Boer Goat Small Farm Feasibility

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Boar goat small farm feasibility

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Chapter 1 Introduction

Across visibly diverse cultures, the goat is recognised as one of the first farm animals from the early Middle Ages (Ensminger & Parker 1986). Up to now, the goat makes very valuable contributions to small farms, especially in less developed rural regions. However, the market potential of the goat has not reached optimal level because these less developed regions lack the capacity to make necessary goat farm investments (Aziz 2010).

Goat meat consumption and production is an indispensable industry in these areas, with particular value noticed across Asia and Africa, making 97% of the world total goat production. Goat meat stock is 2% of the total meat inventory worldwide of 280m MT (FAOSTAT 2008). Production has increased from 2.65m MT in 1990 to 4.93m MT in 2008 (Aziz 2010), China as the largest producer in goat meat at about 38% of global production. Goat meat was often produced mainly for local consumption in particular rural regions, while food preference and consumption patterns of goat meat have escalated regions with increased mobility and migration (Alandia Robles et al 2006).

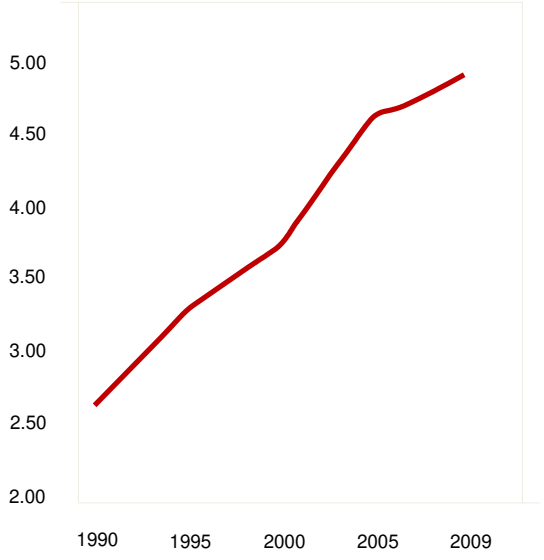


Figure 1 Global goat meat in MMt/yr (Aziz 2000)

Table1 Top ten countries in goat meat production (FAO STATS 2011)
Number of animals slaughtered and the average amount of meat yield per head

Country	Total meat (million MT)	Number of animals slaughtered (million)	Average meat produced per animal (kg)
China	1.8	133.3	13.7
India	0.5	47.8	10.0
Nigeria	0.3	21.3	12.7
Pakistan	0.3	15.4	17.0
Bangladesh	0.2	30.0	7.0
Sudan	0.2	14.5	13.0
Iran	0.1	14.5	13.0
Indonesia	0.1	6.6	10.0
Ethiopia	0.1	7.6	8.5
Niger	0.1	4.4	12.0

Small goat farms are good alternate income sources in rural regions, but require better farm systems and increased capacity to take up forecast market opportunities. A major concern is

that goat contributions to food stability do not compensate for the less the constructive manner of natural resource use in foraging. Crucially, small Boer goat farm efforts require the support of interdisciplinary systems to optimise the potential productivity constrained by the lack of knowledge in many critical biological attributes and functional values of the goat (Devendra 1999).

Industry challenges on goat meat production include consumer education, farmer training, better slaughter and processing facilities, institutionalised breeding programs and marketing channels. Government support for small goat farms can focus on research initiatives for breed development, farm management, and the control of infectious diseases (Aziz 2010).

Figure 2 Boer goat image (Oklahoma State University, 1997)

Chapter 2 GOAT INDUSTRY SCALE & STRUCTURE

Raising goats is an important component of the agricultural sector in Egypt. Goats comprise an important animal resource of arid regions, and small ruminants contribute a greater share in numbers and output compared to the rest of livestock. Small farms seek for the best possible way for handling and allocating resources to improve farm income, typically through traditional experience (MOALR 2004, El Shaer 1999, Al Sheikh et al 2002).

Of the overall gross domestic product in agriculture with value of about EGP 33.6b, the livestock market share comprises roughly 24.5%. Red meat production makes up 629 000 tonnes or 51.6 of the agricultural input, respectively as cattle 51.6%, buffalo 33.2%, sheep6.5%, camel 5.9%, and goat populations 2.7%. Small ruminant population is accounted as sheep 5.4m, goat 3.9m, camel 0.120m and horses 3.2m. Animal production has no trade surplus except for some sheep and goats in limited numbers and highly dependent on small farms in the private sector (ARPI 2009).

Egypt observes an extensively integrated operation of livestock and cropland land use given its few natural pastures. The goat population is concentrated in Upper Egypt region 36 % and Middle Egypt region 23.5% (El-Nahrawy 2011). Typically, the small farms that do not own agricultural lands or control agricultural holdings, take up goats as the main source of animal production. Goat populations in the northwest coastal zone of Egypt account for 8 to 10% of the national stock. Farm integration with animal production comprises about 76% of farming systems in Egypt farms (Alary et al 2011).

Table2 Livestock population of Egypt in millions (FAO STATS2011)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Cattle	3.530	3.800	4.000	4.230	4.370	4.500	4.610	4.930	5.020	5.000
Camels	0.141	0.134	0.127	0.135	0.135	0.120	0.148	0.084	0.107	0.110
Buffaloes	3.380	3.530	3.550	3.780	3.850	3.900	3.940	4.110	4.050	4.000
Horses	0.045	0.053	0.062	0.062	0.062	0.062	0.054	0.066	0.066	0.067
Sheep	4.470	4.670	5.110	4.940	5.040	5.100	5.390	5.470	5.500	5.500
Goats	3.430	3.500	3.580	3.820	3.890	3.920	3.960	4.210	4.470	4.550
Asses	3.050	3.100	3.100	3.150	3.150	3.200	3.270	3.320	3.360	3.350
Poultry	89	91	92	95	95	95	97	98	96	96

Goat farming can be classified in three subsystems: the traditional extensive, semi-intensive and intensive sub-systems. The traditional extensive system is described by low production inputs and outputs for holding of few animals, which is practised in the different agro-ecological zones in Egypt. The intensive production sub-system is characterised by high inputs and outputs for large goat holdings. The semi-intensive subsystem is practised in areas where local breeds and breeding techniques are worth commercial value (ElNahrawy 2011).

Egypt is comprised of vast land area of poor pastureland and very little effective rainfall, unequally distributed to the most 200mm. Pasturelands suffice five percent of animal feed that many rely on the Egyptian clover berseem as forage. The extent of natural resources depletion in the regions of Matrouh and Sinai is part of the prevalent lack of viable production alternatives. Traditional pastureland grazing exposed the land to degradation and the narrowing of its botanical composition. The concentration of plant growth occurs in a short pulse through the short, erratic, rainy season. In effect, this causes the fluctuations in animal numbers and gender composition on the herd. Small goat farms avert the risk somewhat through the use of barley and processed feed, or by moving herds to the Delta or Siwa oasis during years of severe drought (FAO 2010 & 2011). The increasing number of goats has disturbed the natural balance of available forage carrying capacity in feeding units per hectare from 0–4.2FU/ha in dry years to 17FU/ha in good years. The average of 8FU ha is derived (El Nahrawy 2005a).

Table3 Animal farm composition & household category (Metawi 2011)

	High income	Low income
Flock size	225	48.9
Goat only	0	12%
Sheep only	25%	17%
Mixed flock	75%	71.0
Income share	11.6	21.9

Table4 Estimated feed balance (El-Nahrawy 2005a)
Recorded livestock population. TDN Total digestible nutrients/ DCP Digestible crude protein

Available	TDN	DCP
Available	11200 000	1 568 000
Required	13 500 000	1 044 000
Balance	-2 300 000	+ 524 000
% self sufficiency	82.96	17.0

Prices of the Boer based on stock at 8-10 weeks of age or weaning age, are as follows: 100 percent full blood Boer buckling US$450, 100 percent full blood Boer doelings US$450, 100 percent full blood Boer show wethers US$200, 50% Boer doelings US$150, 75percent Boer doelings US$175, 88 percent Boer doelings US$200, 94 percent purebred Boer doelings US$250, 97- 99.2 percent purebred Boer doelings US$275, and 97- 99.2 percent purebred Boer bucklings US$250 (http://studbook.co.za/boergoat).

2.1 BOER GOATS

Capra hircus, of the common name of Boer is a goat breed with animal origin traced to the South African genetic pooling of indigenous goats of the Namaqua Bushmen and the Fooku tribes, having slight resemblances crossing the European dairy and the Nubian goat breeds. While the Boer is associated with the Bantu tribes, the name “boer” is Dutch, which would mean farmer (MacDonald 2009). There are five classifications of Boer goats in the African Boer Goat Breeders’ Association (http://studbook.co.za/boergoat/stand.html). From South Africa, the Boer goats were first shipped to New Zealand through embryo smuggling, then later on quarantined

for a lengthy duration because of scarpie, both in New Zealand and Australia. Large Boer goat production facilities are presently found in areas of the US, New Zealand, Australia and China. Small Boer goat farms are numerous in Mexico and Argentina; Germany on the other hand herds multitudes of Boer as prime research specie (MacDonald 2009).

