is a good milker she will have small pointed ears and will be white in color.

Attitude

In many cases women will be doing the milking so you will want to select a camel that is not afraid of being handled. If possible, determine if she has been a good mother. Camels have a high death loss for calves who have not reached 3 years of age. A good mother will stay near her young to protect it, allow it to suck even when out grazing, and sit near it at night to keep it warm.

Grouping the Stock

In most cases it will not be possible to cull the female stock as closely as you might want to. It is very difficult

to buy replacement stock since most camel keepers will not sell a female unless she has problems getting bred or has aborted several times. One possible system that could be used to cull females where labor and forage were readily available would be to:

- Sell those females who are unable to produce, have a history of abortions or stillbirths, or have genetic problems that prevent their walking well.
- Keep unbred heifers and marginal females in a separate herd which can feed in some of the poorer areas.
- Establish a primary breeding herd with all females over four years of age. These should be kept in areas with better feed. This will help them stay in better condition after they are bred. This system requires considerable labor. It may not be applicable under some circumstances.

Those camels that represent the breeding stock should not be used for work if possible. If enough bulls are available you should keep one bull for twenty females, if not, a bull should be able to handle fifty females if he has no other work.

6.4 - PREPARATION FOR BREEDING SEASON

As rainy season draws near all the camels who are intended to be bred should be closely observed to determine if they are:

- physically fit
- free from disease such as trypanosomiasis, camel pox, brucellosis, mange, worms, ticks, salmonella and other parasites that may affect their breeding.
- supplied with salt and mineral supplements

Although these things should be done throughout the year, it is especially important to provide some preventive management at this time if you are to have a successful breeding season and healthy calves.

The herder should keep close record of which camels have been bred and when breeding occurred. Two to three months after the females are no longer being mounted they may be checked for pregnancy. Those females who go through a breeding season without getting pregnant should be watched very closely to determine if they have some physical problem. If they are unbred

after the second season they should be examined by a veterinarian and culled if necessary.

6.5 - UPBREEDING

The quality of any breeding program must start with the stock you have available in your present herd. With careful selection of the best animals in your herd you can increase the GENETIC POTENTIAL of your stock. A faster way to increase the production within your herd is to use superior stock from another herd. This can be done by purchasing better stock or by borrowing a better bull to put on your females.

An upbreeding program can show results more quickly with cattle or small stock than with camels. Camels have a longer calving interval. When performance testing cattle, a bull can have daughters in milk in three years. Camels may require 4 years or more to reach maturity. Add one more year for its gestation period. Then it will take 2-3 months to determine its milk yield. This amounts to a total of 6 years to see the same results that you can achieve in 3 years with cattle.

6.6 - CONSTRAINTS TO BREEDING

In Kenya there are several constraints to upbreeding a camel herd. Some of these problems are discussed below.

Lack Of Excellent Breeding Stock

The milk yield only differs by 2-3 kg/day between the various types of camels. Until further information is collected on milk production in Kenya, selection from within the herd, selection from local stock of proven ability, and improved management will probably provide the best approach to increased yield. The cost of bringing in a better camel from Somalia or some other country may not be worth the potential increases in production. This may change as management skills increase.

Traditional Camel Husbandry Systems

When most people think of a breeding program they usually think in terms of a commercial ranch that has a good record system and only one main objective to meet with their animal production. On a commercial farm, increased profits is the major objective of a breeding program. Camel raising in Kenya is done on a subsistence level. The majority of the camel keepers in Kenya rely on their camels for as much as 90% of their food supply. Survival is more of an issue to them than increasing profits.

An improved breeding system usually identifies some specific problem or need, such as low milk production, that can be taken care of by breeding a better animal. In a traditional system the family depends on the camel for a variety of reasons such as blood, meat, or transport. This means that they may have to leave the camel in milk for a long time so that they will have enough to eat. A long calving interval will result and this will slow the breeding program down. A short calving interval is better if you are trying to make rapid changes in the camel herd or build up large herds. When using a shorter calving interval the female will calve, wean the calf early, and return to heat to be rebred in as short a period as possible. Under the traditional system the female will stay in milk for a year or more. The calving interval may be as long as 3 years. Lactation will stop 4-8 weeks after conception so the subsistence stockman does not want his females to breed back quickly or he will lose his milk supply.¹

Markets

Any increase in production must be met with an equal way to use the added products. In some cases, the family can use the extra milk supply for its own purposes. But there is a limit to how much milk they can use since camel milk is not used for cheese making in Kenya. Storage can only be done by souring the milk and this serves as a short-term solution.

At the current time in Kenya there is little demand for camel meat. The camels that do go for slaughter are very old and weak so the meat is not of a very high quality. Until markets for camel meat, milk and transport expand we must move ahead cautiously with wide-scale breeding programs. At the traditional level, overproduction is not greatly appreciated because it puts heavy demands on the labor. This is especially hard on the women who must milk the animals as well as find a way to process the milk to keep it from spoiling. The increased production could be well used by the calf, but this requires an extension education program in addition to the breeding plan.

Multiple Use Factor

One of the arguments for increasing the production of the camel herds is that it will allow the owner to keep fewer camels. This would be beneficial because:

- fewer stock should reduce environmental damage from overgrazing
- fewer animals reduce labor needs
- fewer animals to treat with expensive veterinary inputs
- lower costs because of fewer numbers of stock

These points are true for a commercial herd, but for pastoralists who need their camels for survival, some cultural aspects are missing. The needs put upon the traditional herds go beyond production goals. Within the traditional system camels are kept for a variety of reason such as:

- paying for bride prices
- a store of wealth like a bank
- protection against inflation that lowers the value of cash
- a form of social security. By lending stock to clansmen when they are in trouble, they will have someone to turn to for help should fortunes reverse.
- protection against loss by disease or theft. When they have large herds, they are able to split them up so that they have less risk of losing the whole herd to stock raids, drought or illness.

Management Skills

If one breeds to higher producing camels, there are new management problems and decisions that must be met. As production increases the feed supply must also be improved or expanded for the stock to reach its genetic potential. Since each animal is producing more, it is worth more to the owner. A reduction in herd size would make the owner more dependent on fewer stock. The owner would be at greater risk if he lost half of his herd. He would have to put more money and energy into health care and veterinary inputs because each animal is such a valuable investment. At this time in Kenya the necessary veterinary inputs are not available to many of the camel keepers because they live in such remote areas. They see no incentive to keep fewer animals or expensive breeding programs. If up-breeding is going to catch on among the traditional camel keepers it will require an extension education program that clearly points out the benefits of keeping higher producing camels.

The traditional camel keepers of Northen Kenya are already attempting to breed for better production. The Gabbra have been trying to buy breeding stock from the Somalis. Development planners should look at local efforts at upbreeding before any new programs are started. It might be more cost effective to supplement existing breeding programs with an extension education plan rather than start a parallel breeding program.

6.7 - INFORMATION NECESSARY TO DEVELOP BREEDING PROGRAMS

Before breeding programs are undertaken it is wise to gather some information about the needs of the people for whom the system is intended. Some appropriate questions to ask are:

- 1) What are the available feed and water supplies in both wet and dry years?
- 2) What are the management skills of the people involved?
- 3) If improved skills are needed what sort of extension education programs are available or can be developed?
- 4) How are the people using their camels?
- 5) Are there cultural restrictions that might work against such a breeding program?
- 6) How much labor is available? Is the labor seasonal or can it be counted on when there are peak demands?
- 7) Who does the milking? How do they feel about increased milk supplies?
- 8) Is there sufficient improved stock to carry out a long term breeding program?
- 9) Are there sufficient support services such as veterinary technicians, drugs against ticks and other pests, and vaccines?
- 10) What is the market situation? Can it be improved?

Camel breeding is a long term proposition. Before such a program is started it should be determined that the people understand that the results will not be seen right away. This should be stressed at the beginning so that the people do not have unrealistic expectations. Failure to make this clear could result in people leaving the program before it has a chance to succeed.

6.8 - CASTRATION

Castration of bull camels is common on both commercial ranches and among traditional camel-keepers in Kenya. It is believed that castration will produce a better meat carcass and increased rates of weight gain. Castrates are said to be more easily managed and better workers due to their lack of interest in fighting or in females. Bulls are usually castrated

between their fifth and eighth year. It is unwise to castrate too young since it may reduce the size and strength of the male.

Camels may be castrated in the same manner as other livestock. Open castration using a knife or some means of destroying the spermatoc cord such as Burdizzo Pincers are often used on commercial ranches. Traditional camel people sometimes crush the spermatoc cord by twisting it between two sticks. A good manager would avoid such cruel and crude methods. Castration can take place during any season of the year.

There are some questions to be raised with regard to castration. First of all, male camels are easily handled except when they are in rut. Secondly, since most camels are raised on a free range system, the camel owner is always under the risk of losing his breeding bull to lions, hyena or other predators, or injury. If the males are left "entire" or uncastrated there will always be at least some males for breeding purposes should something happen to the herd stud. The sale of camel meat in Kenya is of such a low economic importance that the male is probably worth more as a potential breeding bull than he is as a meat carcass so there is no economic advantage to castration. The problem is more one of management. If there is labor available to keep the males in a bachelor herd during breeding season then there is little advantage to castration.

6.9 - SUMMARY: CAMEL BREEDING PROGRAMS

When establishing a camel breeding program it is important that the needs and priorities of the local people be understood. The program must be tailored to the skills and resources found at the local level. Higher producing camels must have access to a better quality and quantity of food if they are to produce more than the stock currently used in Kenya. The availability of veterinarian supplies must be taken into consideration when planning to introduce high producing camels. If Kenya is going to increase the amount of meat and milk produced by camels, there must be improvements in the animal health system that exists today in Northern Kenya. The most successful breeding programs are those that are sustainable over a long period of time and provide for those needs as identified by the target populations.

** CHAPTER NOTES **

- 1) Field, 1979.
- 2) Coussins, 1971.

7.0 - PRODUCTS FROM THE CAMEL

The potential for camel production is vastly unrealized. The camel can provide Kenya with milk, meat, and other products as well as be used for animal traction. This chapter will:

- describe the quantity and quality of camel milk
- describe the use of camel meat, wool and hides
- list ways in which camels can be used for transport and animal traction

7.1 - MILK PRODUCTION

The amount of milk a camel can produce depends on such factors as:

- management system
- health care program
- available feed supplies
- stage of lactation
- genetic potential of herd
- milking frequency

Based upon reports of traditional subsistence systems in Kenya, camels give about 5-6 liters of milk per day. A normal lactation period is about 12 months. However if the quality of the pasture will keep the mother in good condition, she can produce milk for as long as 18 months or more. The management system is important because animals given supplemental feeding, salt and minerals will give more milk. The genetic potential is also important, especially where there is enough feed to match the heavy producer. In India and Pakistan, camels produce 18-20 liters of milk per day. The camel produces more in the early stages of lactation than in the last few months. In Northern Kenya yields during the first 10 weeks were as high as 13 liters per day and dropped to 3 liters per day in the last 57 weeks.¹ On two commercial ranches in Kenya, 4 milkings per day produced more milk than twice-a-day milkings.² In some traditional systems, camels are milked 5-7 times per day.

In the harsh desert areas of Northern Kenya, a comparison was made between the milk given by a herd of native Zebu cattle and a herd of camels on the same range. Twenty Rendille camels gave as much milk as 80 cattle.³ This is true because camels are not as badly affected by drought and heat, and they are able to eat plants that cattle are unable to eat, such as leaves, shrubs and salt bushes which are still around after the grass has died.

7.2 - MILK COMPOSITION

Appearance of Camel Milk

There is quite a lot of research available on the chemical composition of camel milk. Since many of the people who keep camels must rely on milk for their major source of food it is important to know if it meets their nutritional needs. Camel milk is very white compared to other milk. Even the butter from

camel milk is white, not yellow. This is because camel milk is low in carotene which is necessary for the production of vitamin A. The composition of camel milk depends upon:

- the stage of lactation
- the quality and quantity of the feed supply
- age of the camel
- amount of water in the feed or frequency of watering

Water Content

Among the Bedouin camel keepers, a milking female is taken on long journeys across the desert. They do this because camels have the ability to draw water out of their system and put it into the milk. When a camel is well-watered, the milk has a water content of about 86%. When she has been without water or on very dry feed for long periods of time, the water content is about 90%. This means that the calf or people drinking her milk can get their water from her milk.⁴ This is especially important to the calf because it protects the calf against dehydration.

The amount of water the female has had to drink will also affect the fat content in the milk. As the water content increases the fat content decreases to about 3%.⁵

Table 7.0 Average composition of milk from cattle, sheep, goats and camels.

COMPONENT	COWS ***** Shown	GOATS as Percentages	SHEEP ****	CAMELS
MOISTURE	86.1	88.2	86.4	85.6
ASH	0.6	0.6	0.6	0.9
PROTEIN	3.8	3.3	4.4	4.5
ETHER EXTRACT	5.0	2.9	4.1	5.5
CARBOHYDRATE	4.5	2.8	3.7	3.4
**** Shown as mg./100g ****				
CALCIUM	128	133	144	40
PHOSPHORUS	108	97	122	138
IRON	0.52	0.38	0.41	0.5
THIAMIN	0.04	0.04	0.04	0.06
RIBOFLAVIN	0.01	0.03	0.04	0.08
NIACIN	-	-	0.04	-
VITAMIN C	1.45	1.97	1.34	5.60

Source: Adapted from Knoess, 1976

Vitamins and Minerals

Camel milk is as high or higher in most of the vitamins and minerals as cow's or goat's milk. It is three times higher in vitamin C which is very important since there are very few vegetables available in the Northern districts of Kenya. Camel milk is higher in phosphorus but lower in calcium than goat, cow and sheep milk.

Some people say that camel milk is hard to digest, but people who are used to it report no such problems. It is used in some places in Somalia and the Middle East to cure infections, stomach upset, and tuberculosis.⁶

One reason camel milk is so nutritious is the fact that the camel has a varied diet. It eats the leaves and seeds of many different trees as well as shrubs, herbs, and grasses so it gets a diverse diet with many nutrients.

Camel milk may taste salty at times, but that is probably because the camel has been eating salt bush or is in need of more water. See table 8.0 for a nutritional comparison between different kinds of milk.

7.3 - MILK PRODUCTS

Most people in Kenya use the milk in a liquid state and fresh from the camel. It is also soured as a means of preserving it for long journeys. Ghee or clarified butter can be made from camel milk but it takes a large quantity of milk to produce a small amount of ghee. The ghee is then used as a cooking oil. Cheese can be made from camel milk, but it is a bit difficult. Camel milk has an unusual chemical structure that makes separating the fat from the milk protein difficult. It will produce a soft cheese. Some people make cheese from the buttermilk left after making ghee or butter. Soft cheeses made from camel milk differ from cow or goat cheese because they require much larger amounts of RENNET (60-70 times more) than would normally be used.⁷ Rennet is obtained from the stomach of rabbits, goats, or baby camels. It causes the cheese to form soft balls or curds. The curds can be pressed into blocks or balls of cheese after the water has been drained from it. Some efforts have been made at dehydrating milk so that it can be transported more easily and without spoiling. Additional efforts must be made in finding ways to preserve camel milk and to make additional milk products if camel production in Kenya is to grow.

7.4 - CAMEL MEAT

The major markets for camel meat are Egypt, Sudan, Ethiopia, Saudia Arabia, and other countries in the Middle East, especially during the annual journey of large numbers of Muslims to Mecca. Kenya has not entered into these markets in a direct way to a very great extent. They have supplied these markets indirectly through Somalia. It has been reported that as many as 34,000 camels in 1979 moved from Kenya to Somalia to be exported to the Middle East.⁸ The potential for camel meat has not been explored nearly enough in Kenya.

One of the problems has been that camels are very old when they are finally taken to the market. At one market in Kenya, the average age at slaughter was 14.5 years. This would make the meat tough and not very flavorful. If camels are slaughtered at about 5 years of age, the meat tastes very much like beef.

Camels have a very good dressing percentage compared to other domestic animals. This is the amount of edible meat in comparison to the total weight of the animal. Dressing percentages range from 50-70%. If a camel weighed 500kg. that would supply the market with at least 250kg. of meat.⁹

7.5 - CAMEL BLOOD

Some of the non-Muslim people in Kenya bleed their camels to add extra vitamins and minerals to their diet. The blood is usually drawn from the neck by piercing a vein with an arrow and collecting the blood in a bowl. They may take 2 to 5 liters per month without hurting the camel. Excessive use of camel blood will weaken the camel and should only be taken if absolutely necessary for the family's survival. Blood should never be taken from an immature camel.

7.6 - HIDES AND WOOL

Camels produce large hides of poor quality leather. They are used mostly for sandals, rope or whips. In Kenya there is little or no use of camel hides on a commercial scale.

The wool from camels is used for making bags, tents, and blankets. In Kenya there is almost no camel hair being used on more than a subsistence level. The Nanyuki Weavers and Spinners Guild report that camel hair is difficult to spin into yarn for fine woven goods. There are many carpet makers starting up in Kenya so there may be a potential market for the wool with them. Studies need to be carried out to determine how best to develop this potential. A camel will supply 2-3 kg.

of wool. It is found mainly around the hump and flanks where it can serve as padding against the saddle if the camel is worked.

7.7 Summary: Camel Products

Camel milk production in Kenya averages about 5-6 liters of milk per day. Milk production will be highest early in the lactation cycle. Camels among Kenya's nomadic livestock keepers produce as much as 4 times more milk than local breeds of cattle kept on the same pastures.

The people of Northern Kenya depend heavily on camel milk for their survival. It is relatively nutritious in comparison to other kinds of milk. The composition of camel milk is affected by the hydration status of the female. If she has not had much to drink for the last week, the water content of the milk will be high. This in turn lowers the fat content of the milk.

Most of Kenya's camel milk is consumed in a liquid state. Because of the protein structure of the milk it is difficult to make cheese with it. There are some attempts being made to make a soft cheese. More research needs to be done. Camel milk has the ability to resist spoiling for longer periods of time than cow milk. The local people often sour the milk to store it longer.

Camel meat is eaten at the local level. There needs to be improved markets developed if camel meat is going to help Kenya meet its food needs. Camels can be bled occasionally and the blood is used to supplement the diet of the local people. Camel hair and hides are seldom used in Kenya.

** CHAPTER NOTES **

- 1) Field, 1979.
- 2) Evans and Powys, 1979.
- 3) Spencer, 1973.
- 4) Yagil and Etzion, 1980.
- 5) Yasim and Wahid, 1957.
- 6) Montiel, 1952.
- 7) Wilson and Mukani, 1981.
- 8) Morton, 1983.
- 9) Mukasa-Mugerwa, 1981.

8.0 - THE RIDING CAMEL

The uses of camels go beyond milk and meat. Camels also can be used for riding. This chapter will:

- show how and where riding camels are used
- explain how to train camels

8.1 - POTENTIAL USES OF THE RIDING CAMEL

Under normal conditions, the camel is not ridden in Kenya. Sick or injured people may be transported on camelback by some of Kenya's camel people. Children may occasionally be carried on camels. The camel is not traditionally trained specifically for riding in Kenya as it is in some countries such as the Sudan or among the Tuareg people in West Africa.

In Kenya the introduction of riding camels would be a new technology. In some parts of Africa riding camels have been used as far back as 190 B.C.¹ They have been used in warfare, for delivery of the mail, and for racing. At one time in Kenya there was an active camel corps located in North Horr, but it has fallen into disuse since the coming of four wheel drive vehicles. Why then, should riding camels be considered if they are outdated by the automobile?

There are several ways in which camels could be of service in Kenya. One of the problems Kenya is facing is the heavy cost of maintaining veterinary and health services in the Northern Districts. The cost of petrol has made village visits impossible for many areas. The roads in Northern Kenya are beyond repair in some regions. The camel would allow both veterinary and human health services to be extended to some of the areas untouched at the present. Some missionaries are already taking advantage of the camel for transport. Their success should serve as a model to others.

Another problem faced in camel regions is the ecological damage brought about by new settlements of people. These people used to be much more nomadic so they did not remain in large populations in one place for very long. Now, due to a variety of reasons, many of these people are moving to settlement areas where human social services such as schools and health care are available. This makes it necessary for the people to cut trees for houses and for firewood if they are to stay in one place. Vast areas around these settlements are now treeless. Where herds once roamed large areas, they have been crowded into smaller and smaller areas until there is very little for them to eat. If riding camels were introduced, people could live farther away from these social services and still ride in to use them in a day or two. This would take some of the population pressure off these low rainfall areas so they could be reforested.

Another way in which riding camels could be useful would be to help provide security against the stock thieves that live in the north. A mounted camel patrol would open up grazing areas that people are currently afraid to use. This will reduce the pressure on the available forage in arid regions of Kenya by adding to the total grazing area.

8.2 - SELECTING A RIDING CAMEL

Those countries that have a tradition of riding camels have developed a breed or type of camel specifically for this use. The most famous riding camels found near Kenya are the Beja camels and the Anafi camels of Sudan. The description of a typical riding camel is based on these two breeds.

FEET - small enough to allow the camel to be agile and light of step, yet large enough to support its weight at faster paces. Front feet should be straight while the rear feet should turn out slightly. They should have tough, evenly worn callouses to protect them from rocks or hot sand.

FRONT LEGS - fairly close together, long and straight, elbows should be away from the chest so that they do not rub against the chest pad. They should be well-muscled.

REAR LEGS - straight and long, with no tendency for "cycle hock" or bow legs. The loins should be well-muscled.

BODY - short body with well-sprung ribs to give a small but well-rounded barrel shape. The ribs should lead well up to the pelvic bone. The rump should slope down, being of medium length. Hump should be symmetrical and the chest broad and deep to give the camel stamina and capacity for work.

NECK - well-muscled but not coarse so as to appear out of proportion to the rest of the body. It should be attached lower down on the body, and extend straight out for about 1/3-1/2 of its length, then curve up sharply in sort of an L-shape

HEAD - small, fine boned, with small lips and a long jaw line ending well below the eye. The eyes should be large and prominent. It should have an alert expression, with small ears pointing forward. The head should be carried high so that the bridge of the nose is just about parallel with the top of the head.

