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Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya

Training Manual

2.4.1 SUB-MODULE 1: LIVESTOCK BREEDS

CHARACTERISTICS Livestock breeds and breed characteristics

There are five exotic dairy cattle breeds commonly reared. These were initially imported from Europe but overtime have been adapted to the local environment and through crossing contain some local blood of Zebu ecotypes. These are mainly used to produce milk under various production systems ranging from intensive zero grazing, semi- intensive and the extensive dairy production systems. The common breed types are Friesian, Ayrshire, Guernsey and Jersey which are mainly kept in the highlands of Kenya but through crossing and adaptation some of these breeds have been pushed to the semi-arid areas where they are used for milk production.

Common dairy cattle breeds in Kenya

Friesian dairy cattle

Physical description: Coat colour predominantly black and white with a characteristic white triangular patch on the forehead and white socks from the knee joint to the hooves. (Table 2.17)

Table 2.17. Friesian breed characteristic

Physical description	Coat colour	Predominantly black and white There is a strain of brown and white called Red and white Friesian Characteristic white triangular patch on the forehead, Predominant white socks from the knee joint to the hooves on all four legs
	Coat hair	Short, fine and smooth
	Pigmentation	Black and pink
	Height at withers	Range from 1.5-1.8 m
	Horns	Short horned Polled
	Shape of ears	Variable with prick ears of moderate size
Production	Milk	Lactation milk production of between 3,000kg to 8,000kgs Milk fats range 3.1-3.5% Milk protein range 3.3-3.6%
Reproduction	Weight	Average mature live body weight range from 550-650kg. Higher bone: muscle ratio
	Fertility	75%

Table 2.17. Friesian breed characteristic		
	Age at attaining mature weight	15-18 months
	Age at first artificial insemination (A.I.) service	15-18 months
	Age at first calving	24-32 months
	Calving interval	15-24 months
	Number of parities	6-12

Friesian cattle

Ayrshire dairy cattle

Physical description: Coat colour brown and white patches in almost equal amounts with some cows tending to dark mahogany colour (Table 2.18).

Table 2.18. Ayrshire dairy breed characteristics		
Physical description	Coat colour	Brown and white patches in almost equal amounts with some cows tending to dark mahogany colour
	Coat hair	Shinny Short and fine
	Pigmentation	Black to pink
	Height at withers	1.4 – 1.6m
	Horns	Mostly short-horned Few Polled
	Shape of ears	Horizontal or semi-pendulous
	Face	Straight

Table 2.18. Ayrshire dairy breed characteristics		
Production	Milk	In 305 days milk yield (MY) is from 3,000 – 6,000kg Daily MY 8 – 15kgs Fat from 3.8 - 4.5% Protein from 3.8 – 4.3%
	Weight and height	Mature live weight of 380 – 520kg with good finishing upon retiring from lactation Strong loins, long stooping from hip to pin bones Good spring of ribs and deep body capacity
Reproduction	Fertility	Above 85%
	Age at attaining mature weight Age at first A.I. service	15 – 20 months 15 – 24 months
	Age at first calving	24 – 30 months
	Calving interval Number of parities	12- 20 months 6 – 12

Mature Kenyan Ayrshire cows at an exhibition

Guernsey dairy breed

Physical description: Coat color Fawn brown to yellow to reddish-brown with white patches (Table 2.19).

Table 2.19. Guernsy dairy breed characteristics		
Physical description	Coat colour	Fawn brown to yellow to reddish-brown with white patches
	Coat hair	Shinny short and fine
	Pigmentation	Pink
	Height at withers	1.3-1.5m
	Horns	Mostly short-horned Few Polled
	Shape of ears	Horizontal or semi-pendulous
	Face	Concave
Production	Milk	305 MY from 2,000-5,000kg Daily MY 10-18kgs Fat from 4.2-4.6% Protein from 3.8-4.3%
	Weight and height	Mature live weight of 320-500 and 500-700 kg females and males respectively Weaning weight: 50-100 kg
Reproduction	Fertility	Above 80%
	Age at attaining mature weight	14-18 months
	Age at first A.I service	13-18 months
	Age at first calving	22-27 months
	Calving interval	12-18 months
	Number of parities	5-10

Mature Guernsey cow

Jersey dairy cattle

Table 2.20 presents the characteristics of Jersey dairy cattle

Table 2.20. Jersey dairy breed characteristics

Physical description	Coat colour	Kenyan Jersey are typically light brown in colour, though this can range from being almost grey to dull black
	Coat hair	Shinny short and fine
	Pigmentation	Black nose and almost white muzzle
	Height at withers	1.3-1.5m
	Horns	Mostly short-horned
	Shape of ears	Horizontal and straight
	Face	Concave with protruding eyes
Production	Milk	305 MY from 2,000-4,000kg Daily MY 10-15 kg Fat from 5.0-6.5% Protein from 3.8-4.5%
	Weight and height	Mature live weight of 250-350 and 350-400kg females and males respectively Weaning weight: 50-90kgs
Reproduction	Fertility	Above 85%
	Age at attaining mature weight	14-18 months
	Age at first A.I service	12-18 months
	Age at first calving	21-27 months
	Calving interval	12-18 months
	Number of parities	10-15

Mature Kenyan Jersey cow

Beef cattle breeds

There are several beef breed types comprising of crosses of local beef ecotypes with the exotics and there are locally adapted cattle produced from the pastoral production system. Most of the crosses are eventually finished through feedloting while some locally improved breed types are produced from the ranching production system. Surplus dairy male cattle also end up in the beef value chain. Some of the indigenous crosses of Boran, Sahiwal, and East African Zebu have been crossed with Friesian, Angus, Ayrshire and Charolaise to produce terminal beef crosses for finishing in the feedlot. The Boran comprises of the improved Boran, Orma Boran and the North Frontier District (NFD) Boran which is native to northern Kenya and Southern Ethiopia and from which the improved Kenya Boran that was developed and is a prime beef breed for the region. The Sahiwal which originally came from Pakistan has been adapted as a dual purpose animal that produces substantive amount of milk during the dry season and also produces good quality meat. The key improved beef breeds improved are presented in Tables 2.21-2.26