Boer goats are preferred particularly for meat production. These goats grow at a fast pace, have excellent body muscle form and good carcass quality. The breed is genetically superior with an average birthing size of two litter, and high response levels to cross breeding techniques for birth weight improvement; weaning weight, growth weight, and kidding ratio enhancements. Boer goats are best in forage versatility and survival abilities under adverse foraging conditions, compared over the Angora goat and Merino sheep (Lu 2003).

The average the lifespan of a Boer goat is 7 to 8 years before the animal is about spent. During the lifespan, breeding the Boer once a year, typically results in twins. An eight year old Boer becomes more susceptible to disease, and the reproductive cycle ends (MacDonald 2009).

Industry standards on Boer quality and breeding, started out through Boer goat performance testing in 1970, using the South African goat performance and progeny testing scheme (Casey & Van Niekerk 1988), which comprises five phases. One is the determination of doe characteristics in milk production; growth rate before and after weaning; absorption of feed and body weight of male kids; and qualitative and quantitative carcass progeny (Lu 2003). Boer breed standards and the South African Boer Goat Breeders' Association are simultaneously formed in 1959. These industry standards improved Boer goat grade size and colouring, conformation of the head through the forequarters and down to the hindquarters, skin coverings, reproductive organs, general appearance or type (http://studbook.co.za/boergoat).

2.2 BODY WEIGHT & GROWTH PATTERN

Boer goats have notable capacity for meat production because of its fast growth rate and heavier body weight observed in birth, with an average weight between 3 to 4 kg. The male kids weigh more at 0.5 kg heavier than the female, and the average weight of kids at weaning is about 20 to 25 kg (Lu & Potcoiba 1988). Usually, the bucks weigh about 40 to 50 kg at 7 month of age, while doelings weigh about 35 to 45 kg. A yearling buck weighs between 50 to 70 kg and the doelings average between 45 to 65 kg. The weight for the mature buck is between 90 to130 kg and the doe ranges within 80 to 100 kg. Management methods, genetics, nutrition, health and disease, breeding age and style, all affect the body weight measurements at the varying life phases (Lu 2003). The weight reached by the full grown buck or doe varies as to forage and grain supplements to weigh up more. Boers fed entirely on grain become very fat, which is not also a good thing (MacDonald 2009).

Among the different goat breeds, the Boer grows faster into the first 12 months from birth at 200g/day, given good pastoral conditions. The average growth ratios decline as the animal ages. Age day 0 to 100 the average growth per day is 291g, from day 101 to 150 the average growth per day is 272g, over day 151 to 210 the average growth per day is 245g, and through day 210 to 270 the average growth per day is 250g (Van Niekerk & Casey 1988).

Other factors correlated to growth ratios are weaning methods, stunted growth due to stress (Lu & Potchoiba 1988), such as the adaptation to confinement which reduces the growth ratio substantially (Van Niekerk & Casey 1988, Barry & Godke 1997).

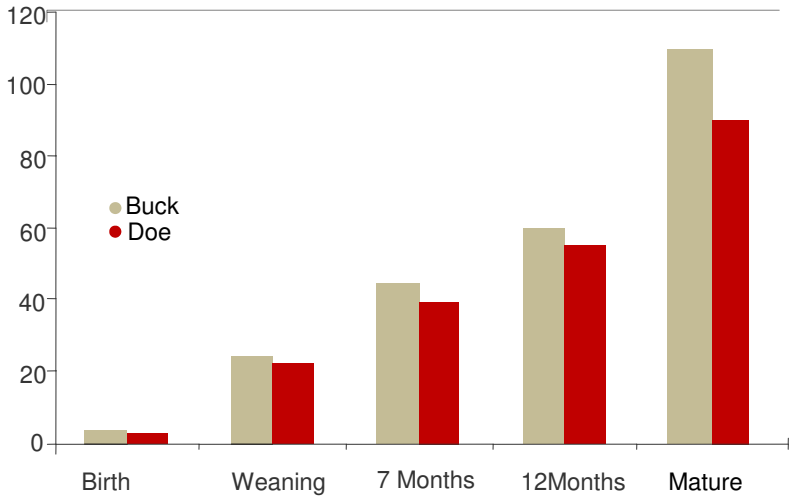


Figure 3 Body weight in kg of Boer buck & doe at different ages

Good conditions of the goat farm environment boost the growth levels above 250g/day especially in the post weaning phase. This growth rate is above the birth to weaning average growth of 125 to 150g/day, and the average growth level at 115g/day from 4 to 8 months of age (Lu & Potchoiba 1988/1990).

Breed crossing and genetic selection, feeding method, and farm management contribute significantly to the rate of growth of Boer goats (Van Niekerk & Casey 1988).

2.3 BREEDING, REPRODUCTION & LACTATION

A unique trait differentiating the Boer is that these goats are genetically semi seasonal breeders. The Boer doe does not exhibit estrus or intervals after birthing or between two periods of copulation. Boer does cycle nearly year round, and in favourable environment every 18 to 21 days. Earlier research finds an average of 17% of the doe population cycle within13 days and 10 percent cycle within 25 days (Greyling 1990). Gestation duration is about 148 days with a mean length in estrus of 37.4 hours. Multiple births are inclined to shorter gestation lengths within 1 to 2 days difference for twins and triplets. Postpartum anestrus fall 37 days within the kidding season to 60 days outside of kidding season (Greyling & Van Niekerk 1986).

Cyclic activity postpartum occurs within 20 days, mating activities peak when the daylight length is shortening. Boers are least sexually active between the months of October to January, in the Southern hemisphere. Boer sexual activity peaks during autumn months and declines in the spring and summer for goatherd in the north hemisphere. When continuous breeding is practices all year round, is not uncommon that very young does are subjected to the buck.

Early breeders are recognised in puberty reached at 6 months age of the Boer does. The bucks are typically active breeders at 5 to 6 months age or at a young 3 to 4 months age if a

body weight of 32 kg is reached. This suggests that breeding by weight is a safe alternative to age. A buck is bred out to 15 does of 6 months age, otherwise to 25 mature does of at least 8 months age. However, early breeding can result in growth retardation (Lu 2003).

Given the high prolificacy distinctive characteristic of the Boer goats for average litter size of two, reproduction indexes show 50 percent twins and 10 to 15percent triplets. In particular conditions nearly 60 percent of does produced twins (Campbell 1984). The practice of artificial insemination and embryo transfers are successful in Boer goats, specifically 87.5 percent of indigenous goats respond to superovulation, compared to the response rate of 50 percent on Boer goat donors (Greyling & Van Niekerk 2000). Boer goats produce higher quality embryos with longer induced estrous period in recipients and ovulations frequency at17.5 versus 14.6 in donors. Undernourished Boer buck presents with 4 percent CP smaller scrotal circumference, reduced testicular volume, higher sperm abnormality and fewer sperm concentration (Schwalbach et al 2000).

Boer goat milk production is practically adequate for rearing multiple kids, with about 1.8 to 2.5 kg/day during the initial 12 weeks of lactation. A shorter lactation span is noted for meat breeds as compared to dairy breeds. Milk solids are usually higher in Boer meat breeds with twice the content of milk fat on the average dairy goats. Slight variations are also observed in the growth rate at weaning ages between single and multiple births (Raats et al 1983). The composition of milk of the Boer doe is characterised with milk fat 6.4 to 9.4 percent, protein 3.9 to 4.5 percent, and lactose 4.6 to 4.9 percent. Recent scientific discovery suggests the Boer doe milk yield is 105 times more during the first 8 weeks of lactation with milk yield of averages 1.91 to 2.32 kg/d, fat 3.4 to 4.6 percent, protein 3.7 to 4.7 percent, lactose 5.2 to 5.4 percent, and somatic cell count 4.8 to 9.6 (Tambajong et al 2000, Lu, 1989).

2.4 BOER TRAITS: GRAZING, ADAPTABILITY & RESILIENCE

Boers are affectionate creatures with mild temperaments, and require no milking or special care and shearing. On the average, a goat can survive under adverse foraging conditions, which is a distinct trait from other livestock. Boers particularly herd for meat and hardiness, resemble the large-framed Nubian goats and consistently form more muscles in less time, compared to other goat breeds. Boers were utilised to clear land given the long grazing hours endured in the heat of day and even in blowing snow. Boers practically thrive on land that cannot support the average dairy goats without supplementation (MacDonald 2009).

Figure 4 Growth rate g/day (Van Niekerk & Casey 1988)

Strong survival skills of the Boer breed is reasoned with the historical evolution in the dry tropics. Given a harsh environment with not many foragers but plenty of browse and shrubs, some even contain noxious compounds that the Boer goats developed ways to dilute these noxious compounds. Typically, goats feed on versatile harvests from one species to another and are classified as browsers dichotomy but have distinct nutritional requirements for better foragers and higher quality feed than most sheep and cow (MacDonald 2009). The Boer diet is 82percent browse, mostly leaves 74percent, and 18 percent grass (Viljoen 1980, ttp://studbook.co.za/boergoat).