This description represents the true type riding camel that the camel-riding people would look for. It does not mean that only camels that have these characteristics should be chosen. Any camel can potentially be taught to ride. The finer boned camels will probably be faster and have a more pleasant gait. There are many camels from the Somali and Rendille populations that could be found to have some of the attributes found in riding camels.

8.3 - PACE OF A RIDING CAMEL

The pace of a riding camel can be classified into a walk, jog, fast run, or a canter. Before buying a riding camel one should watch it move at these various paces. The ideal camel will appear light on its feet, without the plodding gait seen on so many of the larger boned camels found in Kenya and Somalia. The various speeds at which the camel travels are:

WALK - The preferred walking pace is about 4 km. per hour. This pace should be easily maintained even for distances as great as 40 km/ day.

JOG - This is the pace at which a camel is most comfortable to ride. The motion is quite even, and easy on your back. A good riding camel should be able to cover level ground at a speed of 8-12 km. per hour. The distances at which the camel can maintain this speed depends on the conditions in the area in which it is travelling

FAST RUN - A well-bred riding camel can hold a fast run of 14-19 km. per hour for an hour or so. It would be unwise to push the camel at this speed for too long a time. A rider may cover 80 km/day for two weeks if the fast run is used periodically.²

CANTER - The canter will reach speeds of up to 30 km/hour. The camel should not be run at such high speeds for more than a kilometer without running the risk of injuring the camel. It is also very tiring for the rider to canter for long distances.³

8.4 - SELECTING BY AGE

The age at which you begin training a camel to ride depends partially on how soon its services are needed. Ideally, you will begin training with enough foreplanning to allow the camel to practice and work with light weights at first then build up to heavier weights and longer distances. Generally, you would try to choose a well-developed 3 year old. If you work a camel that is too young with very heavy loads you can slow down the growth rate and possibly injure the camel. Starting with a 3 year old will give you more years of service because the camel will have had time to mature and get to know the owner while it is being trained. It may mean that you have to wait longer before it can be ridden at full speed or carry a full load, but it will be a better riding camel as a result.

8.5 - TRAINING CAMELS TO RIDE

Once a camel has been selected, the actual training can begin. The ideal camel selected would be:

- 3-4 years old
- well-developed in bone and muscle
- show little fear around people and be of generally calm disposition. The camel's attitude is important for safety and confidence when handling or riding it.

The training program can be broken down into stages. There are many ways to train camels. Several books written by military men who worked with camels in India and the Middle East are listed in the bibliography. They give descriptions of camel training techniques. The method described here has been used with success in Kenya for training both riding and pack camels. It seems to have fast results and has been easily adopted by traditional camel keepers. The training steps which will be described are:

- Step 1) Handling Stage: getting the camel used to being touched and working with people.
- Step 2) Weight Bearing: teaching the camel to carry a load.
- Step 3) Breaking the Lead: training the camel to respond to the rider's commands.

8.6 - HANDLING STAGE

The camel you are training may have already been working so it knows how to carry a load. But since you do not know how well it has been trained it will be better for your safety and confidence if you assume that you must start from the beginning. The camel must have time to get used to noise and people working closely with it. If the camel bolts while there is a rider on it serious injury may result for that rider. If you are loading baggage on the camel and it suddenly gets scared and runs off, not only do you risk losing the load, but you could easily injure the camel. The following 9 steps are suggested for getting the camel used to riding:

- 1) Camels are curious by nature. When you approach the selected camel for the first time, allow it to smell you so that it will be able to recognize you when you approach. Do not reach out to touch the camel, rather, let it come to smell you first.

- 2) Separate the camel from the herd in the morning before they leave the boma. It is difficult to separate one camel from the herd and expect it to pay attention while you work. Camels do not like to be taken from the group. If the one you are training can see the others it will want to try to join them. Once the other camels in the herd have gone off to graze and are out of sight it will be easier to handle the camel you are training. The boma is a good place to start training because the camel is confined so it cannot run away as easily. A corral or any confined area like a dry river bed will be good, but it helps to limit the space in which the camel has to move. Once the training begins, try talking continuously to the camel in a smooth and even voice. This helps to keep the camel calm and trusting. Do not try to touch the camel's head or face, but stroke its flanks slowly and deliberately so it can get used to being touched and learn that you are not going to hurt it.
- 3) Continue talking to the camel while stroking it so that you can lay the rope over its neck. Do not throw the rope or make any threatening gestures. Haste now will make the job much slower in the future if the camel learns to fear people. Once the rope is around the camel's neck tie a knot in it and run a loop around the camel's neck. The knot keeps the rope from closing around the neck if the camel tries to get free. Take the loose end of the rope and loop it over the camel's nose and back through the neck rope. Now you have a halter to help control the camel. See figure 8.0 for an example of a rope halter.
- 4) Once you have the halter in place, put pressure on the rope so that the camel realizes that it is connected to you and is restrained. The camel will probably try to pull away, so keep talking in a firm but calm voice. Allow the camel a bit of rope so that it has some freedom of movement. If you try to pull the camel up short and force it to obey, you will end up with a battle on your hands because the camel will try to break loose. A frightened camel will pull you wherever it chooses since it outweighs you by a few hundred kilos. If the camel tries to run away, put pressure on the rope and walk in a circle around the camel. This gives the camel the feeling it is not confined so it will relax. By circling the camel, it will not pull the rope away from you. The object is to allow the camel some freedom of movement so that you can reduce some of its anxiety yet still show it that you are in control. If it starts to struggle once again, allow some of the rope to run free, then when the camel is calm pull the rope back in to you. The camel will soon realize that it is connected to you. By talking to it

in a steady voice you develop trust with the camel. When it gets frightened you must calm it so it will depend on you for some of its behavioral signals. Within a few hours the camel should be calm enough that you can start walking with it.

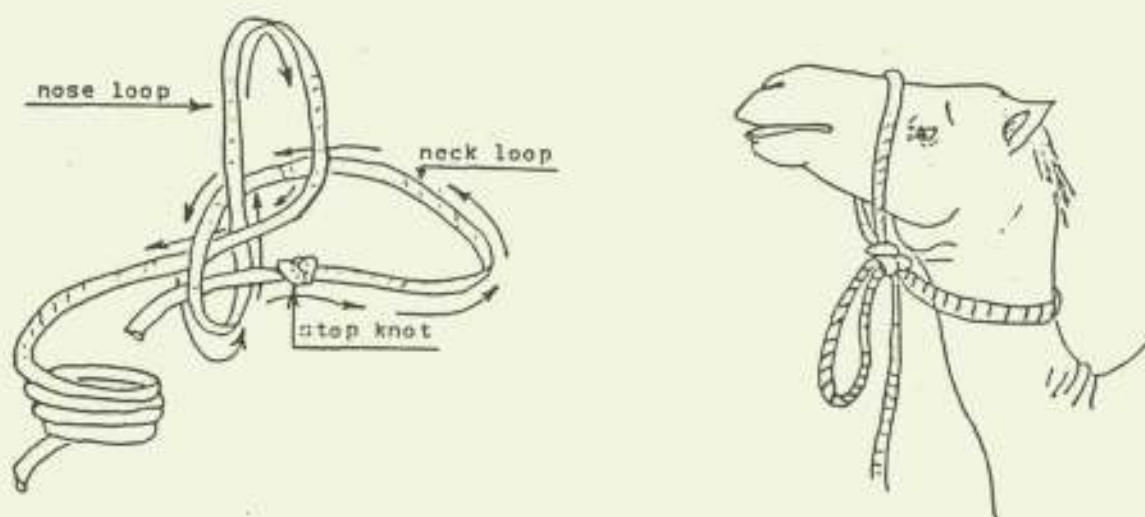


Figure 8.0 A halter made from a piece of rope.

- 5) Now that the camel is getting somewhat used to you and the rope, start teaching it voice commands. If it has already been trained for work, it has a set of voice commands that you should use. If not, start your own commands such as "HUP" or "KWENDA"! Whatever command you use, stay with it, use the same tone of voice and reinforce the command by pulling on the rope. If you want to go forward, call it, then pull on the rope. Stop, pull down and back on the rope, and tell it to stop. Gradually shorten the lead so that the camel gets used to your being close to it and relates to your being in command. At first you might need someone to walk behind with a small stick to tap the camel's flanks lightly when it gets uncooperative. If it tries to pull away allow it a little rope. Then pull the lead up short so that it understands that it is not going anywhere without you. Rope lead the camel for awhile so that he gets used to the rope. Walking the camel on the lead also helps to tire the camel so it is easier to handle.

- 6) When you feel that the camel is used to the idea that you are in charge, you can teach it to sit or be CROUCHED. This is the normal sitting position for the camel so it usually picks up this command fairly easily. The camel sits with its legs tucked underneath it and its belly on the ground. This is also the position the camel must be in to load or mount it. While talking in a calm firm voice, pull the neck down to lower its head and give it the voice command to sit. If it refuses to sit, slap the ground in front of its feet with a stick while pulling down on the rope. If it still refuses, tap its feet with a switch. Since the camel already knows how to sit, all you are really doing is getting the camel used to the command to sit. Once you see that the camel is going to sit, loosen up on the lead rope so that the camel has plenty of room to move its head. It is a slow and somewhat complicated process for a camel to sit down so it must have freedom to move.
- 7) After the camel is sitting, you can prevent it from getting up by standing lightly on its forearm or by tying the fetlock and forearm together. When the camel is in the sitting position, rub the camel's neck, adjust the halter, check for ticks in the ear, or brush the camel so that it will get used to your being close to it and touching it. After getting the camel to sit on command, you are ready to introduce it to the saddle.
- 8) Crouch the camel, then bring the camel saddle over and place it near the camel so that it can smell it. If the saddle pad and saddle have never been used it helps to leave it in the boma for a week or so. This gives the camel an opportunity to see it and get to know it. Camels have a good sense of smell. If equipment has laid in the dung and urine for a few days it will smell more familiar to the camel. While the camel is smelling the saddle, lean on the camel's back so it can feel what it is like to have weight on it. Pick up the blanket and while talking to the camel put the blanket on the camel's back. Be sure to shake out the blanket or check to make sure there are no thorns or burrs in the blanket that will rub on the camel. Next put the saddle on. Before tightening the girth, be sure you have it in front of the camel's penis rather than over it or you may find the camel is quite upset with the situation. With the saddle on, begin walking the camel around. It is good to take the camel out on long walks at first so that it can feel the saddle move about about as it goes up and down hills.

- 9) Stand the camel up using voice commands and walk it around. Continue crouching the camel with the saddle on until it seems to be responding to voice control.

At some point during this first day of training, you will have to let the camel go and eat. It is helpful to make the camel work for a long time without a break the first day so that it is easier to handle. When you do finally allow him to graze, hobble the front legs by tying them together with a short rope. If there is no danger of predators you can tie the camel in bent arm position. See figure 8.1 for different methods of hobbling a camel. If the camel is hobbled it will make it much easier to get the lead rope and halter on it when you begin the afternoon training session. Many camels respond quickly to the rope and halter. Some will put up a fuss but still give in to the lead. Remember when working with camels that they can kick both forwards, backwards and out to the side. There are those camels who either fear or dislike being led so much that it is too much work to train them. If other camels are available it might better to select another camel.

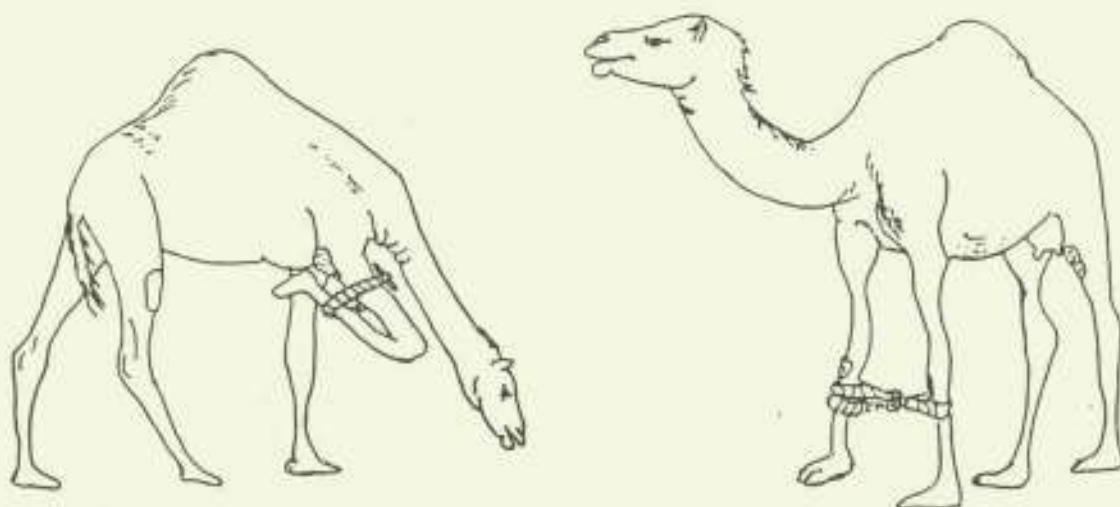


Figure 8.1 Two methods of hobbling a camel.

If it is convenient the camel should be put back with the rest of the herd at night. You may find it better to leave the camel hobbled at night until it becomes easier to put the halter on. The camel will be able to get up and down at night if the leg is tied in the bent leg position.

During the Handling Stage your goal is to try to establish a relationship with the camel so that it knows you and trusts you. Most of the tasks you are asking it to do are new so the camel is vulnerable to your trust. Even when you have been kicked or are angry with the camel, try to speak calmly and move slowly and deliberately. The more consistent you are, the faster the camel will learn.

Talking to the camel has been stressed during the training process. Besides establishing trust with the camel, it is believed by many traditional camel keepers that the camel likes to hear the human voice. Somali camel people have over 200 songs that they sing to their camels. Skilled Somali camel men have different songs they sing for different occasions. There is one song they use to get the camels to stay closer together when in caravan, another they sing when watering or feeding. The pace of the camel is controlled by a different song. Camels that respond well to singing are given a special name. Although you may not be able to learn all of these songs, you should at least make an attempt to learn the voice commands in the language that the camels are accustomed to. For instance, the command "HO" in English is often used to get an animal to stop. Some Somali men use "HOA" to mean walk faster. They are pronounced somewhat differently, but could easily be confused. It might save time in training to learn what the camels are used to hearing.

8.7 - WEIGHT BEARING

When you feel that the camel has gotten used to the saddle, it is time to add more weight to it. An easy way to add the weight is by making a saddle bag that can be filled with sand, rocks, or other heavy material. The saddle bags can be made by opening two feed sacks along the longest sides. Then make sure that both ends of the bag along the short side are sewn completely shut. Straps can be sewn from the top edge of each bag so that they are joined when placed over the camel's back. The saddle bags must be secured to the saddle to keep them from falling off if the camel runs away. See figure 8.2 for an example of saddle bags.

Additional weight should be applied in 20 kg. increments until you have the camel carrying 50-100 kg. without much trouble. When loading a camel be sure to put equal amounts of weight on each side so that the camel's load is balanced.

Once you have started working with the camel it is wise to work with it at least for a short period every day for a week or so. The technique you have used for training a camel to ride is the same as training it for transport up to this point. The more difficult part is breaking the camel from the

lead rope to reins so that you can direct it from the saddle.

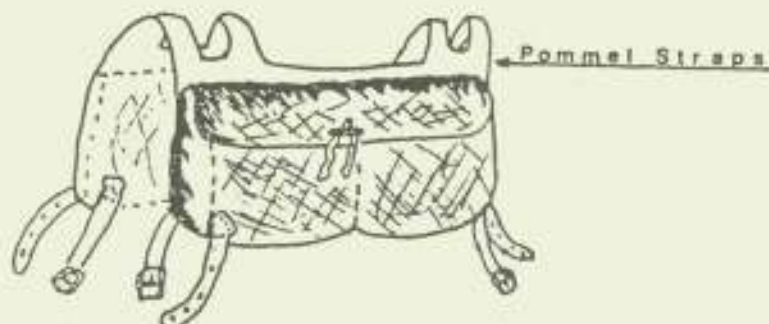


Figure 8.2 A design for camel saddle bags using gunny sacks.

8.3 - BREAKING THE LEAD

When you feel confident that the camel is accustomed to being handled you can try to mount it. Start by crouching the camel and putting the saddle on him. The saddle girth should be tight enough to keep the saddle from sliding around but not so tight that it cuts off circulation. With the camel still in the sitting position get on the camel. Move around so that the camel can feel you on him. One person should be on the saddle and a second person controlling the lead rope to make sure that the camel will not try to run off and injure the rider. Hold onto the reins very tightly because the camel will pitch the rider forward when he gets up. When the camel has gotten his hind legs up he will pitch backwards as he straightens his front legs. The entire motion used for standing will unseat the rider if he is not prepared for it.

The first few days will be spent trying to get the camel used to the extra weight of the rider and, more importantly, the higher center of gravity presented by the rider on top of the saddle. It must seem strange to the camel to have this weight wobbling around on its back. Basically the camel is broken for riding at this point. The next task is to train the camel to respond to the reins and voice command.

There are three major ways of controlling a camel with reins. They are:

NOSE PEGS - With this system the cartilage in the nose is pierced and a wood or plastic tube is put into the hole so that a rope can be passed through the hole in the nose. Traditionally, metal was used, but this can get hot when the temperatures are high and hurt the camel. Unless you will be riding the camel very fast a nose peg may cause more problems than it is worth.

NOSE LEAD - In Sudan, a ring is put through the soft fleshy part of the nostril. This ring may be made from leather rope or silver. Metal is not as good because it will heat up during the day. A single rein is attached to the ring, and the camel is restrained or turned by pulling on the rein. This method gives good control, but can result in nose tears which may get infected or otherwise be a problem. See figure 8.3 for an example of a nose lead.

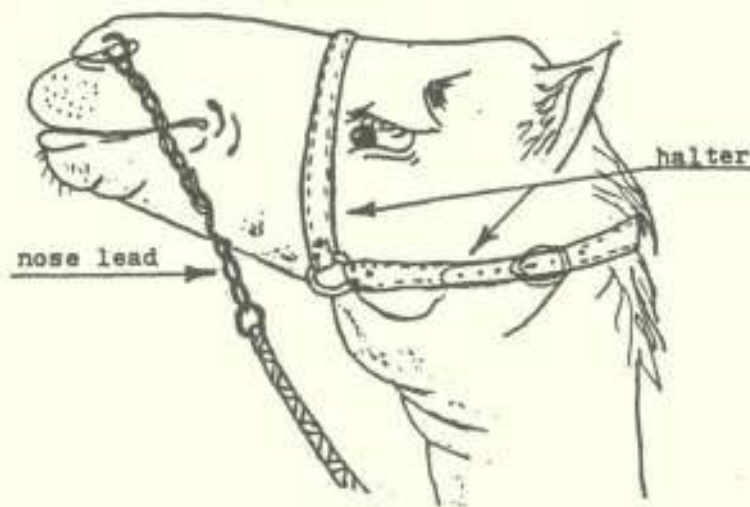


Figure 8.3 Nose lead for camels

HALTER - This system is used by the Tuareg and other skilled camel riders with good results. It is the least painful and most trouble free way of controlling the camel. The halter is a strap of leather that goes around the nose of the camel. This is joined by another strap that lies behind the head of the camel to keep it from pulling the halter off. A rope is attached to the halter on two sides with which the rider can control the camel. The Gabbra use a variation of the halter to lead their pack camels. They tie a rope around the lower jaw behind the camel's molars. This system can be used for guiding a riding camel as well. See figure 8.4 for examples of halter and mouth leads. Some West African camel riders use a light rein, but steer primarily with their feet which they rest on one side of the camel's neck.

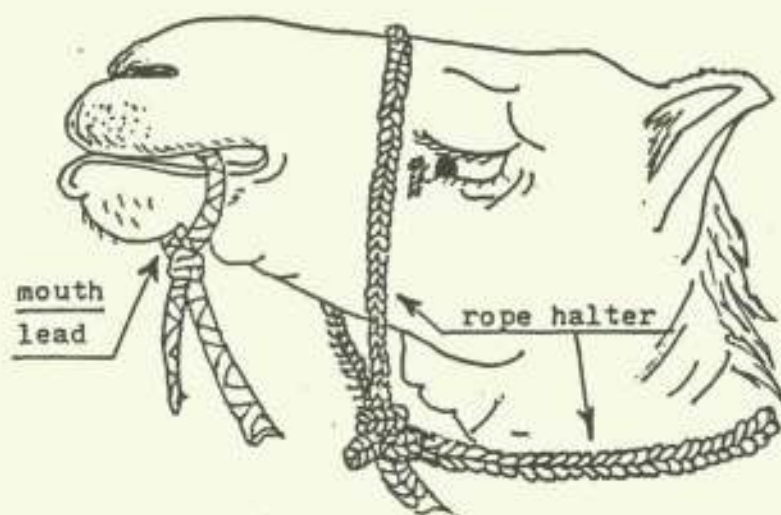


Figure 8.4 Halter and mouth lead for camels.

After riding the camel with someone else holding the lead, you will want to try controlling the camel only with the reins. Wrap the rope lead around the pommel of the saddle and carry a long switch in one hand in case the camel tries to misbehave. When it is time to dismount, you should pull back on the reins and give the voice command to sit. If it seems reluctant, use your switch to tap its legs in the usual place on the fetlock. It may be necessary to get help in crouching the camel at first. If the camel is going to be good for riding, it will have to learn to sit by voice command only. Never strike the camel around the face with your stick or riding crop. Their eyes are quite exposed so they can be damaged easily if hit accidentally.

If a camel is already broken to carrying baggage there is little problem in teaching it to take a rider. Problems may occur when a camel and rider are put with other camels in a caravan. Other camels are not used to seeing this strange object on the camel's back so they get nervous or curious and can create problems. If possible, try introducing the riding camel to the rest of the herd with someone holding the lead rope to help control the camel if there are problems. It is also better to do this out in the open away from motor traffic, noise or crowds.

