Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya

Training Manual

2.4.7 SUB MODULE 7: CAMEL PRODUCTION AND MANAGEMENT

Introduction

- The camel (Camelus dromedarious, the one-humped camel) is an important livestock species uniquely adapted to hot, arid and range environments. It produces milk, meat, wool, hair and hides. It provides long distance transport (a beast of burden), sport riding, and is a draft animal for agriculture.
- In Kenya's rangelands which comprise over 70% of the land surface, camel keeping is increasingly finding its place in the livestock industry.
- The camel is a unique resource adapted and able to utilize the ASAL environment and may be one of the key solutions to the rampant and recurring food crisis in these areas in future.
- It is a more reliable milk provider than other classes of livestock during both dry seasons and drought years. The milk provides about half of the nutrient intake of most camel keepers.
- The average camel produces 5-10 times as much milk as a cow kept under the same climatic conditions due to its prolonged lactation.

Camel population

The camel population in Kenya is estimated at between 850,000 and 960,000 heads, which represents approximately 6% of the total herbivore biomass in the country, but more than 25% in the arid lands where they are kept.

Adaptation

Adaptation is the suitability of the animal to thrive in the prevailing environmental conditions. Some inherent body parts in a camel that enhance its adaptation include:

- Lips – The upper lips are split and equally divided. This enables them to strip nutritious leaves from the thorny and woody trees.
- Eye lashes - Eyelashes are very long and strong for protection of the orbit. As the camel browses in the bushes, the lashes are meant for protection of the eye from damage or foreign obstruction. The camel has a third eyelid.
- Nostrils - Are rich in hair to protect them from dust and any foreign material
- Ear - Is rich in hairs and is very sensitive

- Nose - Camels have the ability to close and open the nose. When hot, it can open the nose very wide. In the nose there are bones which resemble honey combs. These allow air out and moisture inside.
- Neck - The camel has a long neck. An adult camel can therefore browse to a height of up to 2 metres. This reduces the competition for the feeding area with other animals.
- Legs - Long legs which are meant to cover longer distances
- Raise the animal above the ground
- Keep the animal from the heat on the ground
- Camels rest on their legs when they lie on the ground. Legs have Keratin pads which touch the ground.
- Once on the ground, the animal does not get direct contact with the heat on the ground
- They have large pad-like feet, which enable them to walk over soft sand without sinking. They do not cut up the surface of the soil like the hooves of cattle, sheep and goats and therefore contribute less to erosion.
- Tail –Acts as a ventilator as the animal urinates on the tail and sprinkles over other parts of the body to cool.

How the camel adapts to heat stress

- Camels have a long narrow body which, through facing either towards or away from the sun:
- Enables them to minimize the surface area exposed to radiation, especially once the sun is past its highest point.
- Around mid–day, when the sun is overhead, fat stored in the hump serves to insulate the parts of the body mostly direct to the sun.
- When facing the sun, the camel opens the nostrils, and the lungs are enlarged.
- The legs are long, and lift their bodies above the ground and away from the hot reflecting surfaces. Cooler air can pass underneath and their large surface to volume ratio permits efficient heat loss.
- Even when lying down, the sterna pad lifts much of the abdomen above the ground so that air can flow beneath.
- Deep body heat is lost through convection by blood circulating through a network of capillaries under the surface of the skin.
- Localization of the fat in the hump minimises its effects as a heat insulator, which might otherwise prevent heat loss from the rest of the body.
- Camels' hair and skin act as good insulators against incoming radiation; surface temperatures may reach 700C while skin temperatures are 300C lower.
- The hair of a healthy camel is shiny, which reflects incoming radiation.

- It also may stand erect, allowing air to pass through it and to evaporate moisture from the surface of the skin, cooling it more effectively.
- Cutting the hair of a camel may lead to a 50% increase in water loss.
- Respiration rates of camels remain low even at high temperatures.
- They lose less water through respiration than a cow, as the cow breathes twice as fast.
- Since heavy breathing generates heat they also get less hot.
- Camels have a water conservation mechanism whereby moisture from the lungs condenses on the turbinal bones in the nostrils and is not lost into the atmosphere.

Drinking and thermolability

- On a weight-for-weight basis, camels drink more water than other forms of livestock when expressed in terms of volume per unit time.
- After cession of rain, camels obtain sufficient moisture from forage and do not need to drink

- Camels once conditioned, can tolerate prolonged periods away from water e.g. during dry season Rendille nomads condition their camels to wait for up to ten weeks after cessation of rain before taking them to the wells
- Camels are thermolabile, meaning that they allow their body temperatures to fluctuate with the ambient temperature of their surroundings.Low air temperatures at night means that camels start the day quite cool but heat up by 6 0C or more before cooling mechanisms are triggered.
- Range of body temperature difference is 6 0C e.g. in the morning 37 0C can change to 42 0C the body temperature can fluctuate
- Camels do not store water; they conserve it. They store heat during the day and lose it during the night when less energy is required

Camel distribution in Kenya

- Camels in Kenya were first kept by the Somali people of Northern Kenya where much larger breeds and herds are found. They later spread to the Gabra and Rendille tribesmen of Marsabit and further to Turkana, Samburu and Pokot in recent times.
- They have been more recently introduced in new areas in the southern rangelands. There has been an upsurge of camel keeping in the southern rangelands of Kajiado and Narok counties.