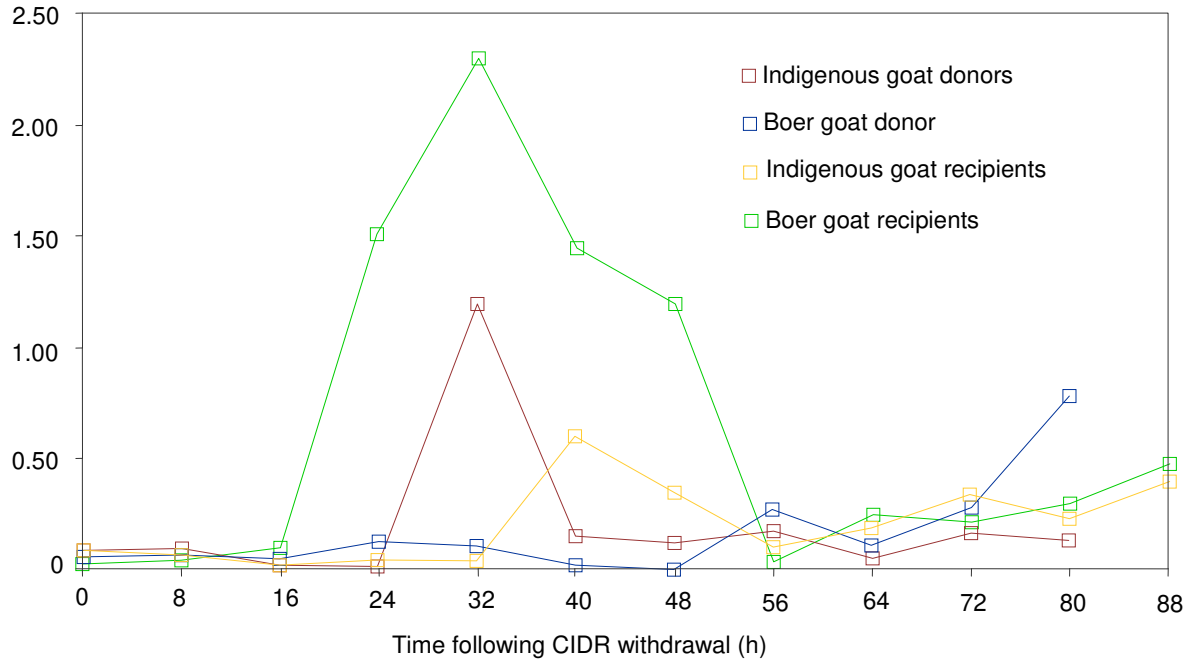


Figure 5 Serum luteinizing hormone concentrations (Greyling & Van der Nest 2000)

Boer goats specifically do not dig out the roots under harsh grazing condition at the same time maximise grazing capacity and biological control of the weeds. These animal breed can travel long distance for food and water, a good resistance for heat stress than other livestock counterparts. Survival characteristics of the Boer can be described as tolerance of tannins, efficient fibre digestion, and adaptation to extreme ambient temperature (Lu 1989, Casey & Van Niekerk 1988). Boer goats are less susceptible to contamination carried by internal parasites (Barry & Godke, www.boergoats.com), and exceptional ability to withstand blue tongue disease, prussic acid poisoning, or enterotoxaemia (http://studbook.co.za/boergoat).

A Boer goat has a stress coping mechanism equal that of Merino sheep and higher than the Angora goats. The excellent adrenal cortex function which is essential in the secretion of gluconeogenic enzymes enables the animal to survive harsh conditions. Stress stimulates the %excretion of corticotropin-release factor or CRF from the hypothalamus, which in turn stimulates ACTH secretion from the anterior pituitary. The breed superior adrenal function enhances the ability of adaptation (Engelbrecht & Swart 2000).

Goats have been bred for specific use which could be as a source of meat, milk or fibre. In less developed regions, the size of goat herd is usually less than 10, with modest provision for

good forage or shelter. For the small goatherd, these goats provide the material, cultural and recreational needs, livelihood, security, nourishment and esteem. Escalating the cost of investment and operating complexity, eliminates the practical reasons that small goat farms exist: goats require no capital input and relatively large profit with nearly no investment risk (Norman 1991).

In the management of small goat farms, there are two fundamental controlling factors to improve on the tenderness of meat. One is through the manipulation of the gene pool and the other is through controlled environments, more particularly by influencing nutritional intake.

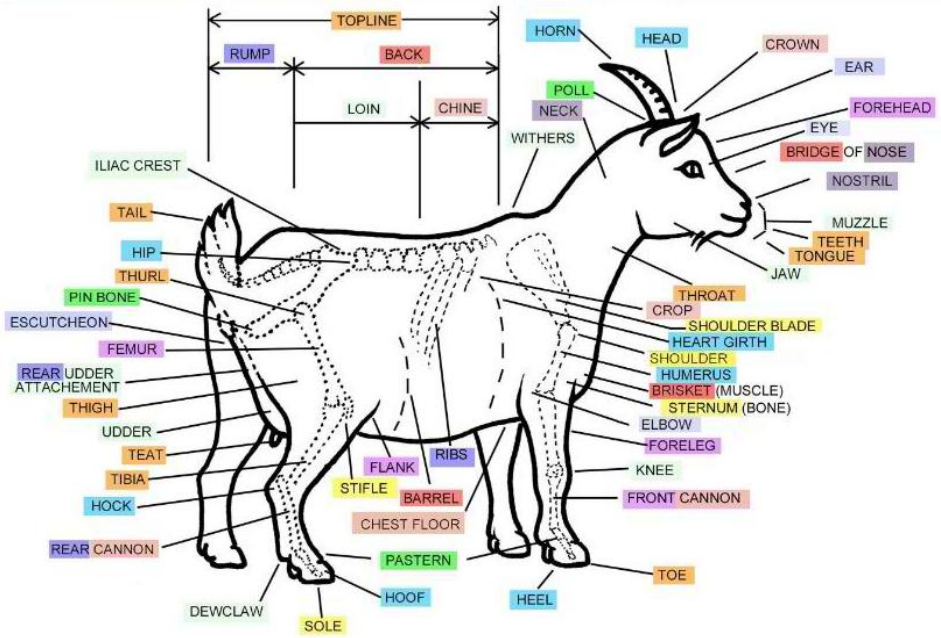


Figure 6 Parts of the goat

2.5 CROSS BREEDING

Across continents there are a total of 102 goat breeds either in small tropical breeds with mature weight from 9 to 13kg to large Boer goats over 100kg. Among goat breeds there are differences in form; for example the long-legged Jamnapari, or the stocky Boer, or the West African Dwarf goat (Warmington & Kirton 1990). But all goats are meat goats regardless of breed. Once a goat is put up for sale, it is sooner or later slaughtered for meal. Certain breeds such as the Boer, Spanish and Anglo-Nubian are better suited for meat production because of the meat quality influenced by a number of factors (Murray et al 1997).

Moving away from the traditional goatherd practices, the Australian goat meat industry first developed the crossbred Boer bucks to improve the breed (Murray et al 1997). Some important animal traits present differently. These traits are quantitative rather than qualitative, given the fact that many pairs of genes are variables influencing the outcome, aside environmental influences. Traits can be controlled by characteristics which is more a continuous variable, in the same way the complexity of hormones control the ovulation rate. Methods improving the

performance of Boer goats are achieved by controlling the environment and engineering its genotype (Haas 1978, Brown & Machen 1997).

Cross breeding techniques are applied to manipulate desirable genetic traits for meat production. Boer goat responses to genetic reformation have resulted in an improved performance from the indigenous breeds. These improvements are indicative in birth weight, breeding weight, growth weight, weaning weight, mature weight, kidding rate and carcass quality (Waldron et al 1997, Cameron et al 2001). As an example, the cross between the Boer and Spanish lines has increased the dry matter intake to an average daily gain by 30 percent. The new genotype helped raise feed efficiency (Cameron et al 2001, Brown & Machen 1995), when compared to high protein diets that do not significantly affect the average daily gain in Boer-Spanish crossbreed. This suggests that an improved nutrition might not increase economic return for Boer crosses (Prieto et al 2000).

2.6 FEEDING FOR GOAT MEAT QUALITY

A critical environmental factor in the growth of the Boer goat is nutrition, which begins in the growth of suckling kids or strictly on milk intake (Warmington & Kirton 1990). Milk intake after birthing is essential that even an extremely low maternal production does not result in lower growth rates of kids (Beischer 1986). In similar manner, the age of the doe upon birthing and the probability to have influenced birth weight and subsequent growth, is insignificant (Warmington & Kirton 1990).

However, growth rates of single kids are visibly advanced over the two litter birthing occurrence (Pralomkarn et al 1991). Breed, maternal nutrition during pregnancy and gender influences the kid weight significantly $p<0.01$ between 2 and 13 weeks of age (Bajhau & Kennedy 1990). The high birth weight of the buck has significant $p<0.05$ influence on growth acceleration (Dhanda et al1999).