8.9 - RIDING SADDLES

Because camels are not normally ridden in Kenya, the following description of riding saddles is taken from countries

which use camels for riding. There are basically two types of saddles for riding. There are shoulder saddles which rest in front of the hump at least 6 inches above the withers and there are hump saddles which straddle the hump.

Shoulder saddles

These saddles are commonly found among the Tuareg of West Africa. They are basically bowls which are mounted on a pedestal shaped like an upside-down V. The legs of the saddle come together in front of the hump and above the shoulders. It is important to keep the saddle high enough up on the camel's back to avoid rubbing the shoulders raw when walking.

On the Tuareg saddles the pommel sticks up quite high in front, sometimes 30 cm or more. It is usually very ornate which indicates how the Tuareg value the riding camel because they are willing to put so much time into their equipment. The back support of the saddle is also about 30-40 cm. high which prevents the rider from tipping over backwards when the camel sits.

A girth stretches from the bottom of the saddle, under the camel, in front of the pedestal and joins the saddle supports on the other side. The rider sits in the bowl, with his feet on one side of the camel's neck. The saddle is made of wood, or a combination of wood supports and a woven matt seat. The rider steers with his feet or with the reins. See Figure 8.5 for some examples of Tuareg saddles.



Figure 8.5 Two types of Tuareg riding saddles

Saddle Pad and Crupper

A saddle pad is put between the camel and the saddle to protect the camel from getting sores from the saddle. It is made from grass matting, or from gunny sacks filled with chopped straw or wool. Some riding saddles have a CRUPPER which keeps the saddle from riding forward when the camel is going down hill. It consists of a leather or rope strap which goes from one side of the saddle, under the camel's tail and attaches to the other side of the saddle. They may also use a BREECH PAD across the chest of the camel to keep the saddle from sliding back when going uphill. If a crupper is used it should be of a material that can be cleaned and is not so rough that it will irritate the camel. Since it goes under the camel's tail it gets covered with urine and feces so it must be kept clean. See Figure 8.6 for components of the riding saddle.

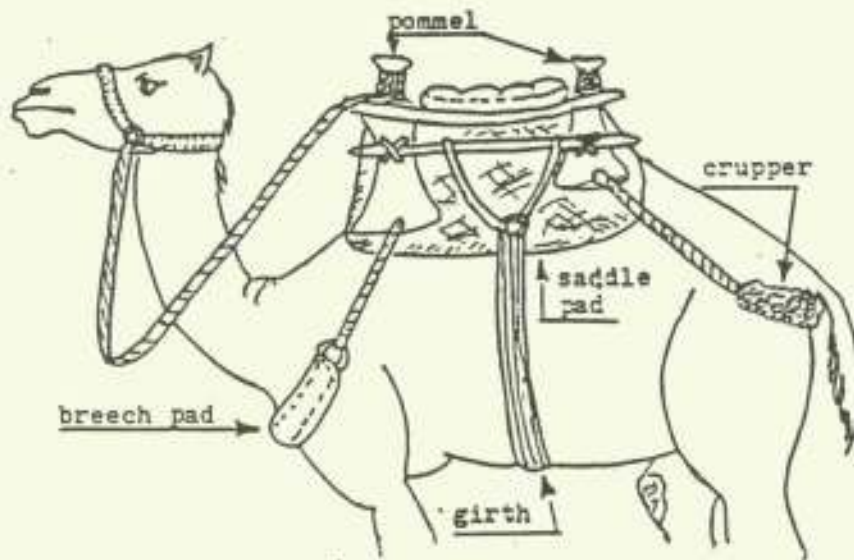


Figure 8.6 Components of a typical riding saddle.

Hump Saddles

A variation of the Tuareg saddle is the Rahla saddle. It is shaped like the Tuareg saddle but actually straddles the hump. The rider sits higher up on the camel and controls it with reins. The Arab Makhlufa and Sudanese Kur saddles are examples of double arch saddles that straddle the camel's hump. These saddles are made from two V-shaped branches, joined front and back by two side boards that run parallel to the camel's body. This type of saddle rests on the top part

of the rib cage behind the shoulder and in front of the hip. The two-arched saddle does not rest on the hump, but passes on both sides of it. The rider sits over the hump, more or less centrally over the camel. A saddle blanket and padding passes under the saddle to protect the camel. A girth holds the saddle on the camel. Control is maintained with a nose peg or halter in addition to reins.

There are some variations to the double arch saddle. One of them is the Indian Pakra saddle. This saddle is similar in appearance to the Arabian saddle but it is somewhat longer and has room for two riders. The Pakra saddle places one rider over the hump and the second rider behind the hump. The Afghanistan saddles also place the rider behind the hump. This is a double arch saddle that has room in front of the rider to place saddle bags. One of the problems with placing the rider behind the hump is that you lose some control over the camel by being so far away from his head. It is convenient to have 2-3 days supply of food and water right near you so that you can get into it while you are riding. See fig. 8.7 for examples of hump saddles.

8.10 - SUMMARY: THE RIDING CAMEL

Camels are not commonly ridden in Kenya. Riding camels are used elsewhere in Africa. Kenya might benefit from the introduction of this skill.

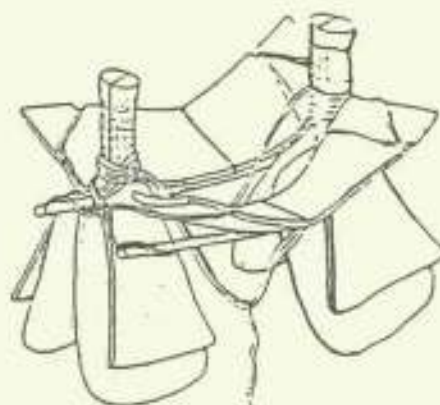
Although any camel can be taught to ride, traditional camel keepers try to select those camels that show the best physical characteristics of riding camels. Generally, riding camels are selected from those camels with lighter bodies, finer bone structure, and smaller feet than those selected for milk or transporting baggage.

The riding camel has 4 basic speeds at which it travels. They are the walk, jog, fast run, and the canter. Walking at about 4 kph is the slowest pace and the canter is the fastest pace at about 30 kph. The faster the speed, the shorter the time at which you should maintain that speed.

Riding camels should be trained at about 3-4 years of age. Only those camels who show a calm and peaceful temperament should be selected for training. Those camels with a mean or nervous disposition are too unpredictable to be ridden safely.



A: Makhlufa saddle, Sudan.



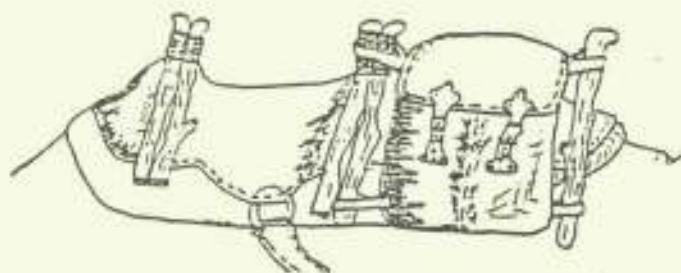
B: Kur saddle, Sudan



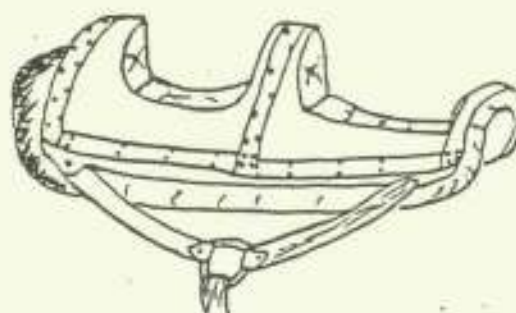
C: Tuareg Kantaki saddle



D: Tuareg hump saddle



E: Afghanistan saddle, rider sits behind the hump



F: Pakra Indian saddle for two people

Sources: A,B,D, Wilson, 1984. F, Gaithier-Pilters, 1981. E,C, Authors notes.

Figure 8.7 Various types of riding saddles that sit over the camel's hump.

Training camels can be broken down into 3 stages. These stages are:

- Handling Stage: getting the camel used to being around people and being handled
- Weight-bearing: in this stage the camel gets used to carrying weight on its back
- Breaking the lead: the rider takes control of the camel from on top of the saddle and the lead rope is no longer used. The camel is ready to be ridden now.

The most widely used methods of leading a camel in Kenya are the halter or the mouth rope which is attached to the lower jaw. Leads which require piercing the nose are not recommended because they can be painful and lead to infections from nose tears.

There are several different kinds of saddles used for riding camels. They can be divided into shoulder saddles and hump saddles. Shoulder saddles rest in front of the hump. Hump saddles rest over the hump. The hump should never have any weight resting on it or the camel can be injured. A saddle pad is used to protect the hump from the saddle supports and from the load. A crupper and a breech pad are used to keep the saddle from sliding forwards or backwards.

**** CHAPTER NOTES ****

- 1) Green, 1885.
- 2) Leese, 1927.
- 3) Gillispie, 1962.

9.0 - CAMELS AS BEASTS OF BURDEN

Camels are used to transport goods wherever camels are found. There is a potential to increase the role of camels as transport animals in Kenya. In addition to carrying goods, camels can be used as draft animals. This chapter will:

- identify the use of camels as beasts of burden
- describe the capacity of the camel as a work animal
- identify the equipment necessary to perform various tasks

9.1 - POTENTIAL USES OF BAGGAGE CAMELS

Wherever camels are found they are used for some kind of work. In Australia, a dromedary was recorded as having carried a load that weighed over 800 kg.¹ Among Somalis they are seldom used for carrying anything more than household goods. The potential for expanding the use of camel transport in Kenya is very great. For example, large trained pack camels could carry four 80 kg. sacks of maize. This would allow famine relief food to be distributed to more remote areas which would decrease the tendency for settlements near relief centers. These settlements place a burden on the trees and water resources near the centers.

Camels could also be put to use by those camel keepers who wanted to start a small business using their camels for transport goods. They could be used to transport charcoal from the forests and scrub lands where charcoal making is appropriate. Many small shops in the remote areas of Northern Kenya have had to close or face chronic shortages of goods. Because the roads are in such poor condition the lorries that bring supplies to these shops are either unable or unwilling to drive so far out with stocks of maize meal, tea, sugar, corn meal or cooking fat.

A mature camel in good condition can carry 350 kg. for 30km/day. One camel could supply a small shop with:

- 1 sack of maize meal weighing 80 kg
- 1 sack of sugar weighing 100 kg.
- 4 boxes of cooking fat weighing 6 kg/box
- 100 boxes of tea weighing 50 kg total

A trained camel could haul this load 100 km. in just 3 days. Since it is as much work to drive one camel as it is to drive 3-4 camels, one camel train of 4 camels could carry as much stock as a small pickup truck. The idea that camel caravans are a thing of the past does not look at the present conditions of the roads and difficulty in getting petrol in Northern Kenya.

9.2 - CAPACITY OF THE CAMEL FOR WORK

There is less concern for a particular body conformation with pack camels than with riding camels. Strength is the main consideration. Several authors agree that a baggage camel should possess at least the following characteristics.

- Large bone structure so that the camel can put on more muscle.
- Larger feet for better support.
- Medium to heavy neck, well-supported by muscle

- Strong well-muscled rear quarters so it can raise heavy loads
- Strong shoulders so it will be able to climb.
- Well-sprung ribs, and a deep chest.

All of these traits can be found in Kenya's camels. Breadth of body is more important than height. The Turkana camels are as good a pack camel as camels 50 cm. taller because they are very strong and agile, especially in rough terrain.

There are several factors affecting the weight a camel can carry. They are:

- Age and Strength: the weight a camel should carry depends on its age and muscular development. A young camel can be permanently injured if it carries too much weight while still immature. It may be able to lift the load, but it should not be worked to its capacity.
- Nature of the terrain: hills, rocky areas, or wet clay will limit the load a camel can carry. The trip should be planned to avoid areas where the footing will be difficult
- Climate: trips through very hot areas with poor feed and little water will limit the distance traveled each day and the amount of weight the camel can transport.

As a general rule, a camel should be loaded with one third to one half of its body weight for trips of a week or more. Mature camels can be loaded to the heavier limits of this range. A mature bull can carry loads equal to its body weight. Unless it is absolutely necessary, there is no point in forcing an animal to work so close to its limits. If a camel is worked at its limits, it will require longer to recover at the end of the trip. Military camels used in India, were loaded on the following basis:

- strong camels should carry 400-450 kg.
- weaker camels should be loaded with 300- 350 kg.

Those camels were receiving supplemental grain rations in their diets so they were able to lift heavier loads than an animal on range feeding. Camels worked for a week should be given a week's rest if they have been pushed hard with heavy loads.²

A camel loaded with one half of its body weight should be able to walk about 3 km/hour for 8-10 hours each day. Baggage

camels with 160-300 kg. loads should be able to cover 24km. per day for an extended period of time. Camels carrying less than full loads should be able to make 25-30 km/day for 30-40 days without difficulty. After extended periods of work, the camel will lose conditioning and should be rested so they can regain weight and strength. As a general rule, camels carrying loads equal to 1/2 of their body weight should be allowed 1 day's rest for every day that they worked. The rest period is usually given after the camels have worked for several days.

It is generally agreed that an eight hour work day is best for the camel. If they are to be worked longer the day should be divided into two parts so that they do not have to work longer than 5-6 hours at a time. Avoid working them during the heat of the day so that they do not suffer from heat stress. A typical working day would be to wake the camels at 2:00 A.M. and allow them to stretch a bit. They should be loaded and moving by 3:00 or 3:30 A.M.. They will begin to slow down about 10:00 A.M. so between 10:00 and 11:00 you can stop and let them browse. They will be ready to move again by 3:00 P.M. so they will not have too long to travel in the afternoon heat. If there is a road or path you can follow it is helpful to travel at night. This avoids exposing the camels to the heat of the day, and the cold while sitting around at night. If it is impossible to work at night it is best to add the extra hours in the morning with an early start so that you can stop the day's journey with enough time to make the night enclosure and set up camp while the camels are feeding.

When you stop to let the camels feed, remove their loads. Do not remove the saddles and saddle pads. This helps them to keep from getting chilled. If there is any doubt that a camel sweats, put your hand under the saddle pad after a camel has been working for a while and you will feel the moisture on its coat. The camel can catch a cold if not allowed to cool down and dry off after working.

9.3 - AGE AT WHICH TO START TRAINING

Some camel people begin training their camels at 2 years of age. It is better to start training camels when they are young. It is important to stay below the camel's carrying capacity so they will not be overworked. Starting too soon or overworking it can retard the camel's growth. Three year old males should have no problem carrying 20 liters of water 3-4 times each week. They can also be used for carrying light loads of straw, fodder, or firewood. In their fifth and sixth years they can start carrying loads that are a greater proportion of their body weight. A camel can carry any weight with which it can stand.³ This is one reason you want a camel to have strong rear quarters if it is a pack camel. The camel will

raise its hind quarters first when standing, then lift one front foot at a time until it can stand up straight.

9.4 - MOVING A CAMEL TRAIN

Working camels are generally moved in one of two ways. They are herded in a straight line or columns. They are also allowed to walk in a broad front through the bush. This allows the camels to eat as they are traveling.

When traveling with a small group of camels and just one or two herdsmen it is easiest to walk in a column. One person with a well trained lead camel can move several camels single-handedly. The strongest bull with the best pace is put in front and the other camels are tied head to tail behind him. This will help keep the pace at a more reasonable speed.

Loose group herding is more appropriate when there is a large supply of labor and you are traveling a long distance. Fifty to one hundred camels are frequently herded out into the bush and pushed along in a loose group. This allows the camels to eat as they move.

There is some difference of opinion as to whether it is better to allow them to eat as they walk along, or to push them a little bit faster and give them more time to eat at the end of the trip. The answer to that question seems to be determined by the available feed. If you can stop somewhere that has good feed and water supplies then it is easier on the men and animals to take a longer break at the end of the trip. If you are unsure about the forage later on, but are in a good feeding area at some point along the way, then it will pay to keep the camels fed and in good condition. The welfare of the camels should always be the first consideration.

Camels are said to be strong swimmers.⁴ It is sometimes difficult to get camels to enter the water especially if the banks are steep or muddy. It is helpful if the camel can see the bottom when he first starts out so that he is more confident. If the camels are showing some fear of crossing a river, take them back from the river's edge and put your well trained camels in front. Once you start them moving across, do not let them bunch up or slow down. Usually if you can get the first couple of camels to start across the rest will follow.

9.5 - LOADING A CAMEL

Training a camel for transport is easier than for riding because they can always be controlled by a lead rope. Once they are taught to receive a load, it is mainly a matter of

strength conditioning before they are completely ready for daily transport work. Females who are not pregnant can be taught to carry loads, but they should only be used when there is no other choice and given light loads only. The training procedure for baggage camels is basically the same as for training a riding camel.

When loading a camel, crouch him first and secure at least one front leg so that he does not try to stand up before the load is tied down. If he tries to get up unexpectedly the load may fall off and hurt someone. Before putting the saddle pad on, brush the back of the camel and check the pad to make sure there are no thorns or burrs that can injure it when weight is added to the saddle.

One reason a camel is able to carry more weight than a horse is because of the arch shape of its back. When loading the camel, you should take advantage of the strength of the arch by getting the weight as high up on the ribs as possible. The saddle should rest on the upper one-third of the rib cage. Once you have the saddle on, look to see if the saddle is touching the hump. If it does, the saddle is too small for the camel. The camel can be injured if it is forced to carry weight on its hump. The girth should be tight while the camel is sitting but once the camel is loaded and on its feet you should be able to squeeze your fingers under the girth. Balance is the key to loading a camel. The weight is applied so that it is divided as equally as possible to both sides of the saddle. It should also be packed so that it is compact and there are no loose ends sticking out to catch on passing branches.

In addition to not putting weight on the hump, there should be no weight on the moving parts of the camel. When you have secured the saddle, check the shoulders and hips to make sure that nothing will rub on them as the camel is walking. If traveling in hilly country, you should use a crupper and breech pad. The crupper should be cleaned everyday to avoid irritating the camel. After loading the camel, look at the load and make sure that it is high enough on the ribs so that no part of the load is within 40-50 cm. of the ground when the camel is sitting.

In the early stages of a safari, check the load periodically to see if it is moving around or chafing the camel. Every time the saddle is taken off or put on, the condition of the camel's skin should be checked to make sure that the load is riding well and the camel has not been injured. A first-aid kit with a topical dressing and materials to repair saddles should be taken on every safari.

9.6 - TYPES OF BAGGAGE SADDLES

Hawia Saddles

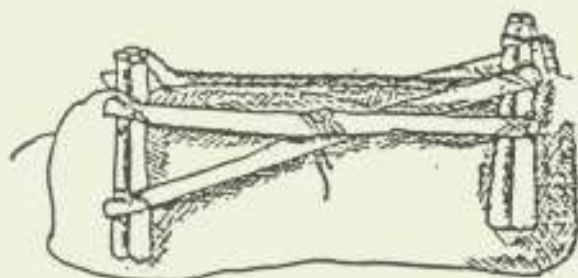
The basic design for the baggage saddle is the Sudanese Hawia saddle. See figure 9.0. It is a double arch saddle with 1 or 2 horizontal pieces, or side boards, running parallel to the camel's body which connect to the end supports or arches. The horizontal cross pieces keep the load from resting on the camel's body. The pads under the saddle must be well stuffed or the weight of the load will bear down on the saddle supports and rub the camel raw. One must be careful not to overstuff the saddle pads or the load will not be able to settle down on the padding. This will cause the load to rock back and forth making the camel uncomfortable and risk dropping the load.



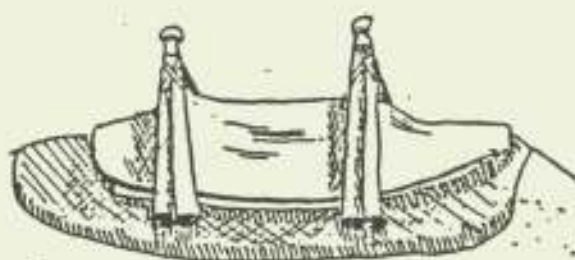
A: Sudanese Hawia saddle



B: Sudanese Hawia saddle



C: North Arabian saddle



D: South Arabian saddle

Source: A and B, Wilson, 1984. C and D, Leese, 1927.

Figure 9.0 Examples of different types of pack saddles.

A loading net was used by the various camel corps of the British Army. It is helpful when there are several smaller items to carry because they can all be lifted off at once and the net keeps everything from moving about. A similar system can be made by sewing pockets or compartments in burlap sackings or canvass. Holes can be left in the cross-over strap so that they can be secured to the pommel of the saddle. This prevents the load from slipping down which will upset the balance. The advantage of this sort of loading net is that it can be quickly and easily removed by two men lifting it off the saddle pommel. The entire load should be tied down with a minimum of rope so the camel can be unloaded quickly. You want the load to stay up high on the camel's ribs so that it does not interfere with the camel's breathing. The load should be covered with a canvas sheet so that it is protected from rain and thorny branches.

Somali or Pole Saddles

In Kenya, there are two pack saddles in use. The traditional camel people use a basic design which can be made of materials available in the bush. It consists of either 2 or 4 poles lashed together. The number of poles used depends on the area from which the people come. The poles are cut into lengths of about 2 meters. With the 2 pole saddle, the poles are placed at an angle starting in front of the hump, down and back towards the middle of the camel's stomach, passing just above the shoulder. It is important that the poles do not rest on the shoulder or it will injure the camel. The poles are then tied together at a point just in front of the hump, and again at the bottom of the poles.

It is important that the saddle poles do not go past the camel's belly or they will be in the way when the camel sits down. The rope that joins the bottom end of the saddle poles must go under the camel to form a girth. Another rope is run from the union of the poles in front of the hump back to the tail, under the tail, and back to the front saddle pole. This serves as a crupper to keep the load from sliding forwards on hills. The rope used for a crupper should be wrapped with cloth to keep from rubbing the camel raw under its tail.