- The threats posed by recent recurrent and more prolonged droughts in ASALs have certainly awakened its inhabitants to pay more attention to camel keeping than ever before.

CAMEL BREEDS

- The camels in Kenya are normally classified into three classes or breeds: Somali, Rendille/Gabbra, and Turkana. The names used for this classification are primarily based on the ethnic group and distribution of the camels; however, some distinguishing features are apparent.
- Recently, camels have been classified by their use: beef, dairy, dual-purpose and racing.
- Beef camels have well-developed hindquarters, large hump, rigid body, relatively short neck and large head, heavy bones and muscles.
- Dairy camels have a high milk production. They may produce over 2500 kg per year under natural grazing conditions: have well developed udders and milk veins, small hump, less beefy body and relatively big abdomen.
- Dual purpose camels are of medium body size, average milk production (1000-1500kg per year), have a medium size hump and relatively high rate of gain when food is available.
- Racing camels have a small head and ears; alert eyes; a fine and supple neck joined low on the trunk; long and fine shoulders; a very deep chest, well sprung ribs right to the back and terminating not far from the pelvic bone. The legs are straight with fairly close forelegs, straight and well-spaced hind legs, well-muscled quarters, medium sized feet, supple skin, easy and tireless pace.

Classification of camels in Kenya

- There are not too many ‘’breeds’’ or local types which are distinguished from others by particular characteristics. Size, build, colour and productive traits differ widely within herds but also within tribal, ecological, geographical or political boundaries
- The camels are mainly classified according to the communities that keep them and they are mainly Somali, Rendille/Gabbra and Turkana. Crossbreeding is common and this makes it very difficult to distinguish separate breeds.

The Somali breed

The camels are primarily owned by Somali peoples of North-Eastern parts of the country. The breeds are larger than other breeds found in the country. Adult females average 550-600kg while adult males avarage 600-700kg. Birth weights average 30-35kg. Camel owners claim the breed

requires more feed than other breeds and prefer browsing although they do graze grass in certain areas in certain seasons. They are often restricted to weekly watering during dry periods. They have a higher centre of gravity and more at home on flat sandy areas than rocky hills

Camel nutrition

The nutrition of the camel is fundamental to production of milk, meat, hides and hair. However, the camel is continuously being introduced in non-camel keeping areas hence the need to know more about camel nutrition.

Feeding habits of the camel

The camel lives in rangelands where plants struggle to survive. The plants in these harsh conditions have developed one or more of the following characteristics for survival:

- Annuals - which rapidly flower, produce seed and die out?
- Deciduous woody perennials.
- Evergreen woody perennials with cuticular layers to reduce evaporation.
- Succulents.
- Many of the plants have features that protect them against browsers. The camel is a facultative browser preferring leafy, dwarf shrubs if available.

Camels mainly feed on trees (25%), dwarf srubs (50%), herbs (14%) and grasses (11%). From these figures, it is clear that camels feed over a considerable height range - approximately from ground level to 3.5 meters. This gives them an advantage over other livestock. The next best being the goat which can stand on its hind legs and reach up to 2 meters.

In Northern Kenya camels prefer to browse on dwarf shrubs, their favourite plant being Indigofera spinosa, which is a legume occurring extensively in the drier eco-zones and far South in the Tanzanian Rift Valley.

Perennial woody plants comprise three quarters of the camel's diet, the remainder being herbs and annual grasses. Since there is considerable variation in structure and composition of the vegetation in different range types, camels also exhibit differences in their food habits.

Trees in some areas are deciduous, dropping their leaves in dry seasons when they contribute less than 5% of their diet while annual grasses may increase to 33%.

Generally, herbs are used in the few months when they are green, during and following rainy seasons. Annual grasses are eaten in the dry season in the form of standing hay. Perennial grasses

however are preferred by cattle but generally avoided by camels since they have a high fibre content, low digestibility and nutritive value. Camels require high mineral intake and prefer halophytic (salt loving) shrubs such as Suaeda monoica, Salsola dendrides and Salvadora persica.