The growth of kids before weaning is consistently faster than afterwards, even with enough high-quality feed available after weaning. It must be noted that weaning is gradual. In fact, post-weaning depression follows after a high growth ratio observed during the pre-weaning phase (Allan & Holst 1989, Mavrogenis 1983). In weaning and as the age advances, there is a significant $p<0.05$ decrease in the average daily gain of kids (Dhanda et al 1999a). Feed solids replacing milk do not simply result in the reduction in weight but a poor feeding program can cause growth retardation (Widdowson & Lister 1991). The age at weaning is immaterial to the weight reached when weaning starts. Kids weighing below 8.5kg at weaning exhibit a delay in growth, while kids weighing 10kg at weaning have no growth retardation (Morand-Fehr 1981).

Gender susceptibility to early weaning is defined with adverse effects on the male kids of compared to female kids. Solid feed intake at early ages supplemental to milking, even in small amounts, present with the highest post-weaning growth rate and larger rumen development (Morand-Fehr 1981). When the goat is malnourished, compensatory growth varies on the age or weight of the kid (McGregor 1984, Morgan 1972).

Table 5 Growth performance (Cameron et al 2001)
Boer x Spanish, Boer x Angora wethers consuming concentrate diet[1]

	GENOTYPE							
	Boer x Spanish			Spanish		Boer x Angora		
Body weight kg	24.4			19.5		25.2		
Average daily gain g/d	154			117		161		
ADG:DMI g/kg	263			235		261		
	BC				SP			
Item & weeks	10	14	18	24	10	14	18	24
DMI g/d	693	734	665	783	770	691	731	697
ADG, g	79	106	89	115	73	74	81	85
ADG:DML g/kg	118	144	133	143	95	107	110	122

BC, Boer3/4 x Spanish ¼. SP, Spanish. Average dietary crude protein
Mature size of selected goat breeds

Breed	Country	Sex	Body weight in kg	Withers height in cm
Alpine	France	M	80-100	90-100
		F	60-90	70-80
Angora	USA	M	46	65-70
		F	46	55-60
Barbari	India, Pakistan	M	35-45	66-66
		F	27-36	61-71
Beetal	India	M	70-90	90-102
		F	45-65	76-86
Black Bengal	India	M	14-15	45-50
		F	8-13	40-45
Criollo	Mexixo	M	40-50	75
		F	30-35	65
Feral	Austria	M	50	75
		F	30-40	65
Feral	New Zealand	M	27-36	
		F	19-26	
Improved Boer	South Africa	M	115	75
		F	50-70	65
Jamnapari	India	M	70-90	90-102
		F	45-65	76-86
Kambing Kachang	Indonesia	M	30	50-60
		F	30	50-60
Saanen	Switzerland. France	M	80-120	80-95
		F	50-90	74-85
Toggenberg	Switzerland	M	65	75-85
		F	45	90-100
West African Dwarf	Guinea, Angola, Nambia	M	20-25	40-50
		F	20-25	40-50
Zhongwei	India	M	14-15	45-50
		F	8-13	40-45

[1] Adapted from Devendra & McLeroy 1982, Mason 1981, Warmington & Kirton 1990

Muscle to bone ratio and skin covering of the goat come in better quality when the animal is reared under intensive and semi-extensive systems, compared to goats raised within extensive systems of feeding management (Saini et al1988). A well-managed intake of grain feed supplements result in heavier carcasses with more subcutaneous fat cover (McGregor et al 1988).

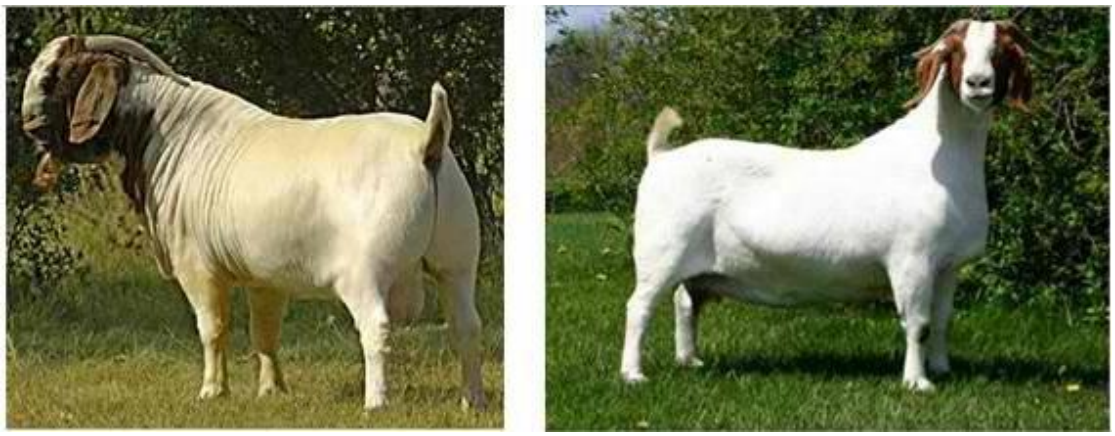


Figure 7 Boer buck on left and doe right (T4Ranch 2004)

2.6.1 Pre-breeding

A Boer herd must be fed a year round balanced diet, more particularly since the Boer is a semi seasonal breeder goat. The buck fertile sperm develops 40 to 60 days in the doe reproductive tract to reach confirmation. Throughout the active months, a buck would need 1-2lbs protein mix, which composes 14-16 percent of the meal of good quality hay and other ingredients. An effective feeding program initiates the supplement meal between six to two weeks before the breeding season. The meal should include adequate vitamins and minerals, and loose mineral salt.

2.6.2 Breeding Season

During the mating season between August and December, good quality meals are essential to maintain the body weight of the Boer buck. A good meal composes quality hay and 2 lbs concentrate of 14-16 percent protein, with added minerals and vitamin. It is important that the grain mixture carries 2000 to 3000 IU of vitamin A and 600 IU of vitamin D. Loose mineral salt is needed to add libitum and plenty of water. Fights between bucks are frequent while activities of a herd sire escalate. The buck can lose up to 17percent of body weight because very little attention is put into feeding. The male s can serve herd doe to 20 times a day within the mating season 350 services can occur.

2.6.3 Post-breeding season

Feeding is reduced by 1-2lbs grain mix in November and good quality hay is sufficient without additional supplements. In conditions where the hay is of poorer quality, 16 percent

crude protein to each one pound of grain as supplement. A herd sire is taken from the herd in mid-January, unless the exact same sire is breeding all year round.

2.6.4 Colostrum

The initial three days of the new born kid is the most critical, but could be spent either with the mother or in separation. When a kid is separated immediately, it is important to provide the very primary secretion of the mammary glands, colostrum, for the first three days. Colostrum carries antibodies for maximum protection against disease in the first three days secretion. 2 to 3 pints of colostrum in two or three daily feedings has to be conducted when the mothering does rejects the kid, and which case another nursing doe can be made to adopt the kid.

2.6.5 Kid starter

Nursing should be until such time the kid is fully weaned, otherwise as long as possible. A milk replacer follows a strict formula for feeding which continues into 8-12 weeks. The kid is taken off the milk replacer when solid feeds intake reaches 0.5lbs grain mix daily, otherwise known as the kids starter. This high concentrate meal carries 16 percent protein and 11percent fibre of full meal composition.

2.6.6 Grower mix for yearlings

Nutrient intake is rigorous especially if the yearling is expected to become a replacement doe. Its starts out with the kid starter intake of 0.5 to 1lbs daily, plenty of good quality forage and pasture. The grain mix should contain minerals at macro and micro levels or a loose mineral mix. Fresh water should be available at all times. At this age, non-protein nitrogen and feed silage is not good for the body. Upon reaching 6 months of age and into the breeding age of 9-10 months, yearlings require 1 to 1.5lbs grain mix containing 14 percent protein, vitamins A, D, and E, minerals and trace minerals. Non-protein nitrogen used as protein intake should not exceed ¼ of the protein requirement.

Table 6 Boer goat nursing ration 18 percent protein (Solaiman 2006)

Ingredient	Price/ton	%	Price/LE
Corn	2540	32	812.8
Oats	2740	29	794.6
Wheat Bran	1800	15	270
Oli Meal (Soy/Linseed)	4355	20	871
Molasses	500	3	12.5
Trace mineral Salt	1000	1	5
Vitamins ADE		1	100
Price of one ton			2,865.9

Table 6A Boer goat kid ration 16 percent protein (Solaiman 2006)

Ingredient	Price/ton	%	Price/ LE
Cracked Corn	2600	29	754
Crushed Oats	2800	29	812
Wheat Bran	1800	29	522
Soybean meal	4355	12	500.825
Trace mineral Salt	1000	0.5	5
Dicalcium phosphate	1350	0.5	6.75
Vitamins ADE		0.5	100
Price of one ton			2,700.58

Table 6B Boer goat grower ration 15percent protein(Solaiman 2006)

Ingredient	Price/ton	%	Price/ LE.
Corn	2540	50	1270
Oats	2740	17	465.8
Alfalfa Meal	2100	15	315
Soybean meal	4355	12	522.6
Molasses	500	3	15
Trace mineral Salt	1000	1	10
Dicalcium phosphate	1350	0.5	6.75
Vitamins ADE		1	200
Limestone	200	0.5	1
Price of One Ton			2,806.15

2.6.7 Pregnant does

Boer goats have less feeding requirement within 4 to 6 weeks prior to the next kidding. 0.5 to1lbs of 12 percent protein grain mix is adequate with good pasture, hay or silage. Does should maintain a good amount of body flesh but not fat through the pregnancy. Alfalfa forage is not advisable for pregnant does because of the high calcium and phosphorous ratio.