Kenya Boran

Table 2.21. Kenya Boran breed characteristics		
Physical description	Conformation	The Boran is medium in size with a short head, loose dewlap, short strong legs and a large hump above the shoulders.
	Coat colour	Kenya Boran cattle are predominantly white, grey and various shades of brown. However other ranges of colour are acceptable except brindle and solid black.
	Coat hair	Fine short hair with loose and pliable skin which also has many sweat glands per unit area
	Pigmentation	dark pigmented
	Height at withers	They vary in height from 114-147 cm tall

Table 2.21. Kenya Boran breed characteristics		
	Horns	They can be horned or polled
	Size of ears	Small ears
Production	Average daily gain yearlings (kg/day) Average Weaning weight (kg)	0.8 kg 240 kg
	Mature weight of female (kg) Mature weight of bulls (kg)	Female being notably small weighing about 380 - 450kg Male grows to a large size weighing approximately 500 - 850 kg
	Carcass quality	Consistent good quality of meat better than other Zebu breeds for meat tenderness, carcass marbling and rib eye area.
Reproduction	Average age at puberty Calving rate (%) Calving Ease Age at first calving (months)	13 months 90% High 27 months
	Calf survival rate (% per year) Calving interval (months)	 14 months
	Consumable meat (%)	

Boran cattle

Kenyan Sahiwal

Table 2.22 presents the characteristics of the Kenyan Sahiwal. This is a dual purpose breed that produces moderate amount of milk and has beef conformation. It is quite resistant to some ecto-parasites and thrives well and dried hay.

Table 2.22. Kenya Boran Breed Characteristics		
	Conformation	The Boran is medium in size with a short head, loose dewlap, short strong legs and a large hump above the shoulders.
	Coat colour	Kenya Boran cattle are predominantly white, grey and various shades of brown. However other ranges of colour are acceptable except brindle and solid black.
Physical description	Coat hair	Fine short hair with loose and pliable skin which also has many sweat glands per unit area
	Pigmentation	dark pigmented
	Height at withers	They vary in height from 114 - 147 cm tall
	Horns	They can be horned or polled
	Size of ears	Small ears
Production	Average daily gain yearlings (kg/ day)	0.8 kg
	Average Weaning weight (kg)	240 kg
	Mature weight of female (kg)	Female being notably small weighing about 380 - 450 kg
	Mature weight of bull (kg)	Male grows to a large size weighing approximately 500 - 850 kg
	Carcass quality	Consistent good quality of meat better than other Zebu breeds for meat tenderness, carcass marbling and rib eye area.
Reproduction	Average age at puberty Calving rate (%)	90%
	(%) Calving Ease	High
	Age at first calving (months)	months
	Calving interval (months)	months

Table 2.23. Kenyan Sahiwa breed characteristics		
	Variable	**Expression/ value**
Physical description	Conformation	The Sahiwals are heavily built with straight and long face, the brow slopes back to the poll and the line from brow to muzzle is straight and long. The hump is in the cervico-thoracic position.
	Coat colour	Reddish brown to chestnut
	Coat hair Skin pigmentation Height at withers, cm	Short, straight and smooth Pigmented, moderately thick, loose and pliable 132-148 cm for male and 124-138 cm for female
	Horns Shape of ears	Horns long drooping ears and set behind and level with the eyes.
Production	Average daily gain yearlings (g/day) Weaning weight (kg) Body weight at 12 months of age (kg)	490 160-180 205
	Average Mature weight of females (kg) Average Mature weight of bulls (kg)	425 500
	Carcass quality	Lean meat with even good marbling
Reproduction	Average age at puberty Calving rate (%) Calving Ease	30 months 93 High
	Age at first calving (months) Calf survival rate (% per year) Calving interval (months)	39 96 441 days
	Fertility (%)	89
	Average milk daily yield (Kg) Butter fat % Consumable meat (%)	1574kg in 293 days 3.5-5.3

Kenyan Sahiwal breed

Indigenous cattle breeds (Small East African Zebu)

Indigenous cattle population in Kenya is dominated by short-horned zebu types with thoracic hump. These cattle are distributed throughout the country and have developed adaptive features and characteristics through selection under varied environmental conditions. The Small East African Zebu (SEAZ) which are believed to have originated from Asia, are further categorized in various groups mainly based on communities that keep them as well as the geographical location and or production environments in which they are found. They are mostly found in pastoral communities within low input production systems and are of varied coloration and morphology due to the broad environmental adaptation. Among some of the common examples are the Maasai, Kamba, Kikuyu, Taita, Nandi, Turkana, Teso, Kavirondo and Jidu Zebu amongst others. However, most of these traditional ecotypes have become extinct due to extensive cross breeding with exotics and only traces of their crosses are commonly found. Common breed characteristics are as represented below.

Maasai Zebu

Maasai Zebu is predominantly found in southern Kenya extending to north-east Tanzania with close association with the Maasai community. Comparatively, it is the largest of all SEAZ types. It is mainly kept for milk and only slaughtered during special social ceremonies. Table 2,23 presents the characteristics of this zebu.

Table 2.23. Maasai Zebu breed characteristics		
Physical description	Coat colour	The type exhibits varied coat colour and conformation but black and white patterns are predominantly evident
	Coat hair	Short, fine, shiny and smooth
	Pigmentation	Black
	Height at withers (cm)	Females: 110-135
		Males: 118-140
	Horns	Short horned while some are polled
	Ear orientation	Lateral
Production	Milk (kg/day)	1-2
	Mature live body Weight (kg)	Females: 275-385
		Males: 300-445
Reproduction	Fertility	Above 87%
	Age (months) at attaining mature weight	24-36
	Age at first service (months)	30-36
	Age at first calving (months)	36-45

Kamasia/Samburu Zebu

Kamasia Zebu is predominantly found in central Kenya plains within Samburu County. It has long been kept by the Samburu community. Few populations are also found in Laikipia and Baringo Counties. It has a cervical-thoracic hump. Tolerant to tick-borne diseases, drought and can walk long distances in search of water and pasture. Mainly kept for milk and meat. Thable 2.24 presents the characteristics of this cattle.

