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Reproductive performance of goats and the limitations encountered by farmers in marketing their goats

Oscar Pienaar de Klerk

[1]Department of Animal Science, North West University, P. Bag X2046, Mmabatho 2735, South Africa.

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A farmer participatory survey was conducted in four communities, Mount Frere, Mount Ayliff, Maluti A and Maluti B, to establish reproductive performance, goat production and marketing constraints, and to examine the selection criteria for replacement goat does and bucks. Goat flock sizes ranged from 5 to 200 goats per household across the communities. Kidding rate varied with the community and also with the feed availability and incidence of diseases. Kidding interval ranged between 7 and 9 months. Early weaning (3 months) was reported in Mt Frere and Mt Ayliff respectively. In Maluti A and B weaning was done at 3 to 4 months post partum. Weaned kids reached puberty at the age of 8 to 12 months. On average, in Maluti A and B mortality rates of up to 35% were reported while farmers in Mt Frere and Mt Ayliff reported average mortality rates of 25 and 30%, respectively. Farmers' decisions on selection criteria for replacement does and bucks in their goat flocks differed with communities. Odds ratios showed that farmers in Mt Frere and Mt Ayliff were biased towards selecting for reproductive and physical aspects. In contrast farmers in Maluti A and B rated adaptive aspects as the most critical. Average market weights of goats differed significantly with community. Goats in Mat Ayliff and Mt Frere had higher markets weights than those in Maluti A and B and were fetching higher sales rates at the market. Umzimvubu Goat Project was offering lower prices than the local market and hence famers now preferred the local market. Poor reproduction efficiency, low goat numbers, high goat mortalities, poor management practices and unfavourable offers at the market were mentioned as major constraints to goat production and marketing. It is therefore necessary to take into consideration the various constraints and factors peculiar to different groups of farmers in different regions which may influence their decisions making processes in implementing selection and breeding strategies to improve goat production and marketing.

Key words: Reproductive performance, mortality rates, selection criteria, flock sizes, goat marketing.

INTRODUCTION

The natural production systems under which most goats are raised in most communal production systems, that is, low drug usage and a grazing-based management system, promote the production of organic chevon (Simela and Merkel, 2008). Goat meat produced under such management systems can be exploited in marketing campaigns that label the meat as natural in the international marketplace, to fulfill the growing demand of such products in many developed countries. In communal production systems, goats can therefore represent the principal economic output, contributing a large proportion of income to the economies of resource-poor farmers (Ben Salem and Smith, 2008). Various constraints, however, have hampered efforts to increase goat productivity and value of the goats at market places. Among others, poor reproductive rates, lack of clear

*Corresponding author: E-mail: dr.kenenisa01@yahoo.com

selection and goat breeding strategies and unavailability of formal and sustainable markets (Van Marle-Köster et al., 2004) appear to be more critical and require adequate investigations and development.

Reproduction is the most important production parameter of any livestock enterprise (Casey and Webb, 2010). The number of offspring born and the number that are weaned and survive to market readiness determine to a large extent the economic viability of the enterprise. Low reproductive rates, high pre-weaning mortalities and slow growth among those that survive are major constraints to goat production in most communal production systems (Sebei et al., 2004). Weaning percentage, which measures survivability of kids from birth to weaning, is generally low, whilst pre-weaning kid mortality is one of the principal causes of economic loss to goat farmers (Hailu et al., 2006). The available information on the reproductive performance of goats in many communal production systems of South Africa is still handy. There is therefore need to adequately examine fertility rates and their impact on goat marketing in these production systems.

The poor reproductive performance levels observed in goats in communal production systems could heavily influence selection criteria and breeding objectives of goats (Kogsley et al., 2006).

The low fertility rates and high pre-weaning mortalities may result in lack of recognition of the goats with supposedly superior genetic merits under normal conditions. Although some goat farmers in communal production systems are recognized as knowledgeable about breeding objectives, their breeding objectives are not clearly defined and selection criteria for maximum return are not used and factors that affect both are not determined (Tabbaa and Al-Atiyat, 2009). Moreover, the farmers' decisions on selection criteria could be affected by various factors, among then breed, flock size, production system, available market stipulations (Jabbar et al., 1998; Wolfova et al., 2005). Generally, information on the selection criteria for breeding goats in communal production systems of South Africa is largely unknown and needs to be established.

Generally, marketing of meat animals by commercial farmers is mostly through a well-organised system with capital resources, infrastructure, institutions, legal frameworks and markets (Roets and Kistern, 2005). In the communal production systems, the major challenge in marketing of goats is the unavailability of the formal markets and where available, farmers are not provided with adequate information on prices and market requirements (Roets and Kistern, 2005; Simela and Merkel, 2008). Critically, the development of a goat meat industry requires readily accessible infrastructure in the form of livestock marketing routes, facilities for slaughtering and processing carcasses and wholesale and retail distribution systems to a receptive and sustainable market (Van Marle-Köster et al., 2004; Roets and Kistern, 2005). Through government intervention in the marketing of goats, some goat projects (for example, the Umzimvubu Goat Project (UGP) in Eastern Cape Province of South Africa) were developed with the aim of facilitating commercialization and marketing of indigenous goats. Although such goat projects are involved in farmer training drive, equipping farmers with basic goat management skills and value addition opportunities, the farmers are, however, faced with numerous challenges, particularly on diseases and nutrition (Roets and Kistern, 2005). There is, therefore, need to identify the constraints faced by the communities so that appropriate strategies can be developed to offset these constraints and improve goat production. The current study was, therefore, undertaken to establish the reproductive performance of goats, selection criteria for breeding goats and the constraints faced by farmers in marketing their goats.

MATERIALS AND METHODS

Study site

Participatory rural appraisals (PRAs) were conducted with farmers in four of the six communities involved in goat production contracted to supply goats to the Umzimvubu Goat Project (UGP) in Alfred Nzo district in the Eastern Cape Province of South Africa. The communities involved were Mount Ayliff, Mount Frere, Maluti A and Maluti B. These communities are known to raise goats together with other livestock species such as cattle, sheep, chickens and pigs. Alfred