The 4 pole system uses 2 poles on each side. They are tied at the bottom and placed on the camel's body while it is in the sitting position. The poles form a V-shape with the top of the poles passing on either end of the camel's hump. The bottom end of the V forms the union of the two poles. The girth should pass from the end of one set of poles, under the camel to the end of the two poles on the other side. The poles are then tied in front of the hump and behind it. A breech pad passes from the front poles across the camel's chest. This keeps the load from sliding backwards when going up hills. In some areas the Somalis use both a breech pad and a crupper.

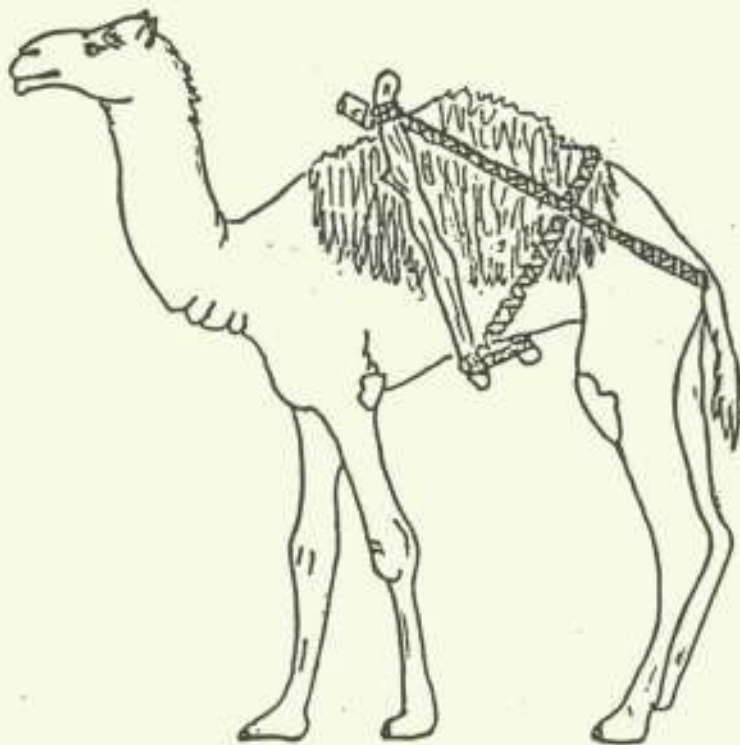


Figure 9.1 A typical saddle made from 2 poles.

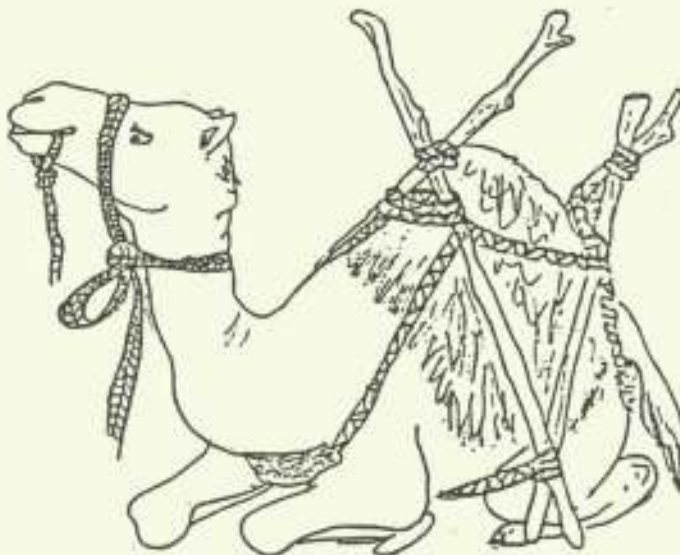


Figure 9.2 An example of a 4 pole saddle.

In the 4 pole system the the tops of the poles where they have been tied together represents the pommels of a Sudanese saddle. The loads are then secured to the pommels in front and back. The advantage of this system is that it can be made in the field or easily repaired anywhere there are trees growing. The grass mats used for making houses serve as the saddle pads. One disadvantage of pole saddles is the time involved in "remaking" the saddle each time it is needed. There is quite a bit of rope involved in tying the saddles together.

The commercial camel ranchers in Kenya use variations of the Hawia saddles. One reason for this is that it is more suitable for heavier weights than the 2 or 4 pole system. Somalis and Gabbra, for instance, seldom use camels to move anything heavier than their households, which can be loaded on the back of one or two camels, or for carrying water. Their loads are irregularly shaped and more or less hang from the sides of the camels. The ranchers use their camels to haul heavier loads which are more regularly shaped such as boxes or sacks of feed, maize, or sugar. With the Hawia saddle the weight is kept higher up on the camel's ribs so it can make use of the natural arch of the camel's back. The Hawia saddle is quicker to put in place on the camel than the pole saddles.

9.7 - MAKING A BAGGAGE SADDLE

Camel saddles are very simple to build. The materials can be found wherever there are trees. If a more sophisticated design is desired one can use 3/4 inch plywood and laminate the pieces together to get the necessary strength. There are basically three parts to the pack saddle. See figure 9.3 for the dimensions of a typical pack saddle.

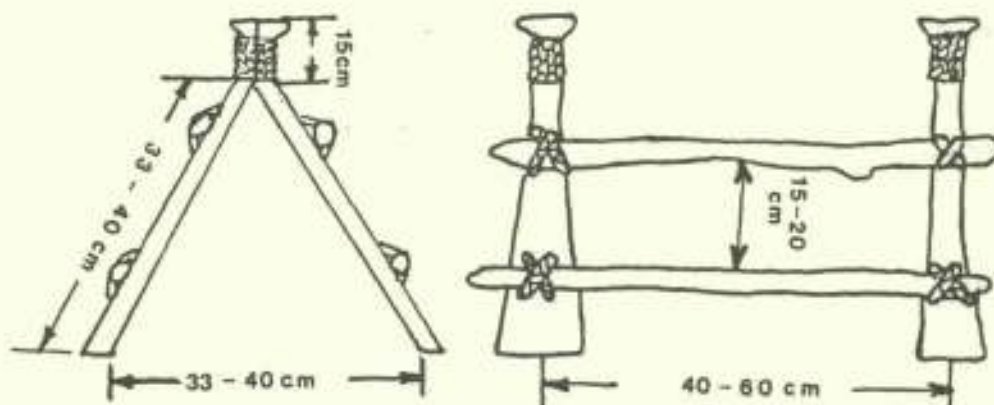


Figure 9.3 Dimensions for a typical pack saddle.

Pommel Pieces

The pommel and legs or arches of the saddle are made from one piece. They can be made from the fork of any suitable sturdy tree. See figure 9.4A. The legs should be about $\frac{3}{4}$ of an inch thick and about 3-4 inches wide. The pommel piece should be flared at the top so that the saddle bags or cargo net cannot be pulled off by passing tree branches or easily thrown off if the camel bolts. It should be split so that it can be adjusted for a larger camel. A spacer can be put between the two pieces for camels with large humps. See figure 9.4B.

When the pommel is cut to the right size, it can be wrapped with wet leather strips which will hold it very tight when they dry and shrink. This also allows you to replace them cheaply if you need to adjust the saddle.

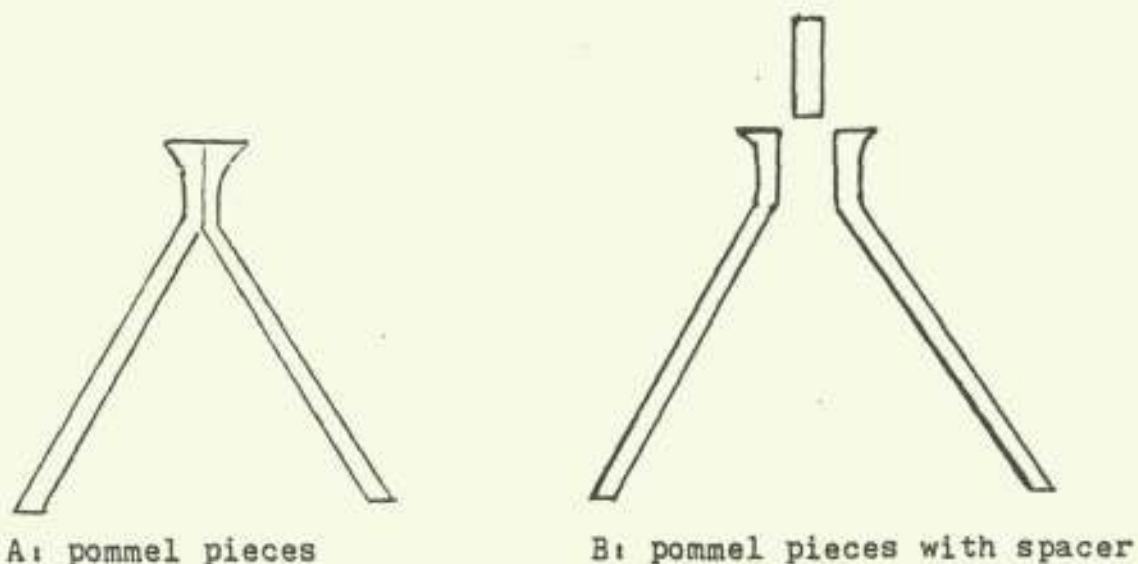


Figure 9.4 Parts of the baggage saddle. A: pommel piece
B: spacer for pommel piece.

Side Boards

One side board about 6 inches wide or two smaller side boards should be attached to the pommel pieces to join the front and back ends of the saddle. They run parallel to the camel's hump, and should be attached to the top of the saddle legs so that the load can rest against it. The first side board should be attached close to the bottom of the legs. The other one should be high enough to provide support and protection but not so high that it will rub against a large hump. See figure 9.5 for the side board design.



Figure 9.5 Side board design for baggage saddles.

Saddle Pads

The saddle pad is used to keep the saddle from pressing directly on the back of the camel. It should be made about 8 inches longer than the saddle to be sure that the camel is protected if the saddle moves forwards or backwards. The bottom edge should be about 6 inches off the ground when the camel is sitting to help protect the ribs from the girth. It can be made from canvas, gunny sacks, or sheep skin with the wool side against the camel's body. Some camel people use grass mats for saddle pads, but these would wear out with constant heavy use. Saddle pads can be filled with chopped straw, grass, sawdust, wool, or anything that will provide some cushioning. Because of the wear the pad gets it must be checked for holes or restuffed when it loses its shape. It will hold its cushioning ability longer if the pad has pockets sewn into it. In this way, only the worn section need be refilled. Pockets also help prevent all the stuffing from settling in one area.

9.8 - DRAFT CAMELS

Camels as draft animals are most often used for pulling carts or plows. Although Kenya makes use of donkey carts and oxcarts, camels are seldom seen pulling anything. One reason for this is that Kenya's camel people are nomadic so they do not practice agricultural cultivation and there is no need for a plow. Traditionally they seldom lived near towns, so there was little use for carts which need some type of road to be very efficient. The potential for using camels for draft purposes is increasing as the population centers in the more remote areas expand.

In India and some other camel countries, camels are used to transport goods on wheeled carts. The advantage to using a cart instead of loading the camel directly is that the camel's carrying capacity is limited by its ability to stand up once loaded. In fact, it is strong enough to carry even more weight if it does not have to lift it. So by using a cart the camel does not have to exert itself trying to lift the load. It can reserve its strength for pulling its load.

In Australia a team of 14 camels was used to haul a cart carrying 8 tons, at a pace of 2.5 km/hour.⁵ In some of the towns in Northern Kenya hauling goods on a camel cart could provide a profitable trade for someone with skill in camel handling. Since the camel would not have to wear itself out sitting and standing every time you want to unload it, you could work the camel for short deliveries in or near town.

The design of the cart is very important in determining how much weight can be carried. In India, where camels are commonly used for transport, a special design was developed for camel carts. The ordinary cart used by donkeys and horses allows a camel to pull 326 kilos. When the carts and harnesses were redesigned specifically for the camel it was able to draw a load weighing 826 kilos.⁶ See figure 9.6 for an example of a camel cart.

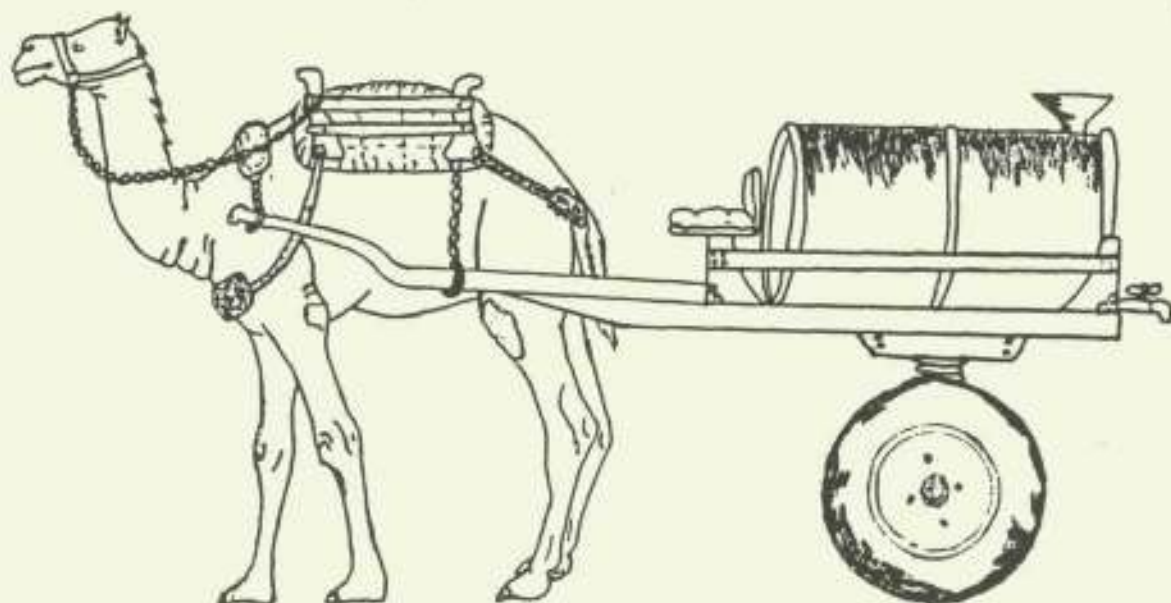


Figure 9.6 A camel cart used for carrying water.

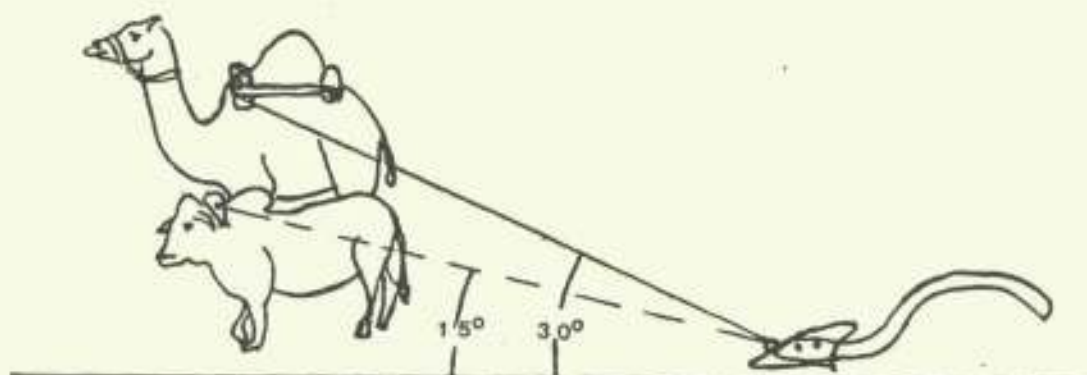
Camel carts are fairly simple to make. They need be nothing more than a wooden platform on wheels. There are many places to find used automobile axles and wheels in Northern Kenya. Metal pipes extending from the side of the cart and running parallel with the camel can serve as TRACES to connect the cart to the camel. The traces connect to a harness or collar that allows the camel to pull the cart. The collar usually goes in front of the camel's hump and extends backwards away from the shoulder to join a belly strap in the middle of the camel's body. Sometimes a second strap joins these two and goes behind the hump which keeps the load from shifting forward on downhill grades. This arrangement seems to be better than a crupper because it will not get as dirty since it is free from the anal area.

Camel carts can be designed to suit the particular load or needs of the community by local craftsman. The potential for using camels to deliver goods and haul water in some of the more remote communities needs to be exploited in Kenya.

9.9 - PLOWING WITH THE CAMEL

In Ethiopia, Kenya's neighbor to the north, both camels and oxen are used for pulling plows. One camel is said to be able to do the work of two oxen.⁷ It is difficult to compare the work done in different areas because of the difference in the soil, types of plow used, skill of the camel driver, soil moisture, and skill and power of the camel. It is generally agreed that camels plow at a pace of 2.5 km/hour.⁸ A camel can be worked for 6 hours each day, with the longest period of work in the morning. Plowing at a depth of 16 cm. a camel can plow one hectare in 20 hours.⁹ In the Sudan, one hectare was plowed at a depth of 15 cm. in 11.25 hours, not counting rest stops.¹⁰ Camels can be hitched to plows alone or in tandem. It is more efficient to work with two animals of equal size and strength. This may not be an economic option, so a camel may be hitched with an ox or some other animal to increase the work capacity.

One of the factors that determines how efficiently an animal can pull is the line of draft. See figure 9.7 for a graphic illustration of how the line of draft is determined. The angle shown in figure 9.7 affects how much power is going to be needed to draw the plow. The greater the line of draft reflected by this triangle, the less efficient the power source will be.



LINE OF DRAFT: CAMEL _____
 LINE OF DRAFT: BULLOCK - - - - -

Figure 9.7 Comparison of the line of draft of a camel and a bullock.

The line of draft of the bullock is more efficient than that of the camel because the point of attachment of the plow is closer to the ground than on the camel. When the line of draft is as great as it is on the camel, there is a tendency for the tip of the plow to be pulled up, and out of the ground. This points out one of the problems that must be overcome when working with camels. One way of dealing with this is to design a collar that allows the tool to be drawn from a point just below the camel's chest, with the lines or TRACES running from between the camel's front legs, under its belly to the point of the plow. Another way of overcoming this problem is to use extra long traces. If the lines that pull the plow are about 5 meters long, there will be less chance of pulling the tip of the plow out of the ground. In Kenya, the Turkana camels may be ideal for pulling a plow because their shorter legs and powerful bodies may be more easily adapted to the necessary harness. Much more work in Kenya needs to be done to take advantage of camel traction.

9.10 - OTHER USES OF CAMELS AS A POWER SOURCE

In Somalia camels are used as a power source for oil seed mills. The mill works like a large mortar and pestle. The camel is attached to the pestle by means of a rope or a wooden arm. The camel walks in a circle turning the pestle which is weighted so that it can crush the seeds that are in

a wooden bowl which forms the mortar. The oil then drains out and the seed cake that is left over is dried and used as an excellent source of animal feed. A camel operating a mill of this sort is able to produce about 1.2 horsepower.¹¹

In addition to being used to power mills, camels can also be used to draw water for wells or small scale irrigation. Table 9.0 shows a comparison of power produced by different animal traction sources.

Table 9.0 Draft power developed by different domestic animals

ANIMAL	AVERAGE WEIGHT (KG)	DRAFT (KG)	AVERAGE SPEEDS (M/SEC.)	POWER DEVELOPED (HP)
Light horses	400-700	60-80	1.0	1.00
Buffaloes	400-900	50-80	0.8-0.9	0.75
Donkeys	200-300	30-40	0.7	0.35
Camels (1)	450-500	75	1.0	1.00
Camels (2)	450-500	90	1.0	1.20
Oxen (Ethiopia)	400	55	0.6	0.44
Oxen (Mali)	350-450	55	0.76	0.56
Mules	350-500	50-60	0.9-1.0	0.70

1) camel pulling a plow 2) camel powering an oil mill

Source: adopted from Wilson, 1984.

9.11 - SUMMARY: CAMELS AS BEASTS OF BURDEN

Camels in Kenya are used for transporting household goods and carrying water. In many other countries they are used for commercial hauling. There needs to be some research done in Kenya to determine if such a commercial use of camels would be appropriate for Kenya.

Camels can transport goods by loading them on the camel's back or by using camel carts. A special saddle should be used to support the weight. Nothing should ever be put directly on the camel's hump. A strong camel can carry 300-400 kg. for for a distance of 25 km. or more each day. A camel cart is more efficient because the camel does not have to expend so much energy just trying to lift the load. A typical camel and cart can haul loads weighing 600 kg. or more.

In addition to using camels to carry loads, camels can also be used for pulling plows. Camels hitched to mechanical devices can be used for oil mills or drawing water.

Some points to remember when using camels for draft purposes are:

- the weight a camel can carry is determined by its strength and age
- secure the camel when loading it to avoid injury
- loads should always be balanced to avoid injuring the camel
- loads should be tied down securely to prevent damage to the goods as well as the camel
- whenever possible, avoid traveling during the heat of the day or through areas that are hilly or rough
- once the trip has begun be sure to check the load occasionally to see if it is riding well and it is not rubbing against the camel
- allow sufficient time for the camels to rest and eat during the day
- the camel should have time to cool before you remove the saddle

If a baggage camel is going to be hitched to a cart it is better to test the camel around automobile traffic before putting it to work.

** CHAPTER NOTES **

- 1) Barker, 1972.
- 2) Leonard, 1885.
- 3) Gauthier-Filters and Dagg, 1981
- 4) Wilson, 1984.
- 5) Barker, 1972.
- 6) Singh, 1963.
- 7) Wilson, 1984.
- 8) Wilson, 1984, and Mukasa-Mugerwa, 1981.
- 9) Knoess, 1976.
- 10) Wilson, 1978.
- 11) Campbell, from an unpublished paper.

10.0 BUYING CAMELS

Because there is no formal market structure for buying breeding camels in Kenya, one must approach purchasing camels differently than they would other livestock. There are both cultural and logistical problems that must be overcome. This chapter will try to help the potential camel buyer by:

- discussing the cultural and economic aspects of camel marketing in Kenya
- list some points to look for when selecting camel stock
- show how to use dental patterns to tell a camel's age

10.1 - CAMEL MARKETING: GAINING ACCESS TO HERDS

In Kenya, there are three major sources from which to purchase camels. They are:

- camel markets
- livestock dealers
- direct contact buying

The most obvious source is the camel market. Kenya does have some camel markets in the District Centers such as Garissa, Isiolo and Mandera. Some of the major towns in the camel-keeping areas also have camel markets such as Lokichor, Wajir, and Lokitong. But the camels sold at these markets are of such inferior quality that they are not worth buying. These are primarily slaughter markets or places to dispose of camels that are no longer productive.