Table 2.24. Kamasia/Samburu Zebu breed characteristics		
Physical description	Coat colour	Varied with red/brown being predominant in most of the herds with spotted patterns
	Coat hair	Short, fine, shiny and smooth
	Pigmentation	Black and/or brown
	Horns	Short horned while some are polled
	Ear orientation	Drooping
Production	Milk (kg/day)	1-1.5

Table 2.24. Kamasia/Samburu Zebu breed characteristics		
	Mature live body weight (kg)	Females: 120-200
		Males: 150-250
Reproduction	Fertility	Above 80%
	Age at attaining mature weight (months)	24-36
	Age at first service (months)	36-48
	Age at first calving (months)	30-36

Winam or Kavirondo Zebu

Winam Zebu is mainly found in western Kenya in the lowlands of the Lake Victoria basin, kept by the Luo and Luhya communities. It is comparatively the smallest of all SEAZ with varied horn shapes, sizes and orientation (Table 2.25). There is a notable variance in hump size and position. It is tolerant to tick-borne diseases and helminthes and kept mainly for draft (tillage), milk and cultural use e.g. in ceremonies.

Table 2.25. Winam or Kavirondo Zebu breed characteristics		
Physical description	Coat colour	Predominant black and white colour
	Coat hair	Short, fine, shiny and smooth
	Pigmentation	Black or brown
	Height at withers (cm)	Females: 94-125
		Males: 195-365
	Horns	Short horned while some are polled
	Ear orientation	Lateral and medium size
Production	Milk (kg/day)	2-3
	Mature live body Weight (kg)	Females: 215-419
		Males: 200-365
Reproduction	Fertility	Varied for different reasons
	Age at attaining mature weight (months)	18-24
	Age at first service (months)	24-30
	Age at first calving (months)	32-40

Nandi Zebu

Nandi Zebu is predominantly found in north rift region, with the Nandi community. The breed is endangered due breed replacement, upgrading and crossbreeding. It is small in size and fine-boned. It has a thoracic hump varying in size and shape with round front and back. The hump is prominent in bulls and hangs backwards. The Nandi Zebu is the dairy type of the SEAZ, comparatively producing more milk than other zebu types. It has moderately developed udders with small closely placed teats.

Table 2.26. Nandi Zebu breed characteristics

Physical description	Coat colour	Variable, but many animals are plain black, red, brown or grey
	Coat hair	Short, fine, shiny and smooth
	Pigmentation	Black
	Height at withers (cm)	Females (Av): 152.7
		Males (Av): 162.3
	Horns	Short horned
		Some polled
	Ear orientation	lateral and medium sized
Production	Milk (kg/day)	2-3
	Mature live body Weight (kg)	Females: 200-320
		Males: 215-420
Reproduction	Fertility	
	Age at attaining mature weight (months)	18-24
	Age at first service (months)	24-30
	Age at first calving (months)	32-40

Feedlots in Kenya

Predominantly, beef farming in Kenya is pasture fed on communal lands and private ranches. New challenges of climate change and rising costs of commercial feed require modern solutions of raising and selling cattle for beef. They include raising premium beef cattle on small farms or cattle finishing and fattening in feedlots as well as value addition of beef products.

In beef, the industry there is need for an adequate fat cover on the carcass which is essential for successful marketing of beef. Cattle produced in the rangelands are normally undernourished resulting in lean meat.

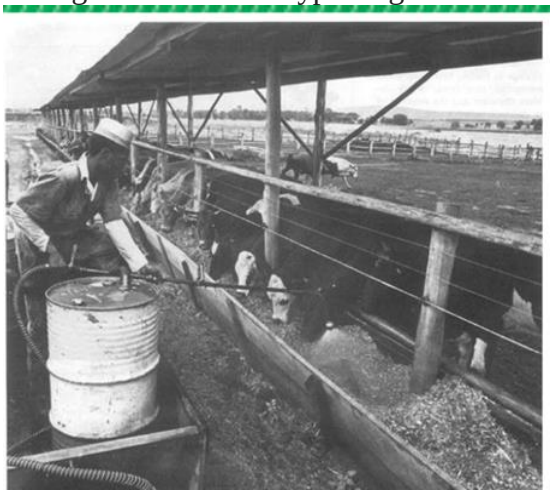
Good beef requires to have a fat content of at least 9% to produce well-marbled beef that can also qualify for canning.

It is well known that there are two factors which affect the amount of fat in carcass: the level of nutrition and the age of the animal. At a low level of nutrition, an animal grows only bone and muscle. However, after maturity, when growth stops, fat may be laid down. When fat is laid down at this stage of maturity it tends to be an energy store and it grows in large blobs over the back and in the pelvic channel. With a sufficiently high levels of nutrition, however, a young animal can be induced to lay down fat as well as to grow. When this happens the distribution of fat is much more even: it lies as a thin envelope over the entire carcass — which is just what the export market requires. Thus, the whole rationale of the feedlot system is a method of preparing the live animal produced from the range so that at slaughter, its carcass has the correct quality specifications to meet market requirements.

The production of beef then becomes a three-stage process of calf production, growth and finishing. Finishing in a feedlot instead of on the pasture allows for specialization in calf production and in growth on the range. The ease with which ranchers can finish cattle on the range depends upon the type of range, the quality of forage and the stocking rate used. Most cattle finishing programs in Kenya are mainly finished in three or four months when they are fed high concentrate diets comprising protein and energy while confined (feedlot) so as not to lose energy while walking long distances.