2.6.8 Nursing does

The food and nutrient intake of a nursing doe should be adequate for milk production, crucially in the first few months of lactation. Quality legume or grass hay is consumed with grain mix of vitamins, minerals and 16 percent protein. Garden products plus the intake of root crops is ideal. Supplements up to 6m IU of vitamin A and 3m IU of vitamin D per ton of grain intake can bring growth levels to optimal.

2.6.9 Feeding management

Goat herds are groups by growing kids, pregnant does, nursing does, and herd sires to determine the average feeding requirement. To increase the weight gain, add 0.55 mega calories for every 100g gain/day, 57g protein for every 100g gain/day, 2.8g calcium for every 100g gain/day. Add 1.3g phosphorus for every 100g gain/day. The nutrient requirement during doe pregnancy is alters depending on single, twin or triplets carried. In the same way, nutrient supplements vary for a nursing doe depending on the number of kids in care.

Figure 8 An Arab man leads herd into market, wife tags along (Al Youm El Sabea 2012)

Chapter 3 MARKET PROFILE

Egypt has its own trade mark for both animal production and market systems of the goat, across the rest of the NENA region (Alary & Boutonnet 2007). Country profile indicates large ruminants stock with high annual growth rates of goat and sheep stocks across Near East and North Africa countries. Market dynamics are more complex because these do not employ self-regulating channels of supply and demand forces but operate through the mediation of social institutions. When loosely placed, this can result in the manipulation of pricing, high barrier on

access to markets, or market monopolies (Turner & Williams 2002). It is to note that goat farming is a common activity in the arid region that the positive role of markets becomes crucial in the advancement of small holders (Peet & Watts 1993, Tiffen et al 1994). Market mechanisms can stimulate local investment (Binswanger & McIntire 1987), and shape the core social capital (Scoones 1989, Turner & Williams 2002).

Small goat farms comprise 50 percent of the total ruminant stock of Egypt, and is a market characteristic different across 80 percent of the NENA region. For two straight decades, the annual growth rate of ruminant stock continuously increased, with a larger portion accounted to goats (Alary 2010) for one million more in head count between 1995 and 2005. One third of the goat population is found in Upper Egypt (Economic Affairs Sector 2007).

Egypt has terminal markets that offer meat to consumers in the nearby cities, while secondary market offer the sale of animals to other traders and breeders. A handful of markets are influenced by the large Cairo demand and typically pricey (El-Nahrawy 2005a). Slaughter rates are about 24.4 percent without including home slaughtering practiced by many herders for family consumption, for social gatherings or to sustain cash flow for family expenditure.

Goat consumption per capita fell from 10 to 5 percent from 1961 to 2003, which suggests an inaccurate capture of consumption irregularities. At the national level, the daily per capita intake of animal protein from red meat is around 22.7g, 28.0g milk, 26.1g fish and 18g poultry meat.

Per capita goat meat consumption averages about 1.1kg. Although the official statistics indicate an increase in goat stocks, the Egyptians are increasingly dependent on poultry meat for home consumption because of the lower price and availability (Galal 2007).

3.1CARCASS CHARACTERISTICS & BODY CONFORMATION

The commercial value of a goat depends on the carcasses yield and quality of lean. Yield would mean the portion of narrowly trimmed, boneless edible lean cuts on a carcass weight basis. The quality of lean is associated with the palatability of the lean which is strongly influenced by the marbling effect or intramuscular fat deposition. Percentage of dressing and meatiness is evaluated in terms of meat-to-bone ratios (Widdowson & Lister 1991, Kirton & Morris 1989, Simela et al 1999, Naude & Hofmeyr 1981).

The dress out of slaughter goats is influenced by age, gender, body condition, weight, amount of gut fill at slaughter, regardless when the carcass is weighed hot or cold, or number of body components added to the yield calculation. The body conformation of a goat shall depend on the stage of maturity attained at a particular live weight (Widdowson & Lister 1991). Leaner structure indicates late maturing animals when compared to early maturing ones. Less mature goats are leggy and put on muscle-to-bone ratio as the animal matures (Kirton & Morris 1989, Simela et al 1999).

Generally, the edible and saleable portion of the goat carcasses lessens with age (Owen & Norman 1977), while the dress out of a goat increases as the goat ages and puts on weight (Dhanda 2001). On the average, the dress out of goats range within 44 and 55 percent (Naude & Hofmeyr 1981). At equal live weight, a doe yields more edible tissue than the buck but has less bone formation in the carcass than the buck. At the same live weight, the doe has lesser carcass yield (Kirton 1970). A doe has less muscle but more fat deposit than the buck (Norman 1991). Carcass tissue growth in the late maturing nature of the goat with levels of lean meat is as high

as 66 percent to 68 percent (Norman 1991, Fehr et al 1976). Carcass tissue distribution of male kids in the muscle is 64-66 percent, fat 10-14 percent and bone 19-21 percent (Dhanda et al 1999b). Any weight comparisons should be performed on the basis of empty body weight, otherwise the live weight minus the weight of the gastrointestinal tract (Gall 1982).

Figure 9 USDA Meat goat grades and carcass fabrication
(Jones, S 2013)

Goats show distinctive hip and leg structure which alters in carcasses cold processing that result to a more elongated and stretched look, compared with other meat types. The amount of kidney, heart and pelvic fat contained within the carcass cavity and corresponding depth of fat over the shoulder and ribs are a result of the breeding techniques used for meat quality. Lean colour indicates physiological age of the live goat and the paler red is highly marketable.

Table 7 Dissectible carcass composition from selected goat breeds (Authored)

Breed /genotype	Carcass wt in kg	Carcass composition (%) Lean	Fat	Bone	L:B ratio	Reference
Nubian × Florida native	10.9	69.0	9.3	21.7	3.22	Johnson et al 1995
Spanish×Florida native	9.6	38.3	10.5	21.2	3.36	
Florida native	9.5	68.0	11.6	20.4	3.37	
Batina	6.0	68.0	10.6	16.4	4.15	Mahgoub & Lu 1998
	8.9	65.8	13.5	16.1	4.09	
Dhofari	6.9	68.8	11.9	15.2	4.53	
	9.2	70.0	12.9	13.2	5.30	
British Saanen	12.8	63.5	14.8	17.7	3.59	Gibb et al 1993
Boer × British Saanen	13.3	61.0	16.8	18.0	3.39	
Anglo-Nubian	13.6	62.3	13.4	19.5	3.19	
Thai native	10.4	63.5	12.7	16.2	3.95	Pralomkarn et al 1995
New Zealand Saanen	10.0	59.8	11.8	23.6	2.53	Colomer-Rocher et al 1992
	20.0	59.6	14.0	21.5	2.77	
Saanen × Angora	15.8	66.7	11.2	20.0	3.34	Hogg et al 1992
Egyptian Baladi	12.3	57.5	10.9	31.6	1.82	
Angora	11.0	57.4	11.3	31.3	1.83	
Black Bengal	10.0	63.4	13.3	21.9	2.89	Sharma et al 1988
Boer	4.0	70.0	9.2	20.7	3.38	Van Niekerk & Casey
	12.0	68.1	17.8	13.8	4.93	1988
	17.0	64.5	21.8	12.6	5.12	
	22.0	63.4	24.1	12.0	5.28	
Boer × Spanish	15.0	57.7	16.2	26.1	2.21	Cameron et al 2001
	11.9	57.6	13.5	28.9	1.99	
	14.1	55.7	16.3	28.0	1.99	
Boer × Angora	10.7	65.1	12.4	21.0	3.10	Dhanda 2001
Boer ×Feral	11.9	64.8	11.2	22.3	2.91	
Boer × Saanen	11.6	64.9	10.9	23.7	2.74	
Australian Feral	11.5	65.6	12.4	20.9	3.14	
Saanen ×Angora	11.4	63.0	12.7	22.9	2.75	
Saanen ×Feral	12.1	65.1	11.0	22.5	2.89	

3.2 GOAT MEAT PRODUCT & CHOICE CUTS

Meat quality is predisposed by a number of factors during the growth of the animal before slaughter. Meat tenderness is described as the amount and nature of connective tissue in the muscles. The connective tissue per muscle unit weight is more in young animals but is

moderately soluble. As the animal matures the solubility of meat collagen decreases with the process of cooking, rather a tougher meat is produced with increased molecular cross linking of the meat collagen (Lawrie 1998).

Goat meat turns increasingly darker and less tender with the gain of age, and is leaner than other red meat species with fat deposits concentrated around the omentum, mesentery and kidneys. A ripe age for goat slaughter is between 8 to 12 weeks of age (Norman 1991, Dhanda et al 1999, Gibb et al 1993, Hogg et al 1992). Goat age influences palatability, with juicier meat from older goats (Smith et al 1978). The water remaining in the cooked product becomes the principal contributor to the sensation of juiciness. Otherwise the ability of the muscles to hold water during cooking results in the moisture content or juiciness (Aberle et al 2001).