Another way of purchasing camels is through an established livestock trader. The majority of the livestock traders in Northern Kenya are Somali people. They or their agents travel across the North buying cattle, sheep or goats. Although few of them deal in camels specifically, some of them will take orders for camels. They will locate the best stock they can find, bring it to a central point, and bargain for the highest price they can get. After setting a price, either you or the trader will move the camels to their final destination. Some of the advantages of the trader system are:

- you do not have to spend time locating the stock
- all the camels can be gathered on one area for inspection
- usually you are not committed to buying all the camels the trader has located
- if you have a labor shortage, he can usually arrange skilled camel herdsman to bring the camels to you

If you are going to be buying camels frequently, you will soon learn who the best traders are for your purposes and be able to establish a safe, reliable system for getting only those camels you want, when you want them. Some of the disadvantages to this system are:

- it isolates you from the camel community so you never develop your own camel connections

- regardless of what kind of stock you asked for, the trader is going to bring whatever he could find at a price that will bring him the best profits. The ten pregnant females you ordered often turns out to be several unbred heifers and two bulls. These fruitless trips cost time and money.
- traders are expensive. They may serve as middle men, selling camels on commission, or they may buy the camels so that they can make a larger profit when they sell them.
- Traders can be unreliable until you become a regular customer. Their main line of trade is in cattle, sheep and goats so they may postpone your request in order to fill an order from a better customer.
- Lack of a reliable communication system means that there is no way that you will know for certain that your order has been filled. You may spend time and money getting your herdsmen and equipment ready only to find out upon arrival that there are no camels.

There is a third way of buying camels that may involve more time, but generally results in better stock being purchased. This requires your going to where the camels are. Because the camel keepers of Northern Kenya are mostly nomadic, they must make use of watering points that are shared in common with many clans or groups. Near Garba Tula, at the well called Kula Mawe, it would not be unusual to see two or three hundred camels in a week. They are there to take advantage of the permanent water and the seasonal grazing nearby. The direct sales method of buying camels would require you to go to such a watering point and camp for three or four weeks while you make contacts with the camel people who come to the well. One can find out where the camels will be watering at a certain time of year by asking the local livestock development officer or the village chief from that area.

It is also helpful if you can get someone who speaks the local language to assist you in making contact at the water point. If you do not know anyone from the area, the District Development Officer or County Council will usually be willing to help out. If all else fails, announcing your intentions at the nearest town will probably get several offers from the locals to act as your agent.

There are disadvantages to direct contact buying. The major problem is that you have no guarantee that the time and expense put into locating camels will lead to your being able to buy any. Payment is more difficult with direct contact buying because most traditional camel keepers do not have

bank accounts nor do they accept checks. Another concern of major importance is the fact that sitting at some semi-remote water hole can be dangerous. There are concerns of bandits, wild animals and harsh habitat. If time, danger and the inconvenience of camping in the bush are not a major problem, the benefits of buying directly from the traditional camel keepers can be advantageous.

The greatest advantage to a person really interested in camels is the education gained by first hand experience with the local camel keepers. The only way to learn about camel husbandry is to spend time with those people who have been keeping camels. If you are willing to have a constant supply of tea ready and answer questions as well as ask them, then the direct contact method of buying camels will provide a value beyond the camels that are bought.

Another advantage to buying at the source is that you develop long term contacts if you should want to buy camels again. If you establish credibility as a camel person, future sales can be forthcoming. Your credibility will be based upon your skill as a trader, knowledge of camels, and goodwill towards the camel itself. This reputation will go beyond the immediate sale to give you access to other herds in the area.

10.2 - DIFFICULTY IN BUYING CAMELS

One of the errors people who are interested in camel husbandry must guard against is the assumption that camels are simply livestock. To most of the traditional camel keepers, they represent much more than mere livestock. There are many reasons they are not interested in selling camels as they would sheep, goats and cattle. Some of the reasons camels are difficult to buy are:

- Camels have a slow reproductive rate, so herd replacements are difficult to get. If one sells their stock, and a disaster strikes, there is no way of rebuilding their herd numbers very quickly.
- The camel represents a survival tool. When a drought strikes, they are the last animal to stop producing. If one has camels, at least there will be milk to drink.
- The camel has many demands put on it in addition to being a producer of meat and milk. They are used for:
 - a) loans to other people who have lost their camels. This provides a kind of insurance in case they should lose their stock later on.

- b) bride price or dowry, may be 8 to 80 camels
- c) store of wealth, like a walking bank.
- d) a sign of social prestige to gain authority in the clan

- There is really no time of year when it is best to buy camels. In times of drought, females are needed for milk. Unbred camels are saved to be used as replacement stock for rebuilding the herds. During times of rain, there is no reason to sell the females because there is sufficient feed for large herds.
- There is a limited marketing system which fails to encourage regular sales of camels.
- Traditional camel herds have a high infant death rate so it is difficult to build up large herds.

In spite of these difficulties, it is possible to buy females occasionally if one is willing to work patiently. Building relationships with the nomadic camel keepers can help gain access to female camels. Usually the female stock that will be offered to you will be too young to be bred, but this will give you an opportunity to get them in good shape before they are mature.

10.3 - SELECTING CAMELS

Generally, no matter how you arrange a camel purchase, the stock you get will not be what you had hoped to get. The best camels are kept for the owners' needs. Those camels available will be compromised animals. They will be good enough to get a fair price, but not so good that it will affect the owners' household needs. Good management, access to salt, and veterinary inputs can often make up for a lack of genetic potential. One of the first questions you should ask yourself when inspecting a camel is, "How would that camel perform if it were given better care?" Although the traditional camel keepers are very good, they seldom have worm drenches, tick control or vaccines.

The effects of good management are clearly shown in an experiment done in Marsabit District. The Integrated Project on Arid Lands made a comparison between herds under a traditional management system and one using improved camel care. The improved techniques consisted of such practices as:

- worming
- tick control
- salt and mineral supplements

- allowing the calf a greater portion of the mother's milk than under the traditional system

These improvements resulted in a definite increase in production. In the treated herds the following results were obtained.

- the daily milk production increased 19.5%
- length of lactation increased by 3 months
- female camels matured more quickly
- there were more long term pregnancies than in the untreated herds

This information would suggest that if the local people had access to improved management inputs they could increase production from the stock that is currently available in the region.

When trying to decide which camels to buy, the following suggestions might be helpful in sorting out those camels that are unacceptable:

- 1) Walk around the camel and determine its physical condition. Are there any scars or burn marks on it? These may be marks from traditional healing methods. These scars can give you some idea what kind of health problems the camel has had in the past. Is the animal in good condition, or is it thin in comparison to the other camels from the same herd? Look at the dung to see if the camel has eaten well.
- 2) How does the camel walk? Does it have a light, springy stride, or does it seem lethargic and dull? Do the elbows brush against the chest pad when it walks? This is a common problem with camels that are being culled from a herd. It makes the camel useless because it will go lame if it must carry a load or walk very far. Does it walk with its front feet turned out and its rear legs crossing? This is a sign that it may have fallen, and will probably not be able to carry much of a load. Make it run so you can see if it limps or has a problem with its stride.
- 3) Stand in front of the camel and check its body for size and shape. Is the chest wide? Are the ribs well sprung and long so that the body has a nice arch to the ribs rather than a barrel shape? This will give it good capacity for eating and birthing. It will also allow it to carry heavy loads without putting too much pressure on the rib cage. Is the hump firm

and large without being so large that it will be difficult getting a saddle on it? Is the bone structure large enough that it could carry more muscle if the feeding were improved? The pedestal should be broad flat and free from cracks, with a good callous to protect the chest when the camel is crouched.

- 4) Are the legs well formed? The feet should turn out in front and turn in slightly in back. The shoulders and rear quarters should be well muscled on males. The hips should be wide on females. Feel the joints, are they hot or swollen? This might be a sign of joint-ill, a common problem with camels.
- 5) Look at the camel's hair and skin. Are there any sores, or signs of mange? Look at the hair on the hump. If there are patches of white hair, the camel may have been overworked when it was young. This can sometimes keep the camel from reaching its full growth and strength. Clumps of mud or matted hair should be brushed well to see if there are sores or infections underneath.
- 6) While the camel is sitting, look in its ears for ticks. Is there a heavy discharge from the nose? This could be a sign of nasal fly problems. Look closely at the eyes. Are they clear? Eye injuries are common with camels, and limits their feeding capabilities. Loss of sight is a common sign of old age in camels. Does the camel seem to have difficulty seeing?
- 7) How does the camel behave? Does it mind people touching it and working around its face? Does it kick or bite? Will the female with calf allow its calf to nurse even when humans are nearby? Is it protective of its baby? Try to hobble it, is it used to having people work around it? A camel with a mean spirit can sometimes be more work than it is worth. Camels can kick in every direction so there is no point in buying trouble for yourself. Examine the feet. Will it allow you to lift its leg?
- 8) Breeding bulls and work camels must be able to get up and down easily. Command the camel to sit. Does it respond to voice commands well? Was it able to get down in one smooth motion? If you are buying camels for carrying loads, have some saddle bags filled with a couple of hundred kilos of sand so you can test the camel's ability to rise with weight on it. Many camel traders will tell you a camel has been trained to work when it cannot do much more than raise its own weight.

When you look at each camel, you must decide if the faults you see in that camel can be overcome by your resources and skills. Once you understand what is involved in raising strong healthy camels, you can buy camels based on their potential not their present condition.

The people you are buying camels from are trying to get the best price they can without parting with quality camels. This is part of your test as a camel person. The first stock that is brought to you is often of inferior quality. You must judge the fair value of a camel and point out the flaws in each camel you turn down. Camel people will respect your trading ability and usually offer you better stock. Most camel people, especially Somalis, enjoy camel trading. The thrill of the moment may even persuade some people to sell camels they had no intention of selling.

Generally, it helps if you show your sincerity and good will by buying something early on in the trading session. This does not mean you should be pressured to buy worthless stock. But it will reduce suspicion about your motives if people can see that you are serious.

This is a social event for most traditional camel people so they will be there at least all day. If you are close to making a deal, but the owner will not meet your price, invite him to your camp for tea, and change the subject for awhile. Pressure seldom works when trading in camels. The first price you pay for a camel will set the scale for the rest of the stock you buy at that sale. It should reflect your skill as a trader, knowledge of camels, and your respect for the people with whom you are trading.

The lowest price is not always the best price. This is especially true if it is the first time you have bought from this particular clan or in this area. Kenya's camel people are a close society in which word travels quickly. Your reputation will determine how much access you are going to have to camel stock in the future.

10.4 - DETERMINING THE AGE OF THE CAMEL

The reality of camel buying in Kenya and many other places in the world, is that you buy what is available, not necessarily what you would prefer. But even under the limitations of available stock, you should never buy a female older than six years old. Unless she is obviously pregnant, it is very likely that she is unable to breed or they would not be selling her. Try to buy females that are about 3-4 years old. At this age it is unlikely they have had their first calves so there should not be any calving problems. You will have to keep them for a year or two

before they can be bred. This is better than buying a mature female that may be sterile.

The older limits for a male are less important. You would not want to buy a male that was older than eight or nine, unless he were quite extraordinary. It does not hurt to buy young males that show breeding potential because you can always use them for work while they are maturing.

You can determine a camel's age relatively accurately from its teeth. At first it is a bit difficult. It can be a very useful skill for identifying breeding stock.

Camels have 22 temporary or milk teeth and 34 permanent teeth. They have teeth at birth or soon after. Usually there are three pairs of incisors on the lower jaw by three months of age. When the camel is very young, the incisors overlap because the jaw is still growing. They spread out during the first year and by the second year are not touching and are slightly worn. The canine teeth are located next to the incisors when the camel is very young, but move away from the front teeth as the jaw expands. The two canine teeth on the lower jaw are larger than the canines on the upper jaw. The camel has two pairs of premolars. The first one on each side is more pointed. The second premolar is blunt or peg-shaped.² By the fourth year, the milk teeth are quite worn, loose, and dark. They are of little use for chewing when they are in this condition. See figure 10.0 for the dental pattern of the lower jaw.

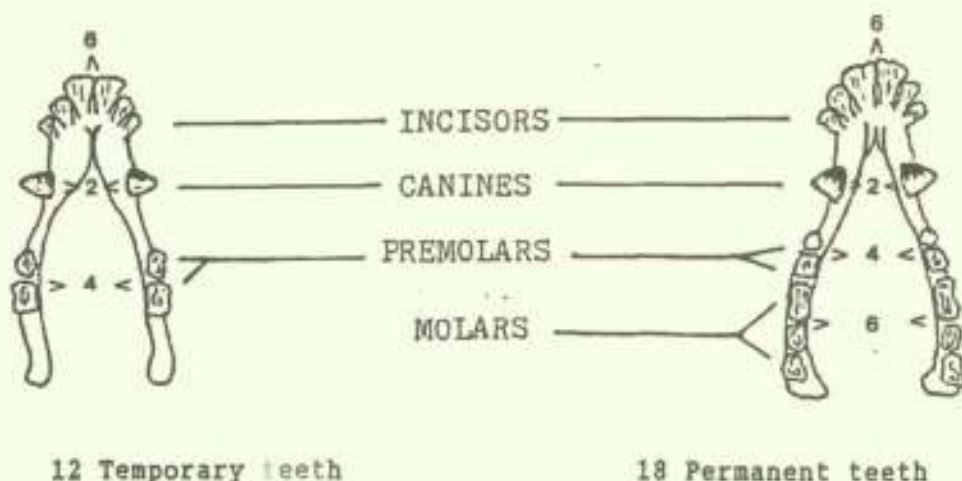


Figure 10.0 Dental pattern for the lower jaw of the camel.

The camel has no teeth in front on the upper jaw. The first temporary incisors are located towards the side on the upper jaw. There is a bony plate under the gum line where the central incisors would be located on the lower jaw. The upper

canine teeth are smaller and point backwards. The first premolar on the upper jaw is not replaced by permanent teeth. The second temporary premolar comes in about the same time as the first premolar. The third temporary premolar comes in last. See figure 10.1 for the dental pattern of the upper jaw of the camel.

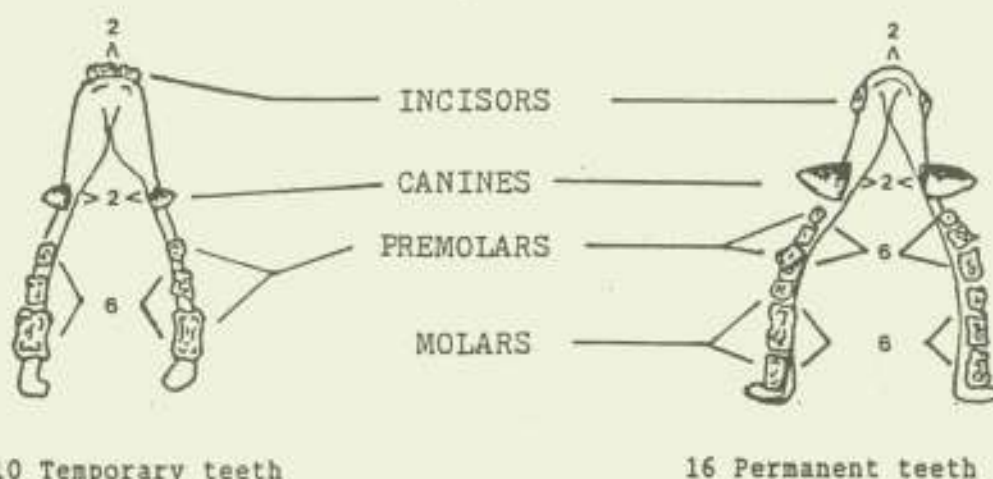


Figure 10.1 Dental pattern for the upper jaw of the camel.

The first molars appear when the camel is between a year and a year and one half old. They come through on both the upper and the lower jaw at about the same time. The next permanent teeth come through at about the middle of the second year. These are the second molars. The lower central incisors begin to come through in about the middle of the fourth year and are already showing wear by the of the sixth year. The second premolar should come through on both the upper and lower jaws by the fifth year. All of the molars should be through by the middle of the fifth year. The lower canines will begin to show in the sixth year and the upper canines should be up by the end of the sixth year. The last teeth to come through are the corner incisors, the first premolar in the lower jaw, and the first premolar on the upper jaw. These should break through by the middle of the sixth year. By the time a camel is eight years old, all of the teeth should be well worn. The premolars should be worn and very dark.

It might be difficult to tell if you are looking at old milk teeth or old permanent teeth. The key is whether or not the molars have come in. On the upper jaw, the three molars should all be in by the middle of the fourth year. In the lower jaw, the permanent molars should all be showing by the middle of the fifth year. So even if the teeth are well worn, counting the teeth should help determine if they are milk teeth or permanent teeth. If there is any doubt, you can try

to wiggle the teeth. Milk teeth are loose while permanent teeth will be well-rooted.

You can use the teeth to determine the age of a camel if you need to have a fairly exact estimate of age. You can also tell whether a camel is older by its general appearance. An older camel has deeper indentations above the eye sockets. Their skeletal frame will be more developed and the hair will be almost worn away in some areas. Because they feed in thick thorn bush, older camels will frequently have scars around the eyes and mouth.

Determining the age of a camel requires experience gained from observing many camels. One can become so skilled that a camel's age can be determined even into its teens by seeing how sharp the cutting edges are on the teeth and the number of rings and indentations on the surface of the worn teeth. Although this skill is useful, it is hardly required when buying your first camels. You will probably not want to buy any camels over nine years old. Aging a camel of this age can be learned fairly quickly.

10.5 - SUMMARY: BUYING CAMELS

Kenya is lacking a true market system for buying camels. If one is in need of camels for purposes other than meat, it is better to buy camels from a trader or directly from local camel keepers. Dealing through livestock traders can be easier and faster, but it denies the buyer the long term access to the camel herds and the knowledge that can be obtained from associating with these traditional camel keepers.

It is difficult to buy females in calf because they are so valuable to the household. Buying unbred heifer camels is safer than buying older females who are without calf because the younger camels are less likely to have reproductive problems. Females between the ages of 3-4 years and males up to 9 years of age are the best stock to purchase. The age of camels can be determined by the number of teeth and their condition. Temporary teeth are never as secure as permanent teeth. Dental patterns seem complicated when reading about them, but become much easier to follow when the buyer has had some experience actually looking in camels' mouths.

** CHAPTER NOTES **

- 1) Simpkin and Field, 1985.
- 2) Wilson, 1984.

11.0 - FEEDING AND WATERING CAMELS

Improved management of camel herds requires careful attention to the condition of the grazing area. If herders are to provide the best feeds available for their stock they must be able to identify which feed sources are available in the district. Although camels are able to go long periods of time without water, it is unwise to force the camel into a state of dehydration. This chapter will:

- identify some of the plants eaten by camels in Kenya
- describe the water needs of camels

11.1 - EATING HABITS OF CAMELS

One of the advantages of raising camels is their ability to make use of available feed. Camels are called "concentrate selectors".¹ They will become more selective as the quality of the plants or forage which they eat decreases in quality. They will begin to select those plants which are of better nutritional value.

Camels are primarily BROWSERS. This gives them an advantage over cattle because they will eat leaves from trees in addition to grass much more readily than cattle will. They have an advantage over some of the other browsers such as goats because they are so tall that they can browse the tops of trees that are 3 or more meters off the ground. Camels will eat grass, especially young fresh grass. Somali camels are said to be particularly fond of grazing.² A herd of camels was brought from Somalia to Laikipia District in Kenya where there was a lot of fresh grass available. They showed a preference for grazing for 2-3 hours in the morning when the grass was covered with dew. Eventually they wandered off to the bush covered areas to continue browsing for several more hours. These Somali camels, even when good grazing was available, browsed nearly four times longer than they grazed. In Kenya, most local camels prefer eating leaves from trees, shrubs and herbs. They will eat grass when it is available.

The browsing preference of camels makes them ideal animals to add to the livestock mix of commercial ranches. Some commercial ranchers in Kenya have added camels to their cattle and small stock ranching system so that they can use the camels to open up new pasture areas for the small stock. In dense brush the camels are brought in to browse the bushes. This breaks up some of the dense brush so that the goats can come in and browse the lower branches. The goats thin out the foliage so that the sun can reach the grasses. The additional sunlight increases the growth of the grasses so that the cattle and sheep have more to eat. By using camels to clear the dense bushy areas of their ranches they have been able to increase the carrying capacity of cattle and sheep in addition to the added benefits of meat and milk from the camels who are eating feed that would normally be unused by the other stock.³

Camels can be fed rations much like other livestock. Sorghum grain, ground maize meal, millet and various pulses are fed to camels in India, Pakistan, and Israel. Although it takes some time for the camels to get used to eating grain, its use can improve production. See Table 11.0 for some examples of rations that can be fed to camels. By using supplemental feeding one major advantage of the camel is defeated, that is, their ability to meet their nutritional needs from plants not used by other

animals. Another disadvantage to feeding camels rations is that you lose some of the nutrients camels get from eating such a varied diet. Because the camel eats from several different trees, shrubs and herbs, in addition to grasses, the milk from the camel is very nutritious. The varied diet assures that the camel is getting sufficient nutrients. Each plant has its roots in a different level of the soil so it is getting minerals from different soils. The camel mixes all of these plants into its diet so even if one plant is lacking minerals for instance, a different plant will most likely supply it.

Table 11.0 Example of some supplemental rations for camels.

PERCENTAGE COMPOSITION AND DIGESTIBILITY OF FOODS USED IN CAMEL RATIONS.