Key browse plants in camel diet		
	Species	**Type**
1	Acacia brevispica	Deciduous tree
2	Acacia mellifera	Deciduous tree
3	A. Nilotica	Deciduous tree
4	Balanites glabra	Evergreen tree
5	Grewia similes	Deciduous shrub
6	Baleria proxima	Dwarf shrub
7	Barleria acanthoides	Dwarf shrub
8	Delosperma remophilum	Dwarf shrub
9	Heliotropium album hispidum	Dwarf shrub
10	Indigofera cliffordiana	Dwarf shrub
11	Indigofera spinosa	Dwarf shrub

Feed Intake by camels

- Camels can consume 1.67% of their weight daily, goats 2.58%, sheep 2.63% and cattle 3.27%. It is possible to calculate daily dry matter intake (DMI) for each livestock category by multiplying these figures by actual mean live weights.
- This gives the following results: Camels 5.02 kg per day, cattle 5.39 kg per day, sheep 0.63kg per day and goats 0.64 kg per day. Apart from cattle, these figures are for animals on a maintenance diet, but not lactating or growing.
- To allow for production the DMI calculations should be increased by 10% for camels and small stock, giving 5.52 kg per day for camels; 0.69 kg per day for goats and 0.07 kg per day for sheep. While cattle DMI remains at 5.39 kg per day.
- In some circumstances when camel browse is insufficient or not available, it may be necessary to feed them from external sources. They may not easily accept feeds that are new to them, and therefore they must be induced to accept that which they are not accustomed to.
- Some common feeds that can be availed to camels are:

- Nearly all cut green feed such as maize, millet, sorghum, legumes, grass and lopping from trees and branches are excellent fodder.
- Dry stover, straw, hay, legume stalks, pods, dried leaves of bushes and trees are eaten but need supplementing
- Grains, beans and grams are usually the main supplementary feeds. These should be gristed before feeding

Water requirements

Camels have remarkable mechanisms for conserving water. Their urine can carry excess salts in very high concentration, thereby losing very little water

Watering Intervals

- One question that is always asked is "How long can a camel go without water? There is no simple answer. With other livestock one can approximate at most 3 to 4 days without serious consequences. With camels there are many factors involved such as:
- The camel itself, if used to frequent drinking, needs to become accustomed to longer periods without water
- The succulence and availability of the feed
- The air temperature
- The amount of hard exertion required of the camel

Camel milk

- Camels produce milk even during long droughts when other animals cease to produce. It is widely recognized that in absolute terms the camel produces more milk and for a longer period of time than other species maintained in the same environment.
- In East Africa where 60% of the world's camel population is kept, the consumption of camel milk is not limited just to the pastoral needs, but is also commercialized and sold in urban areas.

Milking process

- Varies according to the different pastoral groups
- May be milked once or several times in a day
- Most nomadic tribes milk their camels in the early morning before animals are taken to grazing and at night when they return from grazing

- Before milking, the calf is allowed to suckle until the milk is flowing and then the camel can be milked.
- Without this simulation, the dam cannot be milked
- The milker stands on one leg, puts the milk pot on the upper part of the leg and milks with one or two hands
- Sometimes milking may be done by two persons, each milking two teats
- To prevent calves from suckling while at pasture, it is a usual practice to tie up one or more teats with special strings

Milk yields and lactation length

- It is difficult to estimate the daily milk yield of the camel under pastoral conditions owing to inconsistency of milking frequency. Milk yields also varies with species, breed, stage of lactation, feeding and management conditions
- The length of lactation can vary from 9-18 months
- It mainly depends on the husbandry practices, which are largely determined by the need for milk
- More of milk is required in the dry months than in the wet months when other sources of food are available

Milk quality

- Camel milk is generally opaque white.
- It has a sweet and sharp taste, but sometimes it is salty
- The taste depends on the type of fodder and availability of drinking water.
- Compared to cow milk camel milk sours very slowly and can be kept longer without refrigeration
- The first milk, the colostrum, is white and slightly diluted as compared with the colostrum of cow milk.
- In Somalia, the colostrum (dambar) is used as a laxative
- Due to its immunological properties colostrum is essential for the new born calves
- However, some pastoral groups consider it unsuitable even for the calves and milk it on the ground
- Camels are known to produce diluted milk in hot weather when water is scarce

The documented and published milk yields for camels in Kenya shows that theyare lower than the range in other countries because

- Camels in Kenya are kept in the marginal areas and receive no feed supplement
- Management levels are low
- There is little or no disease control
- Camels have been kept for subsistence rather than commercial purposes; hence there has been little quality control. Quantity rather than quality of animals are kept.

Major factors that affect camel milk yields include:

- Forage – Quantity and quality
- Watering frequency
- Climate
- Breed
- Milking frequency
- Calf survival and presence of the calf
- Milking method – hand or machine milking
- Speed of milking
- Health status
- Reproductive status

What is clean milk?