Feedlot finishing of pastoral cattle

Trials carried out in Kenya by the Beef Industry Development Project showed that all of the cattle breeds and crossbreds available in Kenya responded well to feedlot finishing. The common breeds for feedlot finishing are the Boran and the indigenous Zebu ecotypes together with their crosses with exotic breeds.



Molasses being sprayed onto the feed concentrate at the feedlot

Because of disease control limitations, cattle are brought into the feedlots after being tested and treated for diseases and vaccinated e.g. against foot-and-mouth disease. They are quarantined for one month before they are transferred to the feedlot for final finishing for 3 months while on high quality ration. The steers can gain one kilogramme daily and also begin to finish by laying down a layer of fat. As explained earlier, this increases the market value of the meat. It is this increase in grade and the live-weight gain of the animals which makes the feedlot an economic undertaking. Using unimproved pastoral cattle on the range, it is possible to profitably increase the yield of edible carcass from one animal by between 30 and 50% in the feedlot.

Results Obtained in the Feedlot

Some observations to define the input/output relationships of feeding beef cattle under commercial conditions, which involves characterizing the response of the various breeds tested under Kenyan conditions are as follows:

- Improved Boran (from commercial ranches)
- Large crossbreds (e.g., Friesians, Simmental or Charolais × Boran)
- Small crossbreds (e.g., Hereford or Angus × Boran)
- Unimproved (or North Eastern Province) Boran

Trials were done to characterize the responses of these cattle to different rations and feeding periods, and to determine what type of ration and for how long each class of steer should be fed.

The broad design of the was as follows:

4 Breeds	-	as mentioned above
×		
2 Rations	-	high energy/high roughage
×		
2 Periods	-	10 weeks/16 weeks

Thus 50 head of each of the four breeds were fed on a high energy ration and 50 head on a high roughage ration.

After 10 weeks, half of each group was slaughtered and the remaining half continued on feed for a further 6 weeks.

The first of the trials included Friesian × Boran and Hereford or Red Poll × Boran were taken as representative of a large and a small crossbred, respectively (Table X). The following rations were used:
High energy - 67% concentrate/33% roughage

High roughage - 33%concentrate/67%roughage

Summary results of breeds feeding trial

Cattle when entering the feedlot [redacted]

Cattle after 70 days' feeding [redacted]

Breed	North Eastern Boran	Improved Boran	Friesian cross	Hereford cross	North Eastern Boran	Improved Boran	Friesian cross	Hereford cross
High energy	*10 weeks*				*16 weeks*			
Average daily gain (*grams*)[1]	1 023	1 303	1 384	1 378	993	1 260	1 388	1 384
kg feed/kg gain[2]	8.1	6.9	6.7	6.7	8.7	7.4	7.1	7.2
Grade score[3]	4.54	4.57	4.26	4.67	4.38	4.83	4.65	4.96
Dressing percentage[4]	51.2	51.1	50.7	49.2	52.9	52.4	52.7	52.1
High roughage	*10 weeks*				*16 weeks*			
Average daily gain (*grams*)	815	890	868	795	883	1 098	1 060	1 047
kg feed/kg gain	10.1	9.1	9.6	10.5	9.5	7.9	7.9	9.1
Grade scores	4.60	4.64	3.84	4.56	4.24	4.68	4.38	4.67
Dressing percentage	50.0	50.3	48.5	49.2	51.7	52.0	50.9	51.3

Based on carcass weight and a standard 51% dressing.

2 Feed expressed on a dry matter basis.

3 6 = Prime, 5 = Choice, 4 = FAQ, etc. (Prime is the highest grade).

4 Based on unfed farm weights.

5 Daily added value minus daily feed and nonfeed costs (including interest and mortality) 6 Feed Costs per kg weight gain to be considered

Improved Boran steer after 70 days' feeding

Both rations were made from standard ingredients and their composition is shown in table.

What do these results mean to the beef producer in Kenya?

The results can only be used to show the potential for feedlot finishing of Cattle in Kenya. They may interest investors in setting up feeding facilities. The real benefits can be realized when the feeding capacity is up scaled e.g. to more 5000 heads of cattle a year or per session or lot. When this happens, new opportunities will present themselves to producers. Movement of cattle will become more commonplace, and the producer will have a better opportunity to sell immature cattle at a fair price. Equally, investment in feedlots will underpin investments in abattoir construction and live animal marketing facilities. Both of these sectors can only operate effectively when a sufficient volume of business can be guaranteed to cater for overhead costs. The net result is creation of employment and wealth.

PERCENT OF RATION COMPOSITION (ON A 100 PERCENT DRY MATTER BASIS)

	High energy	High roughage
	Percent	
Sorghum grain	52.8	20.6
Sorghum silage	33.4	66.8
4 percent urea molasses	11.1	9.9
Cottonseed cake	2.7	2.7
Total	100.0	100.0
Cost (*in U.S. cents per kg dry matter*)	3.1	3.7

Perhaps one of the most interesting aspects of the results was the performance of the various breeds and crosses. The indigenous Boran appears ideally suited to finishing because its turnover was rapid and the total quantity of maize needed to finish an animal was relatively small. On the other hand, the crossbred do give better carcass when there is grain surplus - when feed costs are cheap- they would become comparatively more attractive to finish than the Boran. It is predictable that the crossbreds will become more important in the future; but for today the cattle which are present in the greatest numbers, and which are fully adapted to the conditions of the country, form the best basis for starting cattle feedlot industry.

GOAT BREEDS

Meat Goats

Small East African Goat

Small East African goat (SEAG) is a diverse group of goats (Tables 2.27-2.32) with variable type, conformation and size of body. It is distributed throughout a wide and diverse range of environments in Kenya, Tanzania, Uganda and southwards through central Africa as far as Zaire, Angola and the north of Namibia. It is adapted to ASALs. The SEAG is known by different local names e.g. East African Dwarf, Sebei, Karamoja, Tanzania, and Zambian types. The breed group belongs to the group of short-eared and small-horned goats. They are hardy animals generally used for meat rather than milk. Table 2,27 presents the general characteristics of SEAG.