Name of Foodstuff.	Chemical Analysis.					Digestible Constituents.						Refer- ence.
	Moisture	Protein	Fat	Fiber	CHO.	Protein	Fat	Fiber	CHO.	Calorie Value.	Calc. from Protein %	
Barley . . .	14.00	8.60	1.50	4.50	67.90	6.5	1.20	2.50	62.20	303	8.5	31
Barley meal . . .	12.60	11.90	2.20	4.60	65.50	8.8	2.00	1.10	60.10	307	11.8	31
Bean . . .	14.30	25.40	1.50	7.10	48.50	20.10	1.20	4.10	44.10	491	26.3	31
Gram (Cicer arietinum) . . .	11.00	23.40	1.10	5.10	54.30	14.70	2.70	2.90	50.50	304	19.8	31
Maize . . .	13.00	9.90	4.40	2.20	69.20	7.10	3.90	1.30	65.70	340	8.4	31
Millet . . .	12.50	10.60	3.90	8.10	61.10	8.00	3.10	2.70	45.80	261	12.6	31
Oats . . .	13.30	10.30	4.80	10.30	58.20	7.20	4.00	2.60	44.80	261	11.3	31
Oat bran . . .	9.50	8.00	3.00	21.90	51.00	4.00	2.00	11.10	35.00	214	7.7	31
Wheat bran . . .	13.60	13.50	3.90	10.60	53.00	10.40	2.80	2.80	38.00	237	18.3	31
Cotton seed (Bombay) . . .	8.50	17.90	19.40	20.00	24.90	12.30	16.80	15.20	15.00	330	15.3	11
Sesame oilcake . . .	9.30	44.50	11.00	4.50	20.90	40.00	10.70	1.40	11.70	317	51.7	11
Barley straw or tilshen . . .	14.00	3.30	1.80	33.90	42.40	0.80	0.60	18.30	22.50	177	2.9	31
Gram bhusa (Missa bhusa) . . .	9.40	5.44	0.48	40.27	32.35	2.15	0.17	16.15	15.29	139	6.1	10
Millet chaff and husks . . .	12.00	4.80	2.20	40.80	29.00	1.70	0.70	15.10	13.60	131	5.3	31
Wheat straw . . .	14.00	2.10	1.30	30.60	40.70	—	0.40	18.30	15.00	140	—	31
Green sorson (Brassica cam- pestris) . . .	85.13	1.20	0.42	4.01	6.86	0.84	0.31	1.36	3.04	27	12.8	14
Hay (Punjab) . . .	7.40	3.25	0.92	37.14	43.74	0.88	0.31	24.91	17.74	181	2.0	15
Hay (good meadow) . . .	14.30	6.70	2.30	26.30	41.00	3.80	1.00	15.00	25.70	192	8.1	32
Turnip . . .	91.50	1.00	0.20	0.00	5.70	0.20	—	0.30	5.20	23	3.0	32

Source: Lietch, 1940.

11.2 - FEEDING MANAGEMENT

When camels are feeding, they move rather rapidly. They will take several bites from one tree, then move to another tree. A well-managed camel herd requires the services of a herdsman who is patient enough to allow the camels to eat at

a pace that is comfortable to them. The herdsman must also be knowledgeable enough about the various plants growing in the area to direct the camels to the best feeding spots. In both commercial herds and traditional systems, the camels are fed by being led to an area and allowed to walk freely while they eat. A good herdsman will try to take note of which plants his camels prefer and then lead the camels to areas with a greater number of these preferred species.

Camels prefer certain parts of plants in different seasons. In the spring they may not eat the leaves from a certain tree; but the camels might eat the seed pods from that tree. Some time later they may go back to that same tree and eat the leaves after the seeds are gone and the leaves have matured. A good camel keeper should know when the trees will be in the stage that the camel prefers.

Some authors feel that camels grow best where they were bred. They know the best plants to eat, and which plants are poisonous. When they move to a new area they lose condition until they figure out the best plants to eat.⁴ If you are adding new camels to your herd, keep a couple of older camels to teach the new ones what to eat. This can help prevent the loss in production that sometimes occurs when camels are moved to a grazing area where the plants are unfamiliar.

Working camels need to spend about 6-9 hours each day eating. They will need that amount of time to ruminate or digest their food.⁵ The amount of time a camel spends eating does not seem to change much regardless of the condition of the range. This is apparently so because the camel selects more closely for those plants with the highest food value.

A male camel needs about 4.5 hectares to browse. A calf and its mother need 7-9 hectares.⁶ This can only be a general rule since the condition of the range, the size of the camel, available water supply and the work or production purpose will also affect the size of the area needed for feeding.

Some of the best information found in Kenya on which plants the camel eats is located in the studies done by the Integrated Projects on Arid Lands. Those studies were conducted in Marsabit District with the Gabbra and Rendille herds as well as with a research herd. Their studies showed that the most favored camel feed in their study area was the dwarf shrub Indigofera spinosa. The shrubs, Duosperma eromophilum and Baleria proxima, were eaten less eagerly. Acacia trees made up a good source of dry season forage and deciduous trees were preferred following the rainy season when they were in full foliage. In Kenya, camels enjoy the tree species Acacia brevispica (both fruit and flower), Acacia mellifera, and Acacia senegalensis.⁷ IPAL's studies showed that the camels ate only the seed pods from Acacia tortalis, and did not eat Acacia

recifiens at all. In addition to these plants, camels ate the grass *Aristida mutabilis* and the salt bushes *Sueda monoica*, *Salvidora persica*, and *Dasypharea prostrata*.⁸ See Table 11.1 for a more complete list of plants eaten by camels in Kenya.

Table 11.1 Plants commonly eaten by camels in Kenya.

NAME OF PLANT	QUALITY OF EDIBLE PARTS
<i>Acacia seyal</i>	Young leaves, fruits
<i>A. albida</i>	Young shoots, leaves and fruit
<i>Aristida mutabilis</i>	Nutrituous feed during dry season
<i>Balanites aegyptica</i>	Entire plant eaten, good dry season feed preferred by most camels
<i>Baleria proxima</i>	Entire plant, preferred feed
<i>Bauhinia reticulata</i>	Pods and leaves
<i>Boscia coriaria</i>	Leaves and fruit
<i>Capparis</i> spp.	Eaten seasonally, varies with species
<i>C. tomentosa</i>	Eaten in Sudan, may be poisonous at certain times of year
<i>Carissa edulis</i>	Leaves eaten, fruit are preferred
<i>Combretum aculeatum</i>	Eaten during rains, excellent feed
<i>Commiphora</i> spp.	Several species eaten by most stock
<i>Cordia abyssinica</i>	Excellent camel feed
<i>Dichrostachys</i> spp.	Good feed, readily eaten
<i>Ficus</i> spp.	Many species of this plant are eaten at different times of year, preferred when young
<i>Indigofera spinosa</i>	Favorite camel feed
<i>Lantana trifolia</i>	Fair feed, leaves and young stems
<i>Leptadenia</i> spp.	Excellent camel feed
<i>Loranthus</i> spp.	Good feed
<i>Maerua crassifolia</i>	Good fodder, leaves and stems
<i>Merremia pedata</i>	Relatively good pasture
<i>Premna resinosa</i>	Good feed, preferred species
<i>Prosopis</i> spp.	Excellent feed, leaves, seed pods
<i>Salvadora persica</i>	Leaves and stems
<i>Simarubacea</i> spp.	Drought resistant plant, excellent feed for those camels who are used to it

Source: Modified from Leitch, 1940, and the Author's notes.

As a general rule, camels need about 9 kg. of dry matter per day depending on the nutritional value of the feed, condition of the animal, and the work it must perform.⁹ In the IPAL study area, the camels weight averaged about 363 kg. They ate 2.5% of their body weight in dry matter each day. A 500 kg. camel would need about 12.5 kg. of dry matter. The availability of feed supplies would certainly be a factor when deciding whether or not

to breed your camels to a larger breed. Insufficient feed would keep the larger animal with an increased appetite from reaching its genetic potential.

Although it is valuable to know the feed requirements of your camels, it is highly unlikely that you will be in a position to weigh the food your camel eats every day. A more realistic sign of how well your camels' nutritional needs are being met is their physical condition. Ability to fight disease, coat quality, hump size and energy level of the camel are good indicators of the camel's nutritional state. Another sign is the shape, smell and consistency of the camel dung. The pellets should be 3-4 cm. long, fairly tightly pressed together into pellets that are concave at one end, and convex at the other. If they have a sudden change in odor or become loose and runny, you should watch closely to see what the camel is eating. Either constipation, which would result in very dry, hard pellets, or diarrhea, which is very runny feces, are signs of an unhealthy camel.

Salt in the Diet

Camels need salt in their diets. Frequently they will be able to get sufficient salt from the plants they eat, but it is wise to give them additional salt in the boma at night. Camels need about 40-60 gms of salt each day. A camel which is working hard during the hot season may need as much as 140 gms. of salt daily.¹⁰ If the salt is placed in a wood or non-metal container in the boma, the camels can eat free choice so there should not be any problems with salt deficiency if the container is kept full. Rock salt or some form of loose salt seems to work better than a salt block since camels do not seem eager to use salt licks. Some camels show signs of calcium and phosphorus deficiency. Joint problems and broken hips and bones often result from not enough calcium and phosphorus in the diet. It would be wise to add a mineral supplement to the salt if it is available.

11.3 - WATERING THE CAMEL

Contrary to popular belief, camels do not store water in their humps or anywhere else. They must drink large quantities of water and then use their ability to regulate water loss to withstand the high temperatures in the regions in which they are found. Even those sheep who are used to high temperatures will die if they go 4 days without water in temperatures greater than 40 C. Camels frequently go 8-10 days without water. This gives the camel the advantage of being able to travel much farther from water points in search of food. Camels can travel twice as far from water as cattle.

The most frequently asked question about camels is, "how long can they go without water?" A far more important question

is, "how often should camels be watered in order to get the best production?" It is believed by some sources that the less often you water a camel, the longer it can go without needing water. Frequent watering leads to the camel getting into a habit of needing water so it cannot go as long without it. In West Africa camels watered every 8-9 days drank less water than camels watered every 3-5 days.¹¹ In studies done in Marsabit District, camels watered more frequently produced more milk than those who were withheld from water. In general, the water needs of a camel are dependent upon:

- TEMPERATURE: the number of days the temperature is above 40 C, and the day/night temperature differential
- FORAGE QUALITY: green plants may provide as much as 30 liters of water
- WORK LOAD: camels used for transport or producing milk need more water than non-producers

Camels should be watered every 3-7 days if possible.

11.4 - DRINKING RATE

If a camel is in good condition physically it can drink about 1/3 of its body weight in about 10 minutes. Even if it seems the camel has been drinking for a short period of time it may easily have gotten sufficient water to meet its needs. A camel should be able to drink about 10-20 liters per minute if it is healthy.¹² An undernourished and overworked camel, in very hot conditions, may only drink 10 liters per day. Under normal conditions, a camel may drink 100 liters of water in a single trip to the well. So the amount of water a camel needs is dependent upon age of the camel, heat stress, stage of lactation, and general physical condition. Generally speaking, camels need 20-30 liters of water per day.

11.5 - SUMMARY: FEEDING AND WATERING CAMELS

One of the major advantages of raising camels is the fact that they can make use of feed that is unavailable to other livestock. Because of their height they are able to browse the upper stories of trees left uneaten by cattle, sheep, and goats. Camels have a varied diet, eating trees, shrubs, herbs and grasses. In addition to grazing and browsing, camels are able to make use of rations which include grains. Salt is a very important supplement to the camel's diet. The varied diet of camels helps them to get sufficient vitamins and minerals to stay healthy.

Another advantage camels have over other stock is their ability to go long periods without drinking. Camels should be watered every 3-7 days depending on workload and water present in the forage they are eating. Camels need about 20-30 liters of water per day. They generally drink this much in one trip to the water hole.

**** CHAPTER NOTES ****

- 1) Pratt and Gwynne, 1977.
- 2) Mukasa and Mugerwa, 1983.
- 3) Evans and Powys, 1979.
- 4) Leonard, 1885. Nanada, 1966.
- 5) Leese, 1927.
- 6) Leese, 1927.
- 7) Maloiy, 1972.
- 8) IPAL (The Integrated Project On Arid Lands) studied the forage in the Marsabit District of Northern Kenya. The results of their work is found in Technical Report E-1.
- 9) Nanda, 1966.
- 10) Leese, 1927.
- 11) Gaultier-Pilters and Dagg, 1981.
- 12) Gaultier-Pilters and Dagg, 1981.

12.0 - COMMON CAMEL HEALTH PROBLEMS IN KENYA

Animal health care should, whenever possible, be left to a trained veterinarian or animal health technician. Unfortunately, there is a lack of trained staff in the camel areas of Kenya. They must travel great distances. The camel owners cannot often wait for assistance. This chapter is intended to give the camel person a basic understanding of camel health. It will also show the causes and treatments for some of the major health problems that affect camels in Kenya. This chapter will:

- identify some of the major camel diseases and health problems that appear in Kenya
- list some possible treatments
- show how to reduce the incidence of these problems through control and prevention

12.1 - CAMEL HEALTH

In many of the traditional livestock-keeping cultures there is a shortage of ready cash. The people may own hundreds of livestock and in fact, be quite wealthy, but their wealth is in their animals. One of the first things they will sell is their livestock in order to purchase veterinary supplies. They appreciate the value of keeping their animals healthy and are eager to accept whatever changes can be proven to improve their livestock.

Since they have little access to trained technicians, they have developed traditional remedies for many of the illnesses they see. Some of these remedies do more harm than good. Table 12.0 gives a list of some traditional health remedies used by two groups of local camel keepers.

Table 12.0 Traditional health remedies used by the Samburu and Rendille people in caring for their camels.

Disease	Symptoms	Medicine and its preparation	Comments
HANGE (Thebedo, S) (Maddo, R)	Loss of hair, bleeding sores, Scratching	Salty water to drink; taken to salt pans to roll in dust and eat salt-rich vegetation. Old engine oil is rubbed onto the skin.	Note: <i>Sarcophaga arabei</i> var. <i>cameli</i> . Engine oil was found to work as effectively as modern drugs
JOINT ILL (Ilgild, S)	Stiff joints.	The animal is branded with hot irons or stones.	
TRYPANOSOMIASIS (Saar, S) (Omur, R)	Weakness	Fruit of <i>Zanthoxylum chalybeum</i> (Loisuk, S) are crushed, mixed with water and drunk twice a day. Skin of giraffe or goat is burnt and crushed to a powder and swallowed.	
GENERAL WEAKNESS (Goiigi, S)		Fruit of <i>Myrsine africana</i> (Sogotet, S) are crushed and eaten.	
SWOLLEN GLANDS (Bengwa, S)		The glands are burnt with a hot brand.	
BACTERIAL INFECTIONS (Ilwangui, S)		Sap of <i>Euphorbia</i> spp. (Ilpara, S) put in wound; or burnt with a hot iron.	
EYE INFECTIONS		Cowrie shells are burnt, pulverized and the powder put in the eye.	
OPEN WOUNDS		The gum of <i>Bumelia hildebrandii</i> or sheep's fat is melted and poured into the wound. Fruit of <i>Myrsine africana</i> (Sogotet, S) crushed and drunk in warm milk.	
TICKS		<i>Cordia purpurea</i> (Ilkiruuet, S) leaves and -vigs boiled with tobacco and applied when cool. <i>Adroscia</i> spp. (Sariada, R) roots boiled with tobacco as above.	
RETAINED AFTERBIRTH		Roots of <i>Salvadora persica</i> (Sogotet, S) boiled in water and drunk the next day. Dik-dik faeces washed in water and the water drunk the next day.	Very effective

S = Samburu name

R = Rendille name

Source: Simpkin, P.S. (1983). IPAL Technical Report E-7.

One practice that is found in Northern Kenya is to burn the camels with a hot iron or hot stone at the suspected source of the illness. Camels with calving problems are frequently burned on the belly or near the anus. "Joint-ill", a stiffening of the joints, is treated by applying a hot iron on the stiff joint. Even if this should prove effective for some reason, the burns are traumatic for the camels and can be a source of infection. If the camel is meant to be sold at a later date, the scar remains to show its health history to whomever is interested in buying the camel. This may be helpful for the buyer, but does nothing to help the seller's position.

Some of the local remedies do seem effective. Purgatives made from plants and roots such as Salvadora persica are useful for curing retained afterbirth, colic, and other ailments. Close observation of traditional healing techniques is advised before adopting them. Although they may provide an alternative to expensive and scarce drugs, some of them are not only useless, but dangerous as well. Anyone planning to work with traditional camel keepers should develop their own list of safe and effective traditional health remedies. It is important to learn the names of various health problems in the language of the people with whom you are working.

The source most frequently used for camel health care was written in 1927. There seems to be a new interest in camels so possibly more research will be forthcoming. Research carried out by the Integrated Projects on Arid Lands (IPAL) has resulted in a list of the major camel health problems reported in Kenya. See table 12.1.

Table 12.1 The camel health problems most commonly reported in Kenya.

TYPE PROBLEM	DISEASE
VIRAL	Camel Pox
BACTERIAL	Anthrax, Brucellosis,
PROTOZOAL	Trypanosomiasis
INTERNAL PARASITES	Hydatidosis, Strongylosis
EXTERNAL PARASITES	Mange, tick related illnesses
OTHER	Skin Necrosis, Predation

SOURCE: modified from Richard (1979).

12.2 - SIGNS OF A SICK CAMEL

Even if one does not have training in veterinary medicine a person can keep their camels healthy by being a good observer. If you or your herdsman spend time with your camels and really watch them you will become so familiar with their habits that it will be easy to tell when they are acting differently. A change in behavior is one of the first signs of illness in a camel. The normal clinical signs such as pulse rate, body temperature, and respiratory rate are less practical since they change over the course of a day. In the early hours of morning they will be lowest and will rise during the day. The following vital signs are given as the normal range for 6 A.M. and 6 P.M.

TEMPERATURE (A.M.) 34.4 C.-35.8 C. Fever=higher than 37 C.
(P.M.) 37.2 C.-38.7 C. Fever=higher than 39.5 C.

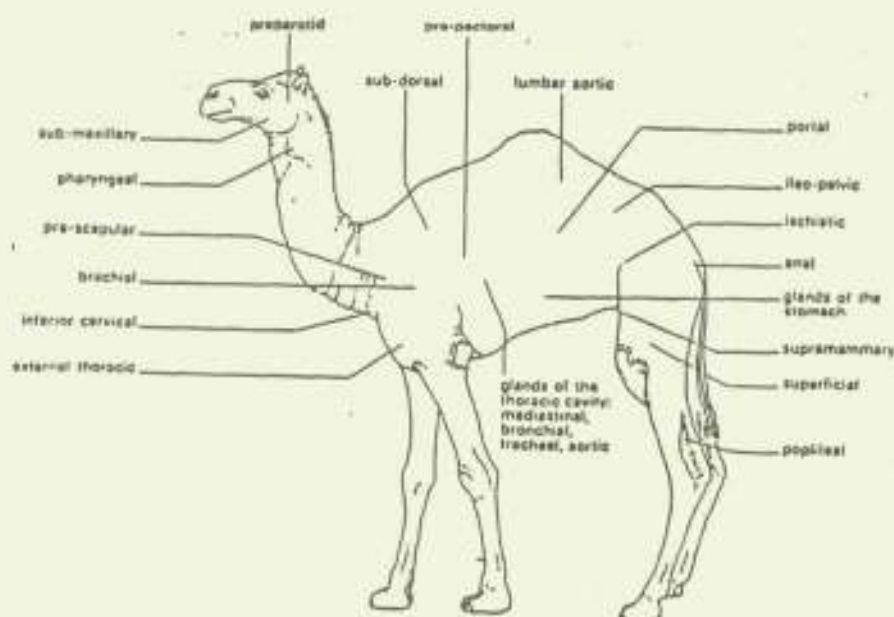
PULSE RATE 45-50/minute: can be taken from the tail

RESPIRATIONS 8-18 breaths/minute¹
(Pain will cause a camel's respiration rate to increase.)

In a field situation it will sometimes be difficult to measure these vital signs so it is advisable to determine if a camel is ill by watching their behavior. Some of the signs of illness in a camel are:

- loss of appetite
- diarrhea
- swollen lymph nodes (see figure 12.0)
- tears from one or both eyes
- does not chew its cud
- rapid breathing
- cough, or raspy breathing
- rolling or pressing its belly on the ground
- extreme or sudden loss of weight
- slow lazy gait, will not keep up with the rest of the herd
- failure to keep its head and neck upright (a camel may sleep with its head stretched out on the ground even when it is healthy)

These signs of ill health are only effective if used by someone who has some experience with "normal" or healthy camels. Camels may roll on the ground or moan just because it feels good. Diarrhea could be caused by a change in the forage. If a camel is seen behaving strangely, it would be wise to watch it more closely. Loss of appetite, discharge from the eyes and the shape and condition of the feces are probably the most important physical signs of illness.



Source: Curasson, G. (1947).

Figure 12.0 Location of the Lymph Glands on camels.

The dung from a healthy camel should be in fairly firm pellets about 3-4 cm. long. They should be concave at one end and convex at the other end. The feces in a healthy camel seldom have a bad odor. One must be well-informed about where the herd has been eating because a change in feed may cause a mild case of diarrhea. Fear may also result in loose dung so the camel should be watched for a few days before deciding that it is sick.

12.3 - EXAMINING THE CAMEL

If you think a camel is sick separate it from the rest of the herd. If possible take it to a shady spot where it can eat if it so chooses. Secure the animal by tying both front feet together or tying the front leg in a bent position. The camel is easier to examine if it is crouched. The camel can be immobilized by grabbing the upper lip and pulling the camel's head around to its side. Be careful not to cover the nose or you will suffocate the camel.

The pulse rate can be taken from the rear leg, at the point of the hock, on the posterior tibial artery. It is the part of the leg that sticks out from behind when the camel is sitting. It can also be taken from the underside of the tail. See figure 12.1 for places to take the camel's pulse. If the pulse rate is higher than 50 beats per minute there is probably something wrong with the camel. The temperature, taken anally, will also give an indication of how sick the camel is. If the camel appears to have a fever, it should be covered at night to prevent it from getting chilled.