After slaughter treatments that affect meat tenderness can be traced to chilling rates or cold shortening where the thinly covered goat muscles contract extensively when rapidly chilled and making the meat less tender (Naude & Hofmeyr 1981). The juiciness of meat is a further result of the method of cooking and temperature reached.

Table 8 Boer goat prime cuts pricing (http://studbook.co.za/boergoat)

Hindquarter cuts	Price per lb US$	Forequarter cuts	Price per lb US$
Loin cuts	US$5.49/lbs	Shoulder roast	US$2.39/lbs
Sirloin roast	US$2.69/lbs	Neck roast	US$1.99/lbs
leg steaks	US$2.99/lbs	Rib chops	US$2.69/lbs
Edible scrap	US$1.99/lbs	Ribs	US$1.89/lbs
		Edible scrap	US$1.99/lbs

Figure 10 Boer goat choice cuts (Farm Drop 2018)

3.3 PROCESSED GOAT MEAT

Processed goat meat products such as biltong, salami, dried sausage, cabanossi, hamburger or bacon are the specialty products developed to put in use the tougher meat animal portions.

After taking out the choice cuts like the whole leg portions purchased for roast, and the ribs which are another favourite of the fresh meat product.

About 24-35% of cost of production cost is related to the added ingredients in the meting out of the meat. Production costs are added on to the selling price. The key element is to add in the customer needs and other requirements into the product essentials to make the item more saleable.

Of the study of Chevon, average shrinkage of goat meat when processed is 38% and revenue per kilo of US$5.4 on the average (Roets et al 2005). Fresh meat of Boer goat averages about US$11.90 per kilo (http://studbook.co.za/boergoat).

Table 9 Potential Income of Carcass (Roets et al 2005)

Fresh cuts	Retail meat in kg	US$/kg	Revenue US$
Leg whole	5.0	12.098	60.690
Sirloin chops	2.0	12.078	24.156
Rump steaks	3.0	6.578	19.734
Loin chops	0.8	12.780	10.224
Rack whole	1.0	4.158	4.158
Rack chops	1.0	5.918	5.9180
Shoulder: Kebabs	2.0	5.258	10.516
Rest of fore saddle minc e meat fresh sausage	3.0	1.942	5.826
Total	11.9		141.022

Table 10 Added value to 34 598k g on ret ail boneless meat (Roets et al 2005)

Processed products	Fresh goat meat /kg	Beef fat/kg	Extend/ loss in kg	Kilos produced	US$/kg	Revenue US$
Cabanossi (fresh, smoked)	13,839.40	2,075.90	(0.1)	14,960.30	8.0	119,666.6
Salami	13,839.40	1,660.70	0.2	3,255.00	8.1	26,388.5
Dried sausage	6,919.70	0	(0.4)	4,151.80	9.7	40,391.5
Total	34,598.40	3,736.60		22,367.20	25.8	186,446.6

Added value to 35 659kg on ret ail boneless meat (Roets et al 2005)

Processed products	Fresh goat meat /kg	Beef fat/kg	Extend/ loss in kg	Kilos produced	US$/kg	Revenue US$
Cabanossi (fresh, smoked)	14,263.7	2,139.6	(0.1)	15,419.0	8.0	123,335.6
Salami	14,263.7	1,711.6	0.2	3,354.8	8.1	27,197.6
Dried sausage	7,131.8		(0.4)	4,279.1	9.7	41,629.9
Total	35,659.2	3,851.2		23,053.0	25.8	192,163.1

Chapter 4 PROTECTIVE SHELTER & FARM STRUCTURES

Farm structures require investments in labour and capital but it is the best way to protect the herd from predators and parasites. These facilities are used when goats are raised under the intensive management system, which confines the goats to yards and shelters where a centralised feeding, cleaning and medication system is conducted. The subsistence herd management is where animals are tethered through daytime and put into protective shelter at night. Extensive herd management is when goats graze over large areas of marginal land unsuited to agriculture, then are shut into a yard at night.

In designing protective shelter, it is important to note that goats do not tolerate mud well and shelters should be built particularly on well drained ground. Simple structures can be used such as gum poles to support low pitched galvanised steel roofing with proper insulation underneath.

Maximum sunshine and wind protection has to be provided and a sloping entry is often used to maintain a clean barn condition. Rammed earth flooring with a slope of 1:50 toward the open front is typical, complimented with a concrete apron sloped 1:25 and extending from 1.2m inside to 2.4m outside.

A good water source and distribution is essential for goats drink, feed troughs and permanent partitions help divide and handle the herd when necessary to carry on activities like disease treatment, docking or shearing. The water from the boreholes supplements small dams or reservoirs installed to hold water coming from the main water source.

It is important to keep goats off the ground to facilitate cleaning and the collection of dung and urine. A stilted structure with a slatted floor raised 1 to 1.5m above the ground is common. Slats shall be 70-100mm wide, 25-30mm thick and layout with 25mm spaces, and individual pens depend on the weight of the goat. A feed trough should be 0.3-0.4m deep front to back and have a 0.5-0.6m high front wall facing into the feed alley.

Table11 Ideal floor and trough space for goats (http://www.fao.org/)

	Weight in kg	Floor space for solid floor m^2/animal	Floor space for slatted floor m^2/animal	Floor space for open yard m^2/animal	Trough space m^2/animal
Doe	35	0.8	0.7	2	0.35
Doe	50	1.1	0.9	2.5	0.40
Doe	70	1.4	1.1	3	0.45
Kid		0.4 - 0.5	0.3 - 0.4		0.25 - 0.30
Buck		3.0	2.5		0.5

Wood, plywood or different kinds of boards are typically materials used in solid floors. These materials are difficult to clean but allow bedding, eliminate draughts through the flooring and minimises hock sores. In most cases goat structures built with solid floors save some building space but can easily induce contamination of feed and water lead because of build-up of manure in cage corners. Perforated flooring is self-cleaning as manure and urine pass through to the ground but must be properly constructed not to injure animals. Usually these are woven or welded wire of not less than 16 gauges for netting stretched over frames with trimmed flush at the bottom edge.

Civil and architectural activities are to include the roadway to the barn facilities and roads to the various grazing camps, earthworks for the terraces, water and effluent passage, barn layout, electrical requirements, perimeter fencing and boreholes, booster pump-station, pipelines, water and feeding troughs and fencing of the grazing camps. Feed storages, breeding pens and housing units for management. Air cooling is essential in the processing facilities for slaughter, slicing and minimal packaging of meat product.

4.1.1 Roads and earthworks

After the testing of soil conditions for compaction ability and survey of the underground strata for boreholes positioning, borrow-pits are to be identified on the location. The borrow area is compacted onsite to form terraces for the barn structure. Terraces use 150mm layer of compacted material over the entire structural footprint and cut-off drains are installed above the structure.

Roadway to the barn structures of 5km and well-built must ensure accessibility and durability in all-weather condition. Pavements shall be 3m gravel roads with sufficient drainage using culverts and side drains to keep storm water from accumulating on the road. An estimate of R100 000 per kilometre was used.

4.1.2 Electrical provision

Electrical provision should be three-phase line connection and small transformer points at the borehole positions. From the determined transformer power source, internal electrical cables to the barn facilities are to be drawn.

4.1.3 Boreholes, booster pump station and pipelines

Boreholes equipped with pumps and pipelines installed to different barn sections and the grazing camp watering points. On the average, 600 goats require about 6000lt per day at the grazing camps. 4000lt in addition shall be required at the different barn sections, or a total of 10m3 daily requirements. A booster pump station is installed from the water reservoir or existing dams to supplement the water to the grazing areas. Figure 9 Feeding trough and pens (below).

4.1.4 Kidding pens

Kidding pens are to be used to house a maximum of 30 does with kids, using a layout of 3 x 2m each unit. Kidding pen units are constructed in groups with a 1m concrete apron around the

pens and 2 concrete roads of 2.5m as separation, with walling of 1.2m plastered brick walls with IBR roof sheeting on top of rafters.

Each unit spaces a feeding trough enclosed by gate and fitted with a single 100w light. A back-up 5000L tank is to connect to a pump system from transformer to distribution board at one of the units. Feeds storage and grazing camps are also designed.

The barn structure uses a concrete floor 100mm thick with a double leaf fully plastered brick wall. Sliding doors on both sides connect to the steel wide bays structure of 6 x 5m. Roof sheeting uses bubble foil under bays, showing 4-ft fluorescent lighting panels and electrical connections. A 100 litre geyser connects to two wash hand basins and the waterline channels to a drinking trough outside the barn.

4.1.5 Training facility and offices

A training centre is used for the preparation of processed products and uses ramps, scales, clamps, crushes, panels and various sorting gates. The barn section should be enough for 30 people and a small office.

4.1.6 Farm house

Living quarters for the farm manager and staff to assist with the handling of the goat farm are to be built with basic amenities.

4.1.7 Buck pens

A distance of at least 500m away from the doe overnight facilities and kidding pens is required when determining the ram pen location. The structure is 8 units that measure 6m x 4m each. Typically, ram pens are built in groups of 4 to occupy an area of 19.1m x 16.5m. For every set of 2 groups of 4 units, the 1m concrete apron is placed around the pens with 1 concrete road of 2.5m to separate these units. The walling of 1.5m fully plastered brick walls with IBR roof sheeting rested on rafters. Unit locate drinking and feeding troughs closed by a galvanized gate and a single 100w lighting fixture. A water reservoir tank of 5000L connects to a pump system.