Small East African Goat

Table 2.27. Small East African Goat breed characteristics		
	Variable	Expression/ value
Physical description	Coat colour	Variable in colour type and pattern, ranging from pure white to black
	Coat hair	Short, fine and smooth
	Skin pigmentation	Black
	Height at withers, cm	60
	Horns	Horned Polled
	Shape of ears	Variable with prick ears of moderate size
Production	Average daily gain yearlings (g/day)	67
	Weaning weight (kg)	8.7
	Body weight at 12 months of age (kg)	15.8
	Mature weight of does (kg)	32
	Mature weight of bucks (kg)	36
Reproduction	Average milk daily yield (g/day)	500
	Age of doe at first kidding (months)	20
	Doe survival rate (% per year)	88.5
	Post-weaning survival rate (%)	89

Table 2.27. Small East African Goat breed characteristics		
	Fertility (%) (number of parturitions per annum)	89
	Twining rate Kidding interval (months) Consumable meat (%)(Consumable meat output as a percentage of live weight at slaughter)	High 9 65

Galla Goat

The Galla goat originated from Arabia and it is widely distributed in ASALs of Kenya, Ethiopia, Djibout, Eritrea and Somalia. It is mostly reared by Somali, Borana, Rendille, Gabra, and Oromia communities under extensive and semi- intensive pastoral to agro-pastoral, production system. This goat inhibits wide and diverse range of environments. Galla goat is utilized by these communities for milk, meat, skin, manure, socio-cultural/ collateral uses. In the regions where it is reared it is also known by other names such as Larger-White-Somali, Digodi, Marebo, Boran Somali, Benadir and Gigwain. The breed has two sub-types known as Degyir and Degeun. Degyir. Degeun are coloured around the head and lower legs with a black stripe along the spine. This is a meat goat but there are some milk variants that produce milk under pastoral production systems. Table 2.28 summarises the characteristics of this type of goats.

Galla goat

Table 2.28. Galla Goat breed characteristics		
Galla Goat	**Variable**	**Expression/ value**
Physical description	Coat colour	Predominantly white
	Coat hair	Short, fine and smooth
	Skin pigmentation	Black
	Height at withers	Buck 70-75 cm Doe 60 cm
	Horns	Horned Polled
	Shape of ears	Horizontal or semi-pendulous
	Face	Straight
Production	Birth weight (kg)	3.0-3.5
	Weaning weight (kg)	18.0-24.0
	Body weight at 12 months of age (kg)	28.0-32.0
	Mature weight of does (kg)	45-55
	Mature weight of bucks (kg)	70
	Average milk daily yield (g/day)	1 Litre
Reproduction	Age of doe at first kidding (months)	20
	Doe survival rate (% per year)	
	Post-weaning survival rate (%)	99
	Fertility (%) (number of parturitions per annum)	75
	Twining rate	Low
	Kidding interval (months)	9
	Consumable meat (%)(Consumable meat output as a percentage of live weight at slaughter)	54-60

Boer Goat

This is a medium sized breed for meat. It is characterized by white body and red head and neck. White patches can be found on the forehead, face and ridge of the nose. Completely white or red Boer are not un-common. It is a native of South Africa and the name Boer means farmer in Afrikaan. Boer goats have large drooping ears and the muzzle resembles that one of sheep. Its fast growth rate, high meat proportion to body weight, high fertility and adaptability to diverse environments makes them popular and it is widespread to other countries apart from South Africa including; Namibia, Botswana, Zimbabwe, Kenya, India and America. It is reared in semi-intensive and extensive livestock systems. Table 2.29 presents the characteristics of this type of goat.

Boer goat

Table 2.29. Boer Goat breed characteristics		
	Variable	Expression/value
Physical description	Coat color	White bodies with distinct brown heads. Completely white or brown are also found. In some instances, white with brown spots or brown with white spots do occur.
	Coat hair	Short and smooth hair
	Skin pigmentation Height at withers: Buck	Brown
	Doe	
	Shape of ears Horns Birth weight	Long and pendulous Both sex horned
Production	Weaning weight	30-35
	Body weight at 12 months Weight of mature does Weight of mature buck	45-70 86-104 91-154
	Milk yield per day	
	% consumable meat relative to live weight	51
Reproduction	Age of doe at first kidding	10-12 months
	Fertility	High
	Twining	High

DAIRY GOATS

Alpine Goat

Alpine is a medium sized dairy goat. It originated from France and spread to the rest of the world. It is a popular dairy goat in Kenya due to its high milk production and adaptability to different climatic conditions. The breed is reared under intensive and sem-i intensive production system.

The breed was introduced in Kenya from Germany in the early 1980s in Nyeri, Murang'a, Kirinyaga, Embu and Kiambu. In Nakuru County, they are reared by farmers under the umbrella of Nakuru Sheep and Goats Breeders Association. After several years of breeding, a Kenya Alpine has been registered. Table 2.30 presents its key features.

Table 2.30. Alpine Goat breed characteristics

	Variable	**Expression/value**
Physical description	Coat color	Mainly gray, brown or black
	Coat hair	Short, fine and smooth with pronounced mane at the back
	Skin pigment	Black
	Height at withers: buck	80-90
	Height at withers: ewes	70-76
	Horns	Horned or polled
	Shape of ears	Erect and medium
Production	Birth weight kg	2.0-3.5
	Weaning weight	15.0-18.0
	Body weight at 12 months	28.0-32.0
	Weight of mature does	50-60kg
	Weight of mature buck	70-76
	Milk yield per day	2.5-4 litres
Reproduction	Age of doe at first kidding	18-24 months

Saanen Goat

Saanen is a large dairy goat which originated from Germany and is spread in many countries. It is mainly found in highlands under intensive and semi intensive systems. The breed has been extensively crossbred with other dairy goats due its high milk production. The breed is prone to photo sensitivity and therefore it is not wide spread in the country. Table 2.31 summarises its key characteristics.