- Clean milk can be defined as: “Milk drawn from the udder of healthy animals, collected in a clean dry container and free from extraneous materials like dust, dirt, flies, manure etc.
- Clean milk has a normal composition, possesses a natural milk flavour with low bacterial count, free from toxins and is safe for human consumption. Milk is a high value source of nutrients. If milk is not produced hygienically it can affect the health of many people and can lead to substantial economic losses.
- Camels produce palatable and delicious milk and are an important factor in the capability of people to survive in arid regions.
- Care and management of the animal and its health is therefore the starting point for clean milk production.
- Milk from diseased animals should be kept separate and disposed of safely.
- Animals suffering from any contagious diseases, including mastitis should be separated from the healthy ones.

Milking practice

- The camels are generally milked in environments that are not ideal for milking. The milk hygiene and quality standards vary greatly depending on management and milking practices.
- Among pastoralists milking vessels are normally made from woven grass, wood fibre or skin. Disinfecting them is often difficult because the vessels are wide mouthed flies, dust and dirt may easily gain access during milking. When good milk is secreted from the udder, it is almost sterile. Contamination occurs at different levels. The employment of hygienic practices at the time of milking is therefore one of the first and most important steps in clean milk production.
- The skin of the udder should be dry and clean from dung and other sources of contamination. The udder is the part of the animal nearest to the milk and should therefore be clean and dry.
- A good milking routine prevents contamination of the milk. The calf should be allowed to suckle at the beginning of the milking to help milk let-down. Gentle milking is an important aspect of good milking practices.
- Potential sources of contamination of milk are dung, water, utensils, soil, feed, the animal and the milker.
- When hand milking the camels, the danger of contamination from the milker is high. The milker should therefore be free from contagious diseases. Nails should be well trimmed; and should wash hands with soap and water before milking, then dry hands with a clean piece of cloth if possible.
- A good milking practice is to milk sick animals last. During milking, foremilk should be examined and abnormal milk should be discarded. The milker should not wipe their hands on the body of the animals or on their own body.
- Dirty milking containers are one of the main sources of infection of milk. It should be rinsed with water. In this way, dust and other contamination will be removed
- The practice of smoking the vessels used for the storage of milk is a common feature of the various camels herding communities. The treatment has the functions of passing the smoke flavour to the milk or milk product and disinfecting (sterilising) the vessel. Among the plants used in smoking of vessels are Olea Africana, Balanites aegyptiaca, Diplorhynchus condylocarpon, and Combretum spp.
- After cleaning and sanitation, the utensils should be stored properly to prevent contamination from flies, insects, dust, dirt etc. They should be stored in an inverted position off the ground to drain off the water.

Poor management and unhygienic milking practices:

- A bad milking practice is for example dipping fingers into the milk as a means of lubricating the teats during milking.
- Poor management and unhygienic milking practices prevalent in the traditional husbandry systems include tying the teats with soft barks to prevent the calf from suckling and cauterization of the udder skin.
- The udder is the one of the sites of choice for tick infestation and is usually infested with ticks. A good practice is to remove ticks even when the animal is dry. Tick infestation causes skin lesions that can facilitate bacterial infection.
- Teat canal blockage with dilatation of the gland is a commonly observed problem in dromedaries. The result could be traumatic lesions and lacerations.
- It is therefore cheaper and easier to prevent mastitis by improving hygienic measures than to treat by medication. The cost of the latter includes veterinary fee, cost of medicine (risk of misuse) and loss of milk production.
- Economics of Clean Milk Production: How to deal with needed, but unhygienic milk
- This is by no means an easy question to answer: Milk is mostly consumed within hours of production and standards for clean milk production reflect the local conditions and how badly milk is needed.
- Boiling of camel milk is rarely practised in the field. With increasing time between milking and consumption, improvement of hygienic measures is required.
- It is best to filter the milk with a clean cloth in order to remove large particles that might have entered the milk. The cloth should be thoroughly washed after use and left to dry in the sun.
- Milk should be stored in clean containers with a lid and kept in a cool and shady place where the danger of contamination is minimal. Milk should be transported in clean vessels.
- Clean milk production should be financially rewarded as an incentive (as an encouragement for producers) for improved hygiene.
- Improved Support Services Necessary for Clean Milk Production in The Future
- An effective and well-trained animal health service and supervision by qualified veterinarians is essential for improving regular healthcare and combating contagious diseases.
- To avoid spoilage, milk collection centres accessible to the producers will be an encouraging initiative.
- Milk producer's cooperatives could facilitate processing, manufacturing of by-products and marketing to maximise returns to the producer.
- In many camel countries, knowledge of hygiene is often not sufficient. An important support- services regarding clean milk production is education and extension. The aim of

this service should be to raise the awareness among the milk producers towards clean milk production and animal health care. These services should be organized at the community level. Women should be given opportunities for training as women mainly do the marketing.