4.1.8 Grazing camps

Five grazing camps with raised Bonnox fencing 1.2m to enclose the area identified for grazing and for subdividing grazing areas into smaller camps. These camps should be within reasonable distance from shared amenities of watering points. The watering points are built on a concrete base to prevent erosion of the soil. Separation gates, steel panels, a crush and loading ramp are aids in the handle of the goats.

4.2 ENVIRONMENTAL MANAGEMENT

(1)Permeability tests are conducted to test the tempo of water percolating through the soil on the site for effluent disposal. The effluent from the facilities is to be treated in septic tanks and the effluent is to flow through soakaways into the soil. These soakaways can be installed on the contour lines of the location footprint. (2)Testing of soil samples are needed to determine the compaction ability and other indications requiring further earthworks on terraced portions.

(3) Consultation with an Agronomist is needed in the identification of areas of the farm will be most suitable for vegetable production, for the natural grazing area for goats. (4) Geohydrolical survey or geotechnical survey is not required on the single storey farm facilities or processing plant. (5) An Environmentalist has to be appointed after the drilling and testing of the boreholes is complete, to generate a report to be approved by the Environment Ministry (6) Water treatment levels are to be determined after water samples testing is performed on each borehole and from the dams or water reservoir.

Table 12 Cost estimates on built structures	
Roads 3m wide 5km	3,289.6
Roads and Earthworks for facilities	1,973.8
Eskom 3km and internal electricity	2,368.5
Boreholes, b pump, pipelines	2,105.4
30 Kidding Pens	3,569.3
Feed storage and overnight facility	2,265.4
Training Centre and offices	2,302.7
Farm house	789.5
Ram Pens	1,700.2
Handling Facilities and water points	986.9
Grazing camps fencing 30km	5,921.3
Estimate Costs	27,272.7
10% contingencies	2,727.3
Sub-Total	30,000.0
14% VAT	4,200.0
TOTAL	34,200.0

The goat farm manager and sales manager are critical posts in the breeding facility, which will require strategic approached to operate the business operation. Salaries for these managers are set at US$378.4 per month. Goat handlers shall be a total of 5 staff required to receive, care for, feed and water the breeding herd. Salaries for each worker are EGP700 per month.

Meat processing training shall be taken up by 8 meat processors for certification with the Meat Industry Centre. The training program for 8 staff shall cost US$24,648.6.

Table 12 Professional services	
EIA Scoping report	506.45
Survey areas	607.74
Geotechnical survey, supervision	911.61
Agronomist	607.74
Preliminary design	2,143.30
Detailed design and tender	1,189.53
Site supervision 6 months	1,982.55
Disbursements	224.86
14% VAT	1,144.33
Total	9,318.1

Chapter 5 FINANCIAL EVALUATION

Table 13 Capital Outlay

Breeding stock of buck, ram and does, 228 heads	98,100.0
Built structure estimated cost	34,200.0
EGP Importation tax 20kUS$	20,000.0
Equipment cost: Fencer, hoof trimmers, small tools, water gadgets	2,000.0
Herding dogs	1,200.0
Land with a size of 12 acres for pastureland and shelter	60,000.0
Meat processors training course	24,648.6
Professional fees pre-operations	9,318.1
	249,466.7

Note 1

The herd size is 228 heads comprised of 200 pureblood does 18 pureblood rams and 10 full blood bucks. The established capitalisation on the purchase of herd is

=200 x US$450 (+) 18 x US$200 (+) 10 x US$450

=90,000 (+) 3,600 (+) 4,500

=US$ 98,100

Note 2

Built structure estimated cost estimate is patterned on the Nkangala Goat Project, but is scaled down to the herd size of this project that is roughly 37%, or 228 goats from 615.

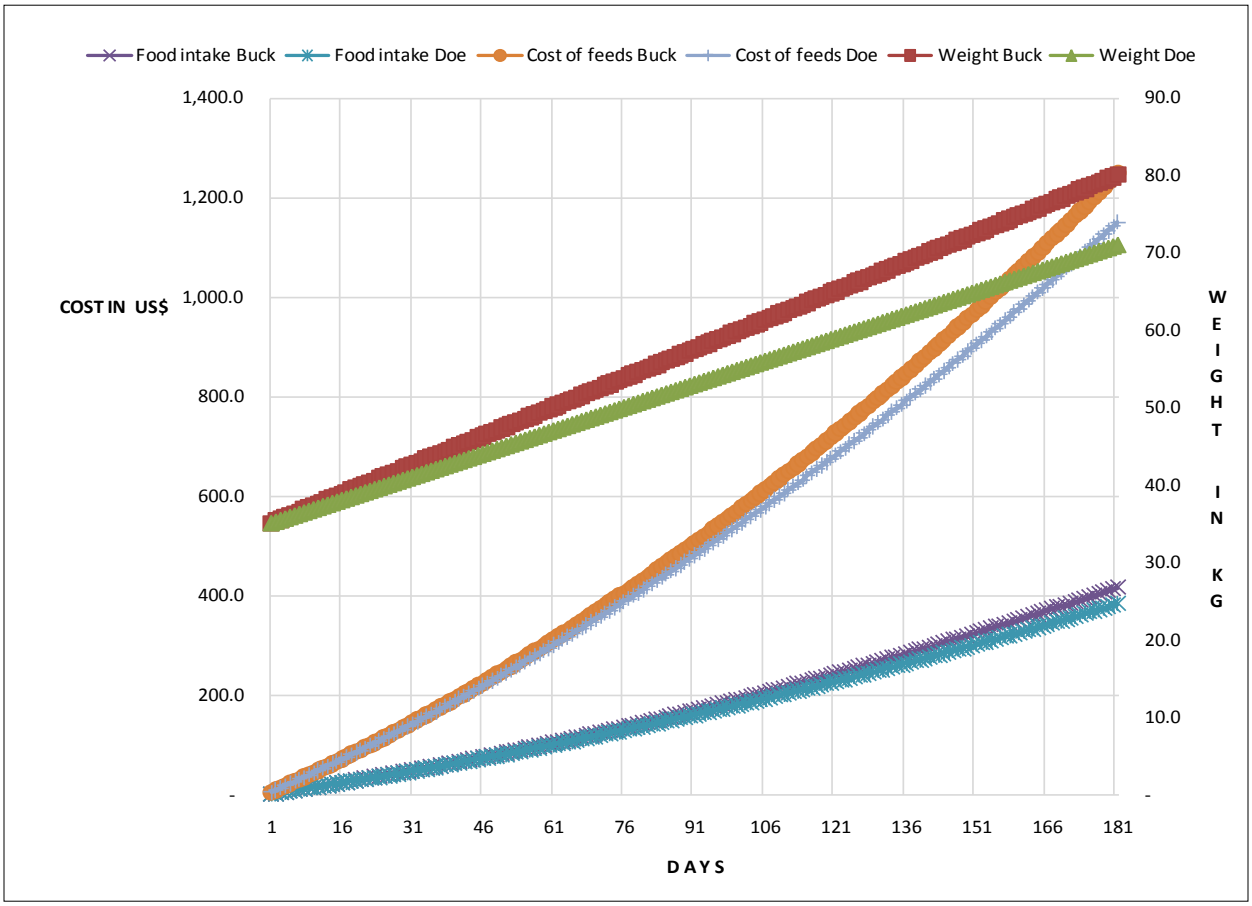
Table 14 Biological Coefficients (Adaptation of Alsheikh & El Shaer 2009)

	Sample 1	Sample 2	Sample 3	Propensity	Selection
Average herd size	20.0	29.0	45.0	31.3	228.0
Average liter size	1.0	1.2	1.6	1.8	410.4
Replacement rate of yearling does)	0.2	0.1	0.3	0.4	45.6
		Saleable kid/doe/180 days raising time			410.4

Note 3

The work of Al Sheikh & El Shaer on biological coefficients using linear programming, establishes the litter rate propensity increases by 0. 2 from the mean of 1 litter size, for every 7 heads added to the herd size. The yearling survival rate is raised by 0.36 for every additional 7 heads added to the herd. In the same way, the doe replacement rate increases by 0.16 for every 7 heads added to the herd. From these defined study samples, the litter rate for the herd size of 288 is 1.8 and completes a growth of 410.4 Boer goats. Given these defined samples, the replacement rate for a herd size of 228 is 0.4 or 45.6 doelings replacements, and the same equivalent from the older group is up for sale (Al Sheikh & El Shaer 2009).

5.1 VARIABLES ON FOOD INTAKE WEIGHT GAIN & COST



Note 4

The chart originates from a daily calculation of both buck and doe growth levels and the cost of feed. For a total of 28 Boer bucks, the food requirement shall cost US$ 34,969.2 for the full cycle of 80 days. Each Boer buck consumes 416.3kg of food and gain an average of 0.25kg daily to reach a full weight of 80kgs after the 180 day cycle. With 200 Boer does, the food requirement shall amount to US$ 23, 0232 for the full cycle of 80 days. Each Boer doe consumes 383.72kg of food and gain an average of 0.2kg daily to reach a full weight of 71 after the 180 day cycle.