Saanen goat

Table 2.31. Saanen Goat breed characteristics

	Variable	Expression/value
Physical description	Coat colour	White or cream
	Coat hair	Short, fine and smooth
	Skin pigment	Pink
	Height at withers buck (cm)	81-92
	Doe	74-80
	Shape of ears	Erect and point upwards
	Horns	Horned or polled
Production	Birth weight	
	Weaning weight	
	Body weight at 12 months	
	Weight of mature does	50-70kg
	Weight of mature buck	70-100 kg
	Milk yield per day	3-5 ltrs
Reproduction	Age of doe at first kidding	20 months

Toggenburg Goat

The breed originated from Switzerland and spread to the rest of the world. It's suited to Kenya highlands where heat stress is not a problem and fodder is of good quality. The breed is reared under both intensive and semi intensive systems. Toggenburg goats have proved to be well adapted and large flocks are found in agro-pastoral areas of Kenya. Toggenburg goats are reared in large numbers in the following counties where it is currently promoted by breed associations after it was introduced by Farm-Africa in 1996; Meru (Meru Dairy Goat Breeders Association), Tharaka- Nithi (Tharaka Nithi Dairy Goat Breeders Association), Kitui (Kitui Mwingi Dairy Goats Breeders Association) and Makueni (Utheu wa Aka Women SHG, Kibwezi). In Nakuru County Toggenburg goats are also reared in some good numbers by farmers who formed Nakuru Sheep and Goats Breeders Association. Table 2.32 summarises the key attributes of this type of goat.

Toggenburg Goat breed characteristics

Table 2.32. Toggenburg Goat breed characteristics		
	Variable	**Expression/value**
Physical description	Coat color	Brown or grayish brown with distinct white stripes on the face and legs
	Coat hair	Short, fine and smooth
	Skin pigmentation	Brown
	Height (in cm) at withers	
	buck	81-92
	Doe	74-80
	Shape of ears	Erect

Table 2.32. Toggenburg Goat breed characteristics		
	Horns	Horned or polled
Production	Birth weight	2.2-2.5
	Weaning weight	15-18
	Body weight at 12 months	24-26
	Weight of mature does	70 kg
	Weight of mature buck	50 kg
	Milk yield per day	1-3ltrs
Reproduction	Age of doe at first kidding	20 months

INDIGENOUS SHEEP BREEDS

Somali sheep

The Somali sheep is a hairy sheep native to Somalia. The Somali sheep is the direct forebear of the Blackhead Persian. It is white with a black head. It belongs to the fat-tail type, and both of the breed's sexes are polled. They are mainly reared for meat, are fat ramped and mainly found in Somali, North Eastern Kenya and Sudan. They are hardy; the skin quality is higher than other indigenous hair sheep and is important for mutton production. This breed thrives well under harsh environmental conditions and has high potential for meat production. The breed characteristics are given in Table 2.33.

Blackheaded Somali

Table 2.33. Blackheaded Somali breed characteristics		
	Variable	**Expression/value**
Physical description	Coat color	White body and black head dominant can be patchy, pied or plain
	Coat hair/wool	Short smooth hair
	Skin pigmentation	Black
	Height at withers	Ram 61.3 cm Ewe 59.9 cm
	Shape of ears	Medium and drooping
	Horns	Polled
Production	Birth weight	1.5-1.8
	Weaning weight	10-12
	Body weight at 12 months	Ram
		Ewe
	Weight of mature ram	29.5 kg
	Weight of mature ewe	25.8 kg
	Consumable meat (%)(Consumable meat output as a percentage of live weight at slaughter	35--40
Reproduction	Age of ewe at first lambing	20-28 kg
	Age at puberty	Male 9-18 months Females 15-21 months
	Lambing interval	8-11 years
	Reproductive live span	7-11 years
	Life time lamb	Upto 10 lambs

Blackhead Persian

The Blackhead Persian sheep has its origins in the Blackheaded Somali. The breed was developed in South Africa and was a cross between the Somali sheep and the South African Boer sheep for the drier areas of South Africa but has spread to other parts of southern Africa and farther north, notably to Tanzania, Kenya, Ethiopia and even toGhana. It has also been introduced for crossbreeding purposes to the West Indies, and to Central and South America.

This breed is popular in the arid and semi-arid areas due to its hardiness and resilience. It is used for meat and fat (for cooking). It is mostly reared under extensive system by pastoral communities in the marginal areas of the country. Table 2.34 presents the key characteristics of this sheep.

Blackhead Persian

Table 2.34. Blackhead Persian breed characteristics

	Variable	**Expression/value**
Physical description	Coat color	White body and black head and neck
	Coat hair/wool	Short smooth kemp
	Skin pigmentation Height at withers	Black Ram Ewe
	Shape of ears	Long and pendulous
Production	Horns Birth weight Weaning weight Body weight at 12 months	Polled 2.4 – 2.7 kg 12.5 kg Ram 32 kg
	Weight of mature ram	Ewe 28.1 kg 68 – 70 kg
	Weight of mature ewe	50 - 52 kg
	Lactation period	84 days (Av. Yield 50 kg milk, 5.9 % fat)
	Consumable meat (%)(Consumable meat output as a percentage of live weight at slaughter	45 - 48

Table 2.34. Blackhead Persian breed characteristics		
Reproduction	Age of ewe at first lambing	18 – 24 months
	Age at puberty	Male Females
	Lambing interval	6 – 15 months
	Lambing %	60- 90
	Fertility rate % Fecundity % (Lambs born/Ewe present p.a) Reproductive live span	70.6 61
	Life time lamb Twining rate %	3.16 6.3

Merino Sheep

The Merino sheep is a native of Spain but it originated from sheep of Asia Minor through North Africa and has since spread to many parts of Africa including Kenya and is suited to medium and high altitudes under ranching and agro-pastoral management systems. The breed is adapted to high rainfall grassland regions and is reported to be less susceptible to fly strike because of their smooth body in comparison to sheep with skin folds.