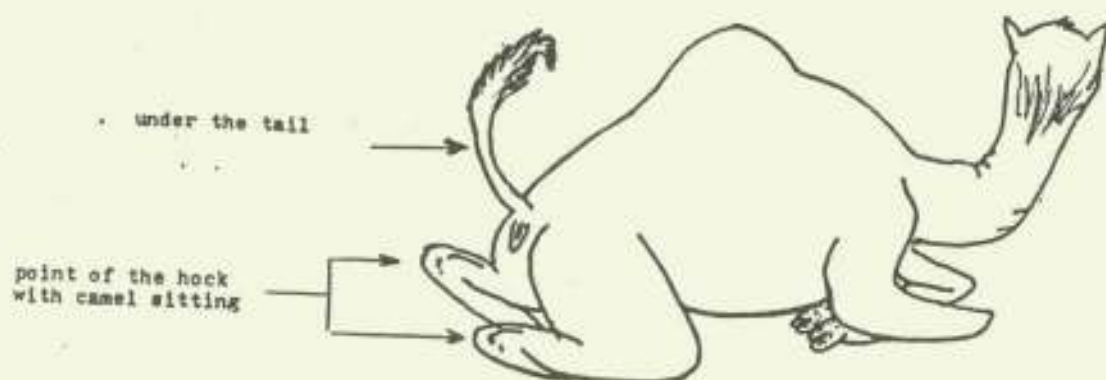


Figure 12.1 Some pulse locations on the camel.

12.4 -COMMON CAMEL HEALTH PROBLEMS

The following health problems are those most often found in camel herds in Kenya. Some health problems are diseases. Many are the result of secondary infections or complications resulting from internal or external parasites. The drugs recommended are found in Kenya. Extreme caution should be used when giving any drugs. Whenever possible a trained health person should be called upon to diagnose and treat sick camels. Overdependence on drugs, especially antibiotics, can result in the disease or the animal becoming resistant to the drug. Consequently, when a very serious disease occurs the drug may be ineffective against it. Never give animal drugs to humans.

12.5 - PROTOZOAL DISEASES

Trypanosomiasis

Trypanosomiasis is probably the most serious disease affecting camels. If camels are in good physical condition when they get the disease, about 20 percent of them survive.² This disease is common in Kenya. There is a research project

working at Kabete on the problem of trypanosomiasis. Dr. D. Rottcher, the head of the project, has provided testing and advice for camel keepers on the control of this disease.

* Cause *

Trypanosomiasis in camels comes from two sources. The most serious in Kenya is Trypanosoma evansi. This disease is most often caused by a biting fly of the Tabanidae family. The fly serves as a VECTOR for this disease because it carries the protozoa from one HOST to another. The fly will bite an infected animal. The parasites or protozoa are then carried to the camel in the mouth of the fly. The parasites can live for several hours in the fly's mouth. They can also live in the blood system of the fly for about 40 hours.³ When a fly bites a camel it transfers the parasites to the camel's blood system.

There are other forms of the disease besides T. evansi. Tsetse flies can carry other forms called T. brucie and T. congolense which affect camels. They are usually found where there are water points and during rainy season. This is because the vector for these diseases cannot live far from water. Since camels are not generally found where there are tsetse flies T. brucie and T. congolense are not as serious as T. evansi. Any warm or cold blooded animal can serve as a host for trypanosomiasis. Trypanosomiasis is sometimes called the "wasting" disease because an animal can suffer with it for 3-4 years during which time it will keep losing weight or "wasting away" until it may die.⁴

* Symptoms *

This disease can occur in varying degrees of severity. In its most serious stage, it can result in death. A camel suffering from Trypanosomiasis will lose weight, refuse to eat, and develop a fever. It is a major cause of abortion in pregnant females. Camels with this disease will suffer a loss in milk production from which they will never recover. Secondary problems can affect the respiratory system, nervous system, and cause intestinal problems. Although the symptoms for trypanosomiasis are easy to see, a blood test is the most positive way of knowing if the camel does in fact have the disease.

* Treatment/Prevention *

The vector, Tabanis flies, are generally found near water. There are four ways to help reduce encounters with Tabanis flies.

- 1) moving camels away from rivers or standing water
- 2) moving the boma frequently because the flies hatch in the manure in the boma

- 3) moving through known trypanosomiasis areas rapidly and at night when it is too cool for the flies to be out,
- 4) watering the camels during the hottest part of the day when the flies stay in the shade

Once the camels have gotten trypanosomiasis, the drug treatment of choice is Antrycide Sulphate. It is injected under the skin in a dosage of 4.4 mg./kg. of body weight. Suramin, sold as "Naganal" in Kenya is affective in a dosage of 10 mg./kg. of body weight.⁵ Avoid using Berenil because it is toxic to camels. All drugs should be used under a veterinarian's supervision because their improper application can result in serious side effects for the camel, and in the development of drug-resistant strains of the disease. See table 12.2 for some drugs used for trypanosomiasis.

Table 12.2 Some common drugs used for Trypanosomiasis.

Drug	Dosage	Method	Efficiency	Common name and notes
Arsenicals, antimonials		long and complicated intravenous	30 - 70 per cent	narrow safety margins
Suramin	10 g aqueous solution	intravenous	very good	'Naganol' 'Bayer 205' 'Antrypol'; if used as prophylactic can lead to resistance.
Suramin + stibophen	4 g + 40 ml	intravenous	100 per cent	stibophen = 'antimosan'
Stilbamidine isethionate	5 mg per kg	intravenous		unsafe at this dose and unreliable at lower rates
Pentamidine isethionate		intravenous	ineffective	ineffective at safe dose rates
Dimidium bromide	2 mg per kg			'Phenanthridium 897' and '1555'
Quinapyramine	2 g aqueous solution (10 mg per kg)	subcutaneous/intramuscular	approaches 100 per cent	'Antrycide'; higher rates are toxic
Diminazene aceturate	5 mg per kg aqueous solution	subcutaneous/intramuscular	very good in combinations	'Berenil'; highly toxic at 7 mg per kg
Isometamidium	1 mg per kg in 2 per cent aqueous solution	intravenous	not as effective at this dose against <i>Trypanosoma evansi</i> as other products	'Samorin'; can also be used subcutaneously and intramuscularly; higher doses more effective but very poorly tolerated

SOURCE: Wilson, 1984.

* Affect on Humans *

Trypanosomiasis is not contagious to man. Humans can be affected if bitten by the vector.⁶

12.6 - BACTERIAL DISEASES

Anthrax

This is a fairly common disease in Kenya. It is somewhat area specific. Wajir has had major outbreaks of camel anthrax.⁷ It is sometimes mistaken for "black quarter" which is caused by a different bacteria.

* Cause *

Anthrax in camels is caused by Bacillus anthracis, a bacteria. The spores formed by the bacillus are very difficult to destroy. They can live in the ground for as long as 60 years under the right conditions. The spores can withstand temperatures of 165 C. and are difficult to kill with disinfectants. The camel gets the infection by taking in the spores either from eating infected meat or bones, or from rolling in soil or old hides that have the spores.⁸ One reason the disease is area specific is because improper disposal of animals that have died from Anthrax can spread the spores for years afterwards.

* Symptoms *

Anthrax can result in death in just a few days. General signs of the disease are fever and swelling around the head and neck, which may make it difficult for the camel to breathe and swallow. Diarrhea is common with Anthrax. Sores may break out on the skin. When the animal dies, a black thick blood comes out of its body openings.⁹

* Prevention/Treatment *

If the disease is discovered early, Tetracycline can be tried as directed for treatment. Death often occurs before the signs are very evident. Vaccination with 'Blanthrax' for both Black Quarter and Anthrax is usually effective for prevention.

If an animal is believed to have died from anthrax, DO NOT open it up. Remove an ear and take it in for examination. If the animal can be buried before it is opened, the spores will die from a lack of oxygen inside the carcass. Cover the body with thorns or in some other way prevent predators from eating the body and spreading the spores. If Anthrax is diagnosed, the carcass should be buried in a deep hole at the site where the animal died. The carcass can be burned, but it should be burned completely and then buried to kill the spores. Soaking the body with diesel fuel to burn it helps raise the temperature high enough to kill the spores.¹⁰

* Affect on Humans *

Humans are severely at risk for Anthrax. They can get the disease from the hides, blood or other body fluids or from eating the meat from a sick animal. It can be fatal for humans.

Salmonellosis

Although it is reported to be a common problem in some other camel countries such as Somalia and Egypt, it does not appear to be a major problem in Kenya yet.

* Cause *

The bacteria Salmonella choleraesuis is the apparent cause of the disease.¹¹ Eating meat infected with the bacteria passes the disease to humans. Salmonellosis can also be spread by handling feces from infected animals. In most adult livestock, stress seems to be one of the factors leading to the disease. Overwork, calving, malnutrition and other disease problems can lower the camel's resistance to disease, including Salmonellosis.¹²

* Symptoms *

The signs of Salmonellosis are increased pulse rate, fever, swollen lymph nodes under the jaw and at the base of the neck in front of the shoulder, muscle twitching in the head and neck area, and diarrhea. Death frequently occurs especially in camels under stress.¹³ In very severe cases, the feces may become black and smell very badly. Salmonellosis may cause various reproductive problems such as sterility and abortion.

* Prevention/Treatment *

Hygiene can help prevent the disease in humans. If the herd shows signs of the infection they can be tested. Those carrying the disease should be separated from the rest of the herd and treated. Treatment with antibiotics or sulphonamides show good results.¹⁴ Nitrofurazone given in high doses is said to be effective.¹⁵ Good management can lower the stress factor which will reduce the chances of the animals getting the disease.

* Affect on Humans *

Meat or milk that has been infected with the bacteria can pass the disease to humans. Children playing on the ground can come in contact with infected feces.

Tuberculosis

Although T.B. has been found in Egypt, the disease is not thought to be a major problem in Kenya. Tuberculosis is

found most often where cattle and camels are kept together. In Kenya the nomadic camel keepers seldom herd camels with cattle because of their different management needs.

Brucellosis

There is little doubt that Brucellosis affects camels in Kenya.¹⁶ One study in Northeast Province, showed that 14.5% of the herds tested were infected with Brucellosis.¹⁷ There is a need to study more closely the relationship between Brucellosis and abortion in camels in Kenya.

Animals infected with this microorganism can pass it to humans through their milk. Boiling the milk from all domestic stock is recommended whenever possible to prevent passing the disease on to humans in the form of Undulant Fever or Bangs Disease. The literature on the subject does not suggest that Bangs Disease is a major problem in Northern Kenya.

12.7 - VIRAL DISEASES

Camel Pox

This disease is common in camels everywhere. It is especially serious for those camels between the ages of 6 months and 2 years. It occurs most often during the wet season and can be fatal in its most severe form.¹⁸

* Causes *

Camel Pox is caused by a Variola virus.¹⁹ It is passed by direct contact between infected animals and man.

* Symptoms *

The sick camel will usually show symptoms after a two-week incubation period.²⁰ The signs typically occur in four stages. Small red bumps come out on the skin in the first stage. These bumps or PAPULES become blisters which get pus inside of them in the second and third stages. In the fourth stage these blisters become sores that form a crust on the skin. The sores are usually found around the face and head, especially on the lips. The papules will break out anywhere the skin is soft.²¹ In immature camels diarrhea may be followed by death. If the camel lives through the sickness it will be immune to it for life. If the camel is nursing a mother who has had camel pox, at least partial immunity will be passed to the baby through the mother's milk.²²

* Prevention/Treatment *

There is some debate over the merits of developing a vaccine to prevent Camel Pox.²³ At this time there is no vaccine available in Kenya. Isolating the infected camels and careful hygiene when handling them could help prevent the spread of the disease. Treating the sore with a topical ointment containing sulphonamides may be of some value.²⁴

Generally, the disease lasts about three weeks and many camel owners do little about it. If the camel can be kept from losing weight, and the sores controlled, there is an advantage to letting the camel suffer through the disease. It will be immune in the future, and can pass on some of that immunity to its offspring.

* Affect on Humans *

There is some concern for humans in that the sores do occasionally appear on humans who have come in contact with sick camels. It does not seem to represent a major health problem for humans.

Rinderpest

This disease, which seriously affects cattle in Kenya, is of minor importance in camel husbandry. Although antibodies to Rinderpest have been found in the blood of camels in Kenya, it is not of economic importance.²⁵

Foot and Mouth Disease

A serious disease in cattle, Foot and Mouth disease does not affect camels in Kenya.

12.8 - INTERNAL PARASITES

Reports from various countries show internal parasites to be a major problem in camels. In Ethiopia, 92% of the camels examined had some degree of intestinal parasites.²⁶ They are of major importance because of the economic losses they cause by lowering production. There are over 60 different parasites which attack camels.²⁷ Besides lowering production they lower an animal's ability to fight disease. Some major parasites are:

Flukes (Trematodes)

These are HELMINTHS of the class of flat worms. The family of flukes most important to camels are the Fasciola genus,

F.hepatica and F. gigantica.²⁸ The disease caused by these parasites is called Fascioliosis.

* Cause *

Fascioliosis is caused by liver flukes. They are less serious in Kenya than in some other camel countries because they are most often found near irrigation schemes, and Kenya has few irrigation projects near camels at this time. Camels pick up the flukes when they are grazing on wet grass or around water holes. The flukes enter the intestine and then settle in the liver. They cause liver damage and bleeding which can make the camel weak and anemic. Camels infested with liver flukes are less able to fight off other diseases because of their weakened condition.

* Symptoms *

A swollen stomach and a dull anemic look is associated with fascioliosis. The feces may be very black from old blood. Besides losing weight and general weakness, the camel may die if large infestations are untreated for a long time.

* Prevention/Treatment *

Cattle and sheep drenches have worked on camels. Abendazole at 10-20 mg./kg. of body weight has been effective.

Tapeworms (Cestodes)

Camels in most countries are found to be affected by cestodes.²⁹ In studies in Lebanon and Syria, 100% of the camels were found to be infected.³⁰ The most important tapeworm in Kenya's camels is Echinococcus polymorphus which are found in camel's liver, heart, and spleen. They are found in the lungs of camels in Kenya in the form of Hydatid cysts. The Turkana people have a higher risk for Hydatidosis because, unlike the Muslim camel keepers, they keep dogs. Dogs are hosts for the Hydatids. They are generally not a major health problem unless they are found in large numbers or in young animals.

* Cause *

The tapeworm is ingested by the camel and lodges in various organs. The hydatid may live part of its life cycle in the body of a dog. The dogs pass the eggs in their feces then humans and other animals then get it from contact.

* Symptoms *

Symptoms include stunted growth due to loss of appetite, and a weakened condition which lowers the camel's ability to fight other diseases.

* Treatment *

Use any worm drench designed specifically for cestodes.

Roundworms (Nematodes)

There are several roundworms responsible for infections in camels. Strongyleworms, responsible for the disease Strongylosis, have been found in 90-100% of the camels tested.³¹ The worst of these worms is from the genus *Haemonchus*. *Haemonchus* species are thought to be factors in camels getting Pasturella, a disease which can result in abortion in pregnant camels.

* Cause *

Strongylosis is caused by nematodes lodging themselves in the stomach or pulmonary tract of camels. *Haemonchus* is known to suck large quantities of blood from the host.

* Symptoms *

In minor infestations, over a short time, there are few if any symptoms. In large infestations that have been going on for a long time, the camel will become weak and anemic from loss of blood. They will have a loss of appetite and alternating diarrhea and constipation. Another problem is the lowered resistance to other diseases such as pasturella.

* Prevention/Treatment *

Periodic drenching with an anthelmintic helps keep the worm load at a lower level which the camel can fight. A good way to keep the camel free from worms is to drench at the beginning of each wet season and follow that with another drench two months later to make sure that you killed all the eggs. Because of the various species of worms, it is best to test before treating so that you kill the worms specific to your herd. Tetramisole hydrochloride 3% oral drench given at 0.5 ml./kg. of body weight seems to be effective against *Trychostrongylus* species. It is sold in Kenya as 'Nilverm'. Nitroxynil works better for *Haemonchus* species. Infections involving more than one species of roundworm, can be treated effectively with 90% Methyridine injectable solution at 1.0 ml./4.5 kg. of body weight, and 4% Moruntal tartrate at 1.0 ml./4 kg. of body weight.³³

* Affect on Humans *

All internal parasites can be harmful to humans. Good personal hygiene is important in keeping worms out of the human system.

12.9 - EXTERNAL PARASITES

Mange

This disease may be one of the most common diseases in camels. It is said to be the second most important camel disease after Trypanosomiasis.³⁴ It is a contagious disease that can be passed to other camels as well as to humans.

* Cause *

Camel mange, specifically Scarcoptic mange, is caused by a tiny parasite called a mite. Scarcoptes scabiei cameli is the mite that affects camels. These mites are just barely visible to the human eye. Once they have multiplied they spread very rapidly over the entire body, and then to the rest of the herd. There has recently been a second mite, found on Galana Ranch near Voi, that attacks camels. It is Demodex species.³⁵ The disease is not only spread by contact with infected camels, but also with saddles and camel equipment and trees which the camels may have rubbed against. Mange is more of a problem during the colder season when the camel's coat is longer.

* Symptoms *

Scarcoptic mange begins as sores on the head and flanks of the camel. Within a month it can cover the entire body. The hair falls out around the sores, and the skin on the legs and hocks becomes hard and blistered. The disease can be so painful that the camel will lose its desire to eat. A loss of production can result from mange.³⁶

* Prevention/Treatment *

Early detection of the disease can occur if the camels are checked periodically, especially when the camel's hair is longer. Work camels should be brushed once a week to prevent injuries from thorns or burrs in the saddle equipment. This is a good time to check for mange. Some camel keepers paint the camels with a mixture of old motor oil and an acaricide to control mange. This seems to be an effective method of prevention. A rub made from burlap sacks soaked in acaricide and used engine oil gives the camels an opportunity to control the mites before they spread

if left in the boma so the camels can rub against it when they are in for the night.

Once the sores have broken out clip the hair around the infected area and scrub it with a strong disinfectant soap. Once the area has dried, apply 0.01% Grammexane or some other hydrocarbon or organophosphate to kill the mites. This can be applied with a paint brush, sponge, or sprayer. It should be applied two or three times per week for three weeks to be sure that you killed the eggs as well.³⁷ Another effective treatment is three applications of 0.05% lindane weekly. Ivermectin injectable is being tried at dosages of 200 mg./50 kg. of body weight as a control for internal parasites, mange, camel botfly (Oestrus cameli) and the larvae of camel nasal fly (Cephalopsis titilator) in a single drug therapy.³⁸ Saddles, blankets, ropes, and harnesses should be treated with 5-10% Phenol to keep the mange from spreading.

* Affect on Humans *

Although humans can get mange, it is unclear if they can get it from camels directly.

Ticks

Ticks are blood sucking parasites, or ARACHNIDS, of the order Acarina. They attach themselves to livestock which is their host, and feed from their blood. Studies done in Northern Kenya show that there are six main species of ticks affecting camels. These studies confirm reports from two other areas in Kenya to show that the ticks of major importance to Kenya's camel herds are:

- | | |
|-----------------------|-----------------------------|
| - Hyalomma dromedarii | - Amblyomma gemma |
| - Hyalomma truncatum | - Rhipicephallus pulchellus |
| - Hyalomma rufipes | - Rhipicephallus pravus |

The most common tick found on camels was Hyalomma dromedarii. It was found on 60% of the camels studied by I.P.A.L.³⁹

Camels pick up the ticks as they wander through the bush feeding. The adult tick lays her eggs in the grass where the eggs hatch and attach themselves to the camel. The ticks travel to different parts of the body where they attach themselves for all or part of their life cycle, and feeding off the camel's blood.

Ticks that feed on camels are quite area specific as to where they feed on the camel's body. Hyalomma dromedarii is found primarily in the ears and nose of the camel. Rhipicephallus species are most often found in the armpits, groin and anal regions.⁴⁰ These are not the only areas where ticks can be found on camels but treatment of the favored tick sites will greatly

reduce the tick load on the camel. The most important places to find ticks on camels are the armpits, under the tail around the anus, the groin/udder area, ears, and nose. Knowing where to locate ticks on the camel not only makes treatment easier, but it makes identification of the ticks easier as well. It is important to identify the type of ticks in your area so that you can use the proper acaricide for controlling those specific ticks.

Hyalomma species seem to be more resistant to the organophosphate acaricides than Rhipicephallus species. A manual useful for identifying the different species of ticks can be bought from Beyer Drug Company of Nairobi.

* Complications *

True tick born diseases are rare in camels. The major form of damage is from mechanical injuries resulting from their bites and irritation.⁴¹ Camels often injure their eyes trying to rub ticks off on trees. Ticks are reported to cause CONJUNCTIVITIS and KERATITIS in camels.⁴² Some of the other problems caused by ticks are:

- transmission of Trypanosomiasis
- they serve as a vector for viral, bacterial, and protozoal diseases
- irritation which causes the camel to go off feed and lose weight and production
- anemia from loss of blood to the tick
- lowered resistance to diseases and secondary infection
- the sites of attachment become infected or serve as a source for fly infestation and maggots

The tick, H. truncatum is known to produce toxins that lead to posterior paralysis and even death. In Kenya death loss among calves under two years old are reported to be 22% from tick related problems.⁴³

* Prevention/Treatment *

Prevention and control of tick populations is important because it can lower the damage done to the herd and increase production. Tick control is a part of good livestock management, especially on commercial ranches where browsing is more confined and the range may be shared with cattle, sheep, and goats. Control of ticks breaks the reproduction cycle and lowers the total number of ticks found in the grazing area which reduces the risk for all stock.

Another reason tick control pays is its effect on other parasites. Camel flies, mites, lice and other skin parasites seem to bother the camel less if it has been sprayed on a regular basis.