The average Boer birth weight is between 3-4kg, and under the same exact feeding cycle of 180 days, each kid would weight about 26.8kgs and consumes 71.62kg of food that would cost US$214.56. Given the biological coefficient of 1.8 litter size, the number of kids at the end of the cycle would be 360 with a total food requirement of 25 747.2kg that would cost US$77,241.6.

An overall live weight for the bucks, does and kids after the first 180 cycle reaches 26 088kg with a total food requirement of 114 147.6kg that would cost US$342,442.8.

Table 15 Economic coefficients for gross output production level

		Dress out	*Bone*	*Lean + fat*
Average weight established using the feeding program for the Boer buck is 80kg, for the Boer doe is 71kg and for the kid is 32.7 (Solaiman2006)	256 kids (x) average live weight of 32.7kg (x) 65% dress out	5,441.3	1,131.8	4,309.5
		Dress out	*Bone*	*Lean + fat*
The typical proportion is to slaughter 71.3% in kid meat and 29% in culled animals. Goat kids are slaughtered between of 2 to 6 months and dressing percentage in such cases is about 50% of the weight of live animal (UNDP 2011)	89 does (x) average live weight of 71kg (x) 65% dress out	4,107.4	579.14	3,528.2
		Dress out	*Bone*	*Lean + fat*
Goat carcass dress out is about 65% of live weight. Of which 70% lean, 9.2% fat and 20.7% bone for the Boer kid. For the doe 68.1% lean, 17.8% fat and 13.8% bone. For the Boer buck the carcass composition is 64.5% lean, 21.8% fat and 12.6% bone (Van Niekerk & Casey 1988)	14 buck (x) average weight of 80kg x 65% dress out of	728.0	99.74	628.3
The total head count at the end of the 180 day cycle is 588, accounting 360 kids, 200 does and 28 buck sires				
Totals for 2 cycles		20,553.26	3,621.32	16,931.94

Note 5

If 71.3% of 360 kids are slaughtered this is equivalent to 256 kids with 103 kids are either replacement does or buck sires for breeding. The buck sires should be kept for the full term of 7 years and only half can be put up for slaughter. 14 young bucks shall be added to the 28 herd sires. To maintain the same herd level of the 200 does, the 89 nannies replaced are up for slaughter.

Note 6

For every 11.9kgs of carcass, the choice cuts completed is sold for about US$141 (Roets et al 2005, http://studbook.co.za/boergoat).

Revenues = (15,342.12kg/11.9) x (US$141)

Revenues = US$181,571.5

Table 16 Coefficients for pricing variation

Slaughter Kids Selection 1

Head	Wt Range	Avg Wt	Price Range	Avg Price
222	40-60	50	70.0 -110.0	92.2
57	60-70	64	97.0 -122.0	107.0
125	70-90	80	114.0 -165.0	133.6
66	90-130	115	120.0 -180.0	142.5

Average price on slaughter kids based on 3 sample ave price over ave weights is US$1.27/kg

Slaughter Kids Selection 2

Head	Wt Range	Avg Wt	Price Range	Avg Price
66	40-60	50	54.0 -70.0	63.9
69	60-90	75	60.0 -115.0	92.8
52	90-130	110	104.0 -135.0	115.0

Average price on slaughter nannies & does based on 3 sample ave price over ave weights is US$0.95/kg

Average price on slaughter bucks based on 2 samples is US$1.25/kg

Slaughter Kids Selection 3

Head	Wt Range	Avg Wt	Price Range	Avg Price
61	40-60	50	40.0 -54.0	47.6
46	60-90	75	47.0 -60.0	53.1
13	90-120	95	98.0-104.0	102.0

Production level on slaughter kids x ave price 5 228.1 kg x US$1.27/kg = US$6,650.85

Slaughter Nannies/Does Selection 1

Head	Wt Range	Avg Wt	Price Range	Avg Price
53	110-125	118	110.0 -140.0	119.1
42	130-150	144	130.0 -172.0	155.1

Production level on slaughter nannies & does x ave price 2,800 kg x US$0.95/kg = US$2,666

Slaughter Nannies/Does Selection 2

Head	Wt Range	Avg Wt	Price Range	Avg Price
49	110-125	114	90.0 -110.0	102.0
22	130-150	140	117.0 -125.0	121.1

Production level on slaughter kids x ave price 5,172.6 kg x US$1.27/kg = US$6,378.5

Slaughter Nannies/Does Selection 3

Head	Wt Range	Avg Wt	Price Range	Avg Price
50	70-80	75	62.0 - 90.0	70.9
129	80-125	99	82.0 -110.0	91.2

Slaughter Bucks/Billies Selection 1

Head	Wt Range	Avg Wt	Price Range	Avg Price
5	130-150	145	180.0 -200.0	190.0
13	150-180	163	200.0 -227.0	210.0

Slaughter Bucks/Billies Selection 2

Head	Wt Range	Avg Wt	Price Range	Avg Price
8	125-150	138	132.0 -180.0	168.2
9	150-180	159	175.0 -200.0	185.1

Goat meat revenue in 180 days	US$15,695.38

Table 17 Financial Statement 5 Years

Loan amount	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
The herd size is 228 heads comprised of 200 pureblood does 18 pureblood rams and 10 full.	($249,466.7)							
Startup funding for 6 months	($373,185.3)	$373,185.3						
	($622,652.0)							
Revenue potential referenced to economic coefficients and biological coefficient in previous pages		$246,639.1	$263,410.6	$281,322.5	$300,452.4	$320,883.2	$342,703.3	$366,007.1
Repayment loan at 11% interest in 5 years for 621,886 amounts to *Loan amount**(1+interest rate)^no of years repayment is US$209,582.8 annually for the next 5 years		Deferred	($209,841.0)	(209,841.0)	(209,841.0)	(209,841.0)	(209,841.0)	
Variable costs								
Feed costs, refer to authors notes 7-8		($715,726.1)	($742,923.7)	($771,154.8)	($800,458.7)	($830,876.1)	($862,449.4)	($895,222.4)
Fuel & repairs		($1,200.0)	($1,245.6)	($1,292.9)	($1,342.1)	($1,393.1)	($1,446.0)	($1,500.9)
Utilities		($600.0)	($622.8)	($646.5)	($671.0)	($696.5)	($723.0)	($750.5)
Office expenses		($600.0)	($622.8)	($646.5)	($671.0)	($696.5)	($723.0)	($750.5)
Farm Manager and Sales Manager		($9,081.6)	($9,081.6)	($9,081.6)	($9,081.6)	($9,081.6)	($9,081.6)	($9,081.6)
Labour for 5 farmers at EGP700 national minimum wage (Tashima 2012)		($6,168.0)	($6,402.4)	($6,645.7)	($6,898.2)	($7,160.3)	($7,432.4)	($7,714.9)
Fixed cost								
Pasture management expense		($1,200.0)	($1,245.6)	($1,292.9)	($1,342.1)	($1,393.1)	($1,446.0)	($1,500.9)
Veterinarian w/ one assistance		($1,800.0)	($1,868.4)	($1,939.4)	($2,013.1)	($2,089.6)	($2,169.0)	($2,251.4)
Marketing		($600.0)	($622.8)	($646.5)	($671.0)	($696.5)	($723.0)	($750.5)
Land taxes, licenses & permits		($7,399.2)	($7,680.3)	($7,972.2)	($8,275.1)	($8,589.6)	($8,916.0)	($9,254.8)
Insurance		($1,995.7)	($2,071.6)	($2,150.3)	($2,232.0)	($2,316.8)	($2,404.9)	($2,496.2)
Gross Margin	($622,652.0)	($126,546.2)	($720,818.0)	($731,987.7)	($743,044.5)	($753,947.5)	($764,652.0)	($565,267.6)
Cash in bank		($126,546.2)	($847,364.1)	($1,579,351.8)	($2,322,396.3)	($3,076,343.8)	($3,840,995.8)	($4,406,263.4)

Discount Rate (Nominal)	15.0%
Discount Rate (Real)	10.8%
Inflation Rate	3.8%
NPV	(2,558,711.1)
FIRR	?
Payback (yrs.)	4
Maximum Capital at Risk	2,558,711.1
Cost Benefit Ratio	0.00

Chapter 6 CONCLUSION

Given the specific feeding program, the investment for the Boer goat farm is not practical. For a Boer buck to average a weight of 80kg after spending US$1,248.9 on food alone by itself makes no gain: when sold in its live weight, the average price would be US$1.25/kg or US$100. For the same Boer buck to be sold at 65%dress out and an average price of US$12 for choice cuts, the animal can be sold at about US$624. The same goes for the does, nannies and kids.

Goat farms should breakeven within the first three years. A high operating expense is a variable that places a higher risk on the business.

Moreover, goat farming is a desirable and profitable undertaking for the minimal capital and operating expense required. Why anyone should bother feeding a fancy meal when the goat is born capable of digesting almost anything.

Going against the nature of things requires a deeper sense of reality.

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