It is found in the highlands under intensive and semi intensive condition. It is hardy and has excellent mothering ability. It is a medium breed kept for meat and wool. Table 2.35 presents its key characteristics.

Merino

Table 2.35. Merino breed characteristics

	Variable	Expression/value
Physical description	Coat color	White
	Coat hair/wool	Fine wool
	Skin pigmentation	Pale
	Height at withers	Ram 73-81 cm
		Ewe 67-70 cm
	Shape of ears	Medium and erect
	Horns	Horned or polled
Production	Birth weight	3.6-4.8 kg
	Weaning weight	28-30 kg
	Body weight at 12 months	Ram
		Ewe
	Weight of mature ram	80-105
	Weight of mature ewe	55-80
	Consumable meat (%)(Consumable meat output as a percentage of live weight at slaughter	36.8-38.5
	Wool weight (Ave)	3.9-4.5 kg
	Wool diameter	21-22 microns
	Wool (staple) length	8.9-9. 1 cm
	Wool texture	Fine
Reproduction	Age of ewe at first lambing	
	Lambing %	
	Fertility %	82-90.7
	Fecundity %	121.6
	Lamb survival %	81.2-88

Red Maasai

The Red Maasai is an East African fat-tailed sheep characterized by short reddish brown to almost black course hair. They are sheep of the semi-arid regions of Kenya and Tanzania, especially in Kajiado, Narok, Laikipia, Samburu and West Pokot Counties of Kenya and in Tanzania in Longido and Ngorogoro Districts in Arusha Region. Table 2.36 summarises its key characteristics.

Red Maasai

Table 2.36. Red Maasai breed characteristics		
	Variable	**Expression/value**
Physical description	Coat color	Red or black sometimes with white markings
	Coat hair/wool	Mottled or greasy hair
	Skin pigmentation	
	Height at withers	Ram 72 - 80cm Ewe 58 - 66cm
	Shape of ears	Long often drooping at an angle
	Horns	Male has twisted horns, females often lack horns
Production	Birth weight	2-3kg
	Lambing Interval	340 days
	Lambing rate %	80 – 84
	Weaning weight	15-20kg
	Av. DWG	128gm
	Body weight at 12 months	Ram 35-40
		Ewe 25-30
	Weight of mature ram	58-80kg
	Weight of mature ewe	45-70kg
	Consumable meat (%)(Consumable meat output as a percentage of live weight at slaughter	??

Table 2.36. Red Maasai breed characteristics		
	Milk yield per day	300ml
Reproduction	Age of ewe at first lambing	15 – 18 months
	Weaning rate	97%

Dorper

The Dorper sheep is a composite breed of South Africa developed at Grootfontein in 1940-1950 with good mutton qualities. It was developed through the crossing of the Blackhead Persian ewes with the Dorset Horn rams. The Dorper sheep thrive in arid to semi-tropical climate and are suitable for areas with rainfall of only 100 to 760 mm. The breed has been exported to many countries throughout the world including Namibia, Zimbabwe, Zambia, Kenya, Mauritius, Malawi, Burundi, Israel, Saudi Arabia, and Australia. Table 2.37 summarises the key characteristics of this nd of sheep. The Dorper sheep is a composite breed of South Africa developed at Grootfontein in 1940-1950 with good mutton qualities. It was developed through the crossing of the Blackhead Persian ewes with the Dorset Horn rams. The Dorper sheep thrive in arid to semi-tropical climate and are suitable for areas with rainfall of only 100 to 760 mm. The breed has been exported to many countries throughout the world including Namibia, Zimbabwe, Zambia, Kenya, Mauritius, Malawi, Burundi, Israel, Saudi Arabia, and Australia. Table 2.37 summarises the key characteristics of this and of sheep.

Dorper

Table 2.37. Dorper breed characteristics		
Physical description	**Variable** Coat color	**Expression/value** White body and black head
	Coat hair/wool	Kemp with short coarse wool
	Skin pigmentation	Black

Table 2.37. Dorper breed characteristics		
	Height at withers	Ram
		Ewe
	Shape of ears	Medium erect ears
	Horns	Male polled or with short horns, females polled
Production	Birth weight	3-4 kg
	Lambing Interval	8 months
	Lambing rate %	150-180
	Lamb survival %	90-96
	Fertility rate %	78-90
	Twining rate %	10
	Weaning weight	23-35 kg
	Av. DWG	243gm
	Body weight at 12 months	Male 40-50 Female 35-45
	Weight of mature ram	65-80
	Weight of mature ewe	55-65
	Consumable meat (%)(Consumable meat output as a percentage of live weight at slaughter	50-54
	Milk yield per day	
	Butter fat	5.5
Reproduction	Age of ewe at first lambing	12-15 months
	Weaning rate %	99-140

CAMELS

There are two main types of camels namely, the Bactrian camel (2 humps) and the Dromedary (one-humped) mainly found in the cold deserts of China and Mongolia, and hot deserts of Africa and the Middle East, respectively. They are mainly used for food by providing milk and meat and transport as a beast of burden. Camels can live for 40 years, but the productive lifespan is between 20 and 30 years. Different camel breeds are traditionally named after the ethnic communities who own and keep them. These are Somali, Rendille/Gabbra and Turkana breeds. Originally, they inhabited Garissa, Mandera, Wajir, Moyale, Marsabit, Turkana and Tana River counties. There is a third breed of camel called Pakistani which was imported from Pakistan into Laikipia ranches early 1990s. However, there is no pure Pakistan camels but exist crosses with Somali or Turkana breeds. Currently, Kenya has 6% of Africa's camel population with

camel density in most ASALs estimated at 3.1 camels per km2. Camel is the key contributor to food and nutritional security through milk and meat to human populations in ASALs. In addition, it contributes to sustainable socio-economic wellbeing through sales of live animals and its products, payment of dowries and acting as economic security. Among the pastoral community, it's an indicator of wealth, prestige and honor