* Methods of Tick Control *

The most common method of control is by using acaricides which are chemicals used to kill arachnids. They are available at most farm supply stores in Kenya or from your local veterinarian. They can be bought in both liquid and powder forms that mix with water to form a solution that can be applied to the surface of the camel. Hand spraying will be the most convenient way to apply acaricides because the equipment is simple, fairly inexpensive, and portable. This can be done with :

- a back pack pressure sprayer
- a push pull sprayer used with a bucket for the solution
- a bucket of solution and a paint brush if a sprayer is not available.

Most farm supply stores carry different kinds of sprayers which are commonly used to spray crops and vegetables but are fine for spraying livestock. It gives better protection to cover the entire camel, but at least treat the danger areas where ticks are commonly found. If a backpack sprayer is used an entire camel can be sprayed in 5-6 minutes. Special attention should be paid to the ears and nose. It is often difficult to spray these areas very well since the camel can close its nostrils, and does not like having its ears sprayed. Hand application with a sponge, cloth, or small paint brush works better in these areas. After spraying, tick grease should be applied to the ears and around the nose to give added protection. This is an acaricide in a greasy mixture that lasts several days and kills ticks. How often you spray depends on how bad the tick problem is in your area. Weekly spraying offers good control in most areas but with traditional herders monthly spraying may be more realistic.

All chemicals used to control parasites are dangerous and should only be used as the directions say. Read the directions carefully. Any buckets, sponges or clothes used with the sprays should never be used for any other purpose. Wash your hands after using all chemicals and never spray upwind.

Fly Irritation

Various species of flies can cause irritation to the camel as well as transmit disease. Although seldom fatal, flies can result in a loss of production as well as the spread of diseases such as trypanosomiasis.

* Cause *

Nasal fly (Cephalopsis titilator) causes damage to the sinus cavities and may possibly lead to meningitis in severe infestations by the larvae of these flies. Camel flies from the family Hippo boscidae are common in almost all camel areas. In addition to irritating the camel, they are believed to be involved in spreading T. evansi.⁴⁴ In addition to these flies, many other flies are responsible for laying eggs in open wounds, and causing a loss of production by irritating the camel.

* Symptoms *

Discharge from the nose, frequent shaking of the head, and sneezing are signs of possible fly infestation. The camel may try to rub its head against other camels if the flies are in its sinus cavities.

* Prevention/Treatment *

Rubs soaked in acaricide and used engine oil help keep the flies away. As pointed out previously, some anthelmintics are helpful in killing fly larvae. Open wounds should be watched carefully to prevent maggots from hatching.

* Affect on Humans *

There is no affect on humans.

12.10 - OTHER HEALTH PROBLEMS

Skin Necrosis

This problem is extremely common in all camel countries. It is seen as a sore that usually is found on the back or the hump. It is apparently highly contagious to other camels. Although it is seldom if ever fatal, it is still a bother because the pus that comes from the open sores can reinfect the camel. If the sores are not looked after, they can get infected or serve as the site for flies to lay their eggs. Skin necrosis will make the camel unable to work and presents a management problem trying to separate the sick camels from the rest of the herd.

* Cause *

There is general agreement among most sources that skin necrosis is due to lack of salt in the diet. The pus from the sores is "an almost pure culture of streptococci".⁴⁵ It is spread to other camels by rubbing the open sores. It is also attributed to improper fitting saddles or loads which rub the camels raw.

* Symptoms *

A lump appears on the skin surface which gradually becomes hot and sore. Eventually the hair falls out from the sore area which is hard and appears black in the center. The sores form when the lump breaks open and pus runs out. The sores are about 2 cm. in diameter and the skin sloughs off around the sore as the disease progresses.⁴⁶ Skin necrosis does not seem to be as severe for healthy camels.

* Prevention/Treatment *

Because of the highly contagious nature of the disease, it is important to separate the healthy camels from the sick ones. The sores should be drained and cleaned with a disinfectant. The cloth used to clean the wound should be burned after use to prevent the spread of infection. Success has been achieved using 1:100 solution of Acriflavin to clean the wound. This author has had good results injecting hydrogen peroxide 0.3% solution into the wound to clean deep inside.

* Affect on Humans *

There is no known affect on humans.

NOTE: There is a similar condition found in Kenya and elsewhere. It appears in camels who have been getting salt in their diet, and have not been working so it is not trauma related. It looks quite similar, but sometimes may disappear without breaking open. It will at times result in sores much like those seen in skin necrosis. It does not appear to be painful and most traditional camel keepers just ignore it. An effective means of healing the sores is by applying sulpha powder mixed with glycerine to form a paste. This condition may be caused by *Corynebacterium pseudotuberculosis*, and *Streptococcus* of the Lancefield B-type.⁴⁷ Although it does not seem particularly troublesome to the camel, the open sores can serve as a site for flies to lay eggs or for secondary infections to occur.

Bloat

This is an extreme case of stomach gas. Bloat and other stomach ailments can be very painful for the camel. There are anti-bloat drugs available, but linseed oil given in dosages of 3/4 - 1 liter will help relieve the pain. In an emergency, liquid parafin, vegetable oil or even NEW engine oil can bring relief. DO NOT GIVE USED ENGINE OIL UNDER ANY CIRCUMSTANCES. Severe cases of bloat can be fatal. Like most intestinal ailments, the camel will roll on the ground, or try to lay on its side if suffering from bloat.

Impaction

If the camel has been eating very dry forage or has become quite dehydrated, a blockage of the third and fourth stomach can occur causing an impaction of feces. It may also happen if the camel has eaten some form of poison. It is extremely painful, and if untreated can be fatal. A good herdsman should be aware of early signs of impaction because the feces will change shape and constipation will get progressively worse. A drench of 2 liters of linseed oil or 0.5-1.5 kg. epsom salts and 2 liters of water helps to loosen the impaction.

12.11 - SUMMARY:COMMON CAMEL HEALTH PROBLEMS

There are many illnesses that camels can get. Anyone interested in working with camels should invest in a good veterinary manual. Many of the diseases associated with camels also affect cattle and other stock. Whenever possible a trained animal health technician should be consulted. The camel husbandry person should learn how to detect the common camel diseases, give injections, drench camels and take the vital signs. It is beyond the scope of this paper to detail every camel disease and treatment. Check the bibliography for various authors who have written about camel diseases.

** CHAPTER NOTES **

- 1) Leese, 1927, reports that the respiration rate for camels is 5-12 breathes/minute. Wilson, 1984 reports the repiration rate to be 8-18/breathes/minute. The difference between these two figures may be the result of improved monitoring techniques or different breeds of camels.
- 2) Mukasa-Mugerwa, 1979.
- 3) Wilson, 1981.
- 4) Mukani, 1984.
- 5) Rottcher, 1984.
- 6) Thedford, 1983.
- 7) Bremaud, 1969.
- 8) Hall, 1977.
- 9) Mukani and Muguga, 1984.
- 10) Thedford, 1983.

**** Chapter Notes ****

- 11) Curasson, 1947, Cheyne et al, 1972.
- 12) Hall, 1977.
- 13) Cheyne et al, 1972.
- 14) Mukasa-Mugerwa, 1981.
- 15) Hall, 1977.
- 16) Wilson et al, 1982.
- 17) Waghella et al, 1978.
- 18) Cross, 1917.
- 19) Fazil, 1977.
- 20) Mukasa-Mugerwa, 1981.
- 21) Wilson et al, 1982.
- 22) Mukani, 1984.
- 23) Richard, 1979, is in favor of the vaccine, Wilson, 1979, sees little or no need for it.
- 24) Hall, 1977.
- 25) Taylor, 1968.
- 26) Richard, 1976.
- 27) Wilson, 1984.
- 28) Edisougi, 1979.
- 29) Bouvier, 1976.
- 30) Dailey and Sweatman, 1965.
- 31) Mukasa and Muguga, 1983.
- 32) Wilson, 1984. Mukani, 1984.
- 33) Lohde et al, 1977.
- 34) Wilson, 1984.

**** Chapter Notes ****

- 35) Sayer and Olahu, 1984.
- 36) Curasson, 1947.
- 37) Fazil, 1977.
- 38) Sayer, 1983.
- 39) Crees, 1985.
- 40) Hoogstral, 1956.
- 41) Mukasa-Mugerwa, 1981, Schwartz et al, 1982.
- 42) Rutagwenda, 1983.
- 43) Field, 1979b.
- 44) Wilson et al, 1982.
- 45) Leese, 1927.
- 46) Fazil, 1977.
- 47) Mukasa-Mugerwa, 1981.

13.0 - DEVELOPING A RECORD-KEEPING SYSTEM

If more efficient camel management systems are to be developed and numbers of camels in Kenya expanded, data must be collected and compared on the various systems of management. The improvement of camel husbandry will require some form of record-keeping system. This chapter will:

- explore the needs for keeping records
- identify different record keeping systems
- give examples of three types of record systems

13.1 - WHY KEEP RECORDS?

It is said that some of the nomadic camel keepers live so closely with their camels that they can tell by looking at the camel feces when the animal was watered last, where it came from, what it was eating and the general health of the animal. From looking at their footprints they can tell the age, weight, sex, and whether the camel was carrying baggage or not. These people have an appropriate record keeping system for their needs. It is easy to transport, easy to update, and the information can be passed on to other people easily.

In the modern sector this system would not be as practical. Most people working with camels in the modern sector do not live as closely with their animals. Livestock development agents or government veterinary officers have several different herds to look after. They must also handle much more information in a day than the nomadic herdsman does. For some, a written record is the only practical way to record information.

The efficient management of a livestock system depends upon information about the herd. Whether the animals belong to you or you are a livestock development officer, you must have some way of organizing the information you need.

If you are working with herd health, you will need to know the medical history of each animal. If you are developing a breeding program you will need to know how each animal has performed in the past so you can assess its genetic potential. If you are doing research on camel husbandry you will need to know how each animal is producing in comparison to other camels in the study group. It may be that you will be able to keep records in your head, or you may need a computer to record data. No matter what you intend to do with livestock, it will be done much more efficiently if based upon some collection of knowledge. This knowledge is most beneficial if kept in a record system that is organized and easy to use. Some questions to consider when developing your system are:

- 1) Can the information be easily read? Is it understandable to anyone who may need to use this information?
- 2) Can the information be easily updated by adding new material or removing old, out-of-date information?
- 3) Can the system be transported easily to the field? Is it stored in a way that it will be able to withstand the rigors of traveling over rough roads, or by camel?
- 4) Can it be organized in a simple clear manner so that it will be easy to use in the field?

The easier it is to use a record system, the more likely it is that it will be kept current. A record system should not be a place to put information; rather, it must be a place to find information.

13.2 - WHICH INFORMATION TO KEEP

A record system can make our job much easier. It tells us what we need to do. It should also tell us what we have already done. It can be used for filing reports about treatments given or progress of the herd. It can serve as a tool for deciding which animals to cull. Records can also tell us how our animals are progressing under the present management plan. A record system should point out problems that occur periodically. We should look at the record system frequently to determine when, why, and how often problems are occurring. A record system can help make up for a lack of technical resources by allowing us to avoid or understand problems that keep us from reaching our management goals.

The following are some types of records that we could keep to help us manage our livestock.

Breeding Records

The purpose of breeding records is to identify the contributions each animal is making to the production of the herd. A particular camel may be adding to the value of the herd or it may be a weakness. Enough information should be kept on each animal to decide if an animal should be kept or removed from the herd. Some information that might be useful on a breeding record is:

IDENTIFICATION - name, I.D. number or brand

AGE - if the exact age is unknown, the teeth will give an approximate idea of the camel's age

SEX - male or female

BREEDING DATE - (females)

DATE CALVED and SEX OF CALF

SIRE and DAM

CALVES BORN TO DATE - number of calves reaching 4 years of age, stillbirths, fate of calf, etc.

AVERAGE MILK PRODUCTION - should be tested during wet and dry season to get a more realistic idea of production.

CURRENT BREEDING STATUS - open, bred, immature

COMMENTS - this part of the file gives you an opportunity to make notes on what should be looked for in the future with this animal. For example if she has been in milk for several months, you may want to make a note to be sure and get her calf weaned so she will be ready to breed by the next wet season.

The purpose of the record system is to provide some "red flags" or things you should be watching more closely. These red flags can be noted in the comment section or possibly by actually placing small red marks by the section with which you are concerned, such as being open or unbred for several breeding seasons. See figure 13.0 for an example of a breeding file. It could be kept in a notebook or on a 4 x 8 inch index card. Use whatever is available and convenient.

<u>IDENTIFICATION</u>	<u>DATE OF BIRTH</u>	<u>SIRE</u>	<u>SEX</u>
Fatima, #26	01 - 10 - 72	Garba	female

CURRENT INFORMATION

Current Calf #:127

Days in Milk: 270

Date for Weaning: 6 - 85

Date for Rebreed: 8 - 85

The current information should be recorded in a way that is easily updated so that it will reflect each lactation. It serves as a management tool for the current lactation.

Figure 13.0 - An example of a breeding record.

In addition to a breeding record, it is helpful to keep a calving history. This record is used to determine when the cow calved, her lactation record and the sex of each calf. This type of production record is more important for commercial herds than it is for traditional camel keepers because it requires a relatively accurate means of collecting milk. Figure 13.1 is an example of some of the information that could be recorded in a calving history.

DATE BRED	DATE CALVED	CALF I.D.#	AVG. MILK PROD.*	CALF SEX
6 - 76	6 - 25 - 77	# 14	5 kg./d/380 d	male
9 - 78	10 - 9 - 79	# 18	7 kg./d/360 d	female
4 - 81	4 - 21 - 82	# 30	7 kg./d/387 d	female
28 - 82	9 - 5 - 83	died	9 kg./d/212 d	male

* Milk Production in kilograms per day for the number of days the camel is in lactation.

Figure 13.1 An example of a calving history including milk production.

Health Record

Health records are a means of keeping track of the animals under your care. It should record what you have done to them and what needs to be done in the future. They are especially useful for veterinary officers who may only visit the herd periodically during the year for herd health check-ups or for treatment. A good record system will make the job much easier because you will know immediately what work needs to be done and what equipment you will need. It can tell you which animals need treatment, what its health history is, and how long it has been in the herd. It is helpful to know how long it has been in the herd so you will know if the problem came from outside the herd or if there is a management problem within the herd. Records can also tell you how effective your treatments have been so you can decide to continue or change the treatments. A good health record system can also tell you if there is a recurring problem that can be corrected by management changes. It is also useful in writing reports because you can look back at your whole month's work just by checking your records. An example of how health records can affect your management system would be if you are treating a herd for a high number of abortions or stillbirths. You could then find out if the herd has been dipped or sprayed to control ticks from infecting the herd. Possibly they have not been treated regularly or the spray has been too weak so the camels are getting trypanosomiasis from the ticks which carry the disease.

If you are trying to decide which information you want to put into your record system you might ask yourself, "how much do I want to know?" You should include enough information to tell yourself the story of each animal in terms of

its health history. Too much information could make the system useless. As you use your health records you will soon develop some idea of what information is being used and which information to cut out. Some basic information to include is:

IDENTIFICATION - name, brand or I.D. number

SEX - female, male castrate, male entire

DATE OF BIRTH - if unknown use teeth to determine age

ORIGIN - how and when did it enter the herd, was it bought or bred by a herd sire

STATUS - dead, loaned out, sold, bred, open

DISEASES OR AILMENTS - date, condition when examined, treatment, comments, or results of the treatment.

See figure 13.2 for an example of a health file.

IDENTIFICATION	AGE/ D.O.B.	SEX	ORIGIN	STATUS
Makora # 127	9-10 years	castrate	bought	died 6-84

DATE	PROBLEM	TREATMENT	REMARKS
2-12-82	vaccinate for trypanosomiasis	5cc Sammarin HCl I.V.	swelling at site of injection
4-25-82	routine tick control	spray with Delnav in 10cc/l of water	none
1-05-83	eye infection from thorn	Sulpha powder twice/day for 3 days	watch for loss of vision
6-28-83	routine herd health	none	blind in left eye
5-25-84	lion attack, right foreleg cut badly	wash wounds with Iodine, inject 20cc combiotic daily	large blood loss
6-9-84	camel died	*****	no response to treatment

Figure 13.2 An example of a health record.

13.3 - CAMEL PROFILE

A profile is used for identifying each animal in the herd. It is most useful when getting to know a new herd. It is often used by livestock development agents and veterinary officers who may only see the herd periodically. If properly used and recorded it can prevent injuries and help in gaining a camel owner's respect. Traditional camel owners are able to identify each camel on sight. Often they know the animal's history going back generations. Trust and co-operation will be developed much faster if the owner is able to see that you care enough to recognize his camels. It is also very useful when informing a new agent or technician about the herd.

The profile record should be written in such a way that you can easily recognize the individual camels in each herd. Once you have entered the information it will not have to be updated unless the camel's physical appearance changes. It may be helpful to actually draw each camel's scars and markings on the profile card.

One way of deciding which information to record is to ask yourself "what do I think of when I think of that particular camel?" What would you want to tell someone who was going to work with that camel? Is it gentle, large, or mean? Does it walk with a limp? Will you need help when treating it? Records are meant to make your job easier. See figure 13.3 for an example of a profile card.

NAME / I.D. #	SEX	DATE OF BIRTH
Mama Wajir #81	female	Birth date unknown
COLOR - dark brown		Bought 4 - 7 - 7

* MARKINGS - burn scar on belly and near vulva, split left ear, scar on her nose

DISPOSITION - very nervous around a rope, only kicks when you try to put a halter on her, does not bite

REMARKS - burns near vulva and belly suggest she has had some calving difficulty, keep a good record of her calving date so the herdsman can give her special attention, Approach her cautiously, crouch her before putting her halter on or at least hobble her so you do not get hurt.

* - it might be helpful to record some of the markings or special brands so that new herdsman can identify the camels

Figure. 13.3 - An example of a profile record.

13.4 - SUMMARY: DEVELOPING A RECORD SYSTEM FOR CAMELS

Every level of livestock management can benefit record-keeping system. The traditional camel keepers may not have the resources for a written system, but they can benefit from learning which information is best remembered. Anyone working with camels in a veterinary or livestock development position should develop a system of record keeping that will show them:

- information on health care to make treatment easier and more complete
- breeding so that genetic improvements can be traced and blood lines recorded
- a general information system so that the knowledge about each camel can be passed on to fellow workers. This can insure safety and greater cooperation with herd owners.

A record system must provide for both efficient storage and retrieval of information. Ultimately a well designed record system should contain sufficient information to give a portrait of the past history of the herd and enough current information to plan for the future.

GLOSSARY

ABORTION - the birth of a fetus before the full term of pregnancy has been completed; the baby is expelled from the womb at such an early stage of development that it is unable to survive outside the mother

ACARACIDES - chemicals, usually of the organo-phosphate family, that are used to kill arachnides on livestock.

ARACHNIDES - eight legged ecto-parasites (those found on the outside of the body) including mites and ticks which cause serious livestock production losses

ANUS - the opening at the rear of the alimentary canal through which the feces passes

BOMA - kiswahili word commonly used when referring to the enclosure made from thorn bushes in which to keep livestock.

BROWSER - an animal that eats twigs and leaves from trees and shrubs for its food

CASTRATE - a male animal that has had its testicles removed

CERVIX - the narrow outer end of the uterus in the female reproductive organs

COITUS - the act of sexual intercourse between males and females of a species. (also copulation)

COLOSTRUM - first milk secreted by a mammal for a few days after giving birth; usually it is high in protein and anti-bodies

COPULATION - the act of sexual intercourse between males and females of a species. (see coitus)

CROUCH - term frequently used to refer to the camel in the sitting position

CULL - to select and remove from a group

DEHYDRATION - the state of having lost water; having had water removed

DESICCATE - To dry up; specifically, when plants lose their cell water and become very dry.

**** GLOSSARY ****

DISCHARGE - the flow of fluid from a wound or opening

EDEMA - an accumulation of fluid that causes swelling of the tissue in a particular area of the body

EJACULATION - the release of semen by a male.

ENTIRE - a male that has not been castrated

ESTROGEN - a sex hormone tending to promote oestus and stimulate the development of female secondary characteristics.

FETUS - unborn young of an animal

GENETIC POTENTIAL - the possible outcome from the crossing of genes that takes place when two animals mate

GESTATION PERIOD - that period from conceptio to calving; the amount of time it takes for an animal to produce its offspring in the womb of the female

HALOPHYTIC - plant that grows on salty soil such as salt bush.

HORMONE - substance that circulates in the body to stimulate certain organs

HOST - the source of nourishment for parasites; cattle can be hosts to certain ticks

HYPERVENTILATION - excessive rate and depth of breathing that leads to an abnormal loss of carbon dioxide from the blood.

LIBIDO - sexual energy or urge that leads animals to mate

LOOPS of HENLE - a series of loops within the kidney system that plays a part in water reabsorbtion.

OPEN - an unbred female; one that is not pregnant

PARTURITION - the act of giving birth

PLACENTA - organ in the uterus that nourishes the fetus

PREPUCE - fold of skin around the end of the penis or clitoris

PRESENTATION - the position the baby camel is in when it comes out of the birth canal

**** GLOSSARY ****

RECTAL PALPITATION - method of determining the stage of pregnancy by reaching through the anus to feel if the fetus is developing in the uterus

RELATIVE HUMIDITY - the amount of moisture present in the air compared to how much it could hold if it were completely saturated

RUT - an annual or periodic state of sexual excitement that occurs in some male animals; may also be called musth

SERVICE - the act of copulating with a female animal.

SPERMATOZOA - a living male germ cell.

STUD - a male animal used for breeding purposes.

TRACES - the connection between a draft animal and the thing it is pulling, such as a cart or wagon

TRYPANOSOMIASIS - the name of a group of diseases caused by small organisms of the genus *Trypanosma*; cause anemia, weight loss, abortion and death

UMBILICAL CORD - cord connecting the fetus to the placenta

UMBILICUS - the point of attachment of the umbilical cord and the fetus

UTERUS - hollow female organ where the fetus grows

VAGINA - part of the female sex organs that leads to the uterus

VECTOR - organism that carries disease from one animal or host to another; flies can be vectors for trypanosomiasis

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**INTRODUCING
THE
CAMEL**



BASIC CAMEL KEEPING FOR THE BEGINNER