Somali Camel

This is the breed with the highest camel population mainly inhabiting Garissa, Mandera, Wajir, Moyale, Isiolo and Tana River counties. It's mainly kept by the Somali community in the northeastern region of Kenya. It's also called Hoor, Sifta, Gelab and Aidimo depending on specific features of differentiation. Due to its comparatively better performance, it has been distributed to most ASAL environments in the county. Somali camel is known for high adaptability in hot and dry environments with a strong ability to walk for longer distances and going for a longer period without water in free range system of production. Its milk and meat are highly medicinal. Special products from camel include the nyir nyir (meat) and camel fat. Somali camel is the largest native single-humped breed. This and other camel breed characteristics are given in Tables 2.38-2.40. These Tables summarise the key characteristics of each camel types.

Somali camel

Table 2.38. Somali Camel breed characteristics		
Physical description	Coat colour	Creamy
	Coat hair	Short Males with dark brown hair line from withers to hump
	Average height at withers	2 m
	Average abdominal girth	2.6 m
	Average hump circumference	1.47 m

Table 2.38. Somali Camel breed characteristics		
Production	Meat	Average mature live weight from 450kg
	Milk	3-5 kgsper day Lactation length of 12-17 months
Reproduction	Age at first calving	4-5 years
	Average at calving interval	2.5 years

Rendille/Gabra breed

This is the second largest native camel breed. It's named after the Gabra and Rendille communities that inhibit the northern counties of Kenya, namely: Marsabit, Moyale and Samburu. The breed highly adapted to extreme rocky desert condition of Chelbi desert and can tolerate very severe drought than any other camel breed. The light coat colour makes able to thrive and withstand hot and dry environmental conditions.

Rendile/Gabbra camel

Table 2.39. Rendile/Gabbra Camel breed characteristics		
Physical description	Coat colour	Light creamy to whitish
	Coat hair	
	Average height at withers Average abdominal girth Average hump circumference	1.8 m 2.45 m 1.27 m
Production	Meat	Average mature live weight from 300-550kg

Table 2.39. Rendile/Gabbra Camel breed characteristics		
	Milk	1-3 kg per day Lactation length from 12-17 months
Reproduction	Age at first calving Average at calving interval	5-6 years 3 years

Turkana breed

This is the smallest camel breed in Kenya. It is named after the Turkana community that keeps it. It is native to eastern parts of the country specifically in Turkana County but also inhabits parts of West Pokot, Baringo and Samburu Counties. The breed is highly adapted to rough terrain and extreme drought. In addition to milk and meat, the Turkana community utilizes blood tapped from live animals for food for the young and elderly

Turkana breed

Table 2.40. Turkana breed characteristics		
Physical description	Coat colour	Dark brown hairs
	Coat hair	Long hairs along the backline and the hump
	Average height at withers	1.79 m
	Average abdominal girth	2.25 m
	Average hump circumference	1.21 m
Production	Meat	Average mature live weight from 250-500kg
	Milk	1-2.5 kg per day Lactation length from 12
Reproduction	Age at first calving Average at calving interval	5-6 years 3 years

INDIGENOUS CHICKEN

The indigenous chicken (IC) (*Gallus domesticus*) is found commonly within human settlement and comprises more than 80% of overall poultry populations in rural villages. They exhibit extensive phenotypic diversity due to varying environmental adaptation and low selection pressures. They have not been classified into breeds, but are ecotypes named according to their morphological features. The main types include; normal feathers, frizzled, naked neck, crested etc.

The IC plays a significant role in the economic and social life of resource- poor households, contributing to a cheap source of animal proteins and cash incomes. They are highly adapted to the harsh scavenging conditions limited and poor feed resources, disease and parasitic challenges.

Normal feathers

They are the most common type of birds reared by farmers, good for both egg and meat production. Widely distributed and are of various plumage colours and highly adapted to diverse environments

Female (left) and Male (right)

Frizzled Feathers

It is a dual purpose breed with the main characteristic of curled or frizzled plumage. The plumage curves upwards and forward


Female (left) and Male (right)

Naked Neck

This ecotype is devoid of feathers on its neck. It's a dual purpose bird; lays a reasonable number of eggs and are also considered desirable for meat production


Naked neck (left) and Crested (right)

Crested

The ecotype has a characteristic crested head. Table 2.41 presents the key characteristics of this type of IC.

Table 2.41. The key characteristics of Crested Chicken		
	Variable	**Expression/ value**
Physical description	Plumage colour	Variable in colour type and pattern, ranging from red, brown, black ,white, gray orange to yellow
	Comb type	Single, pea, rose, cushion

Table 2.41. The key characteristics of Crested Chicken		
	Wattle colour	Red, white, red/white, yellow, black, grey
	Earlobe colour	Red, white, red/white, brown, black, blue
	Iris colour	Yellow, orange, brown, red, pearl
	Skin colour	White, grey, yellow, black
	Shank colour	Gray, yellow, white, black, green, blue
Production	Ave mature body weight Males (kg)	1-2
	Ave mature body weight females (kg)	2-3
	Average age of maturity (months)	6-8
	Ave length of productive life (years)	3-4
	Average daily gain (gms)	8-10
	Average carcass weight (kg)	1.5
	Dressing %	70
Reproduction	Age at first egg (months)	6-7
	Clutch size	10-15
	Average eggs per year	40-60
	Average egg weights(gms)	35
	Broodiness (times per year)	2-3
	Number of eggs set per hen	8-12
	Average litter size	7
	Chicks survival rate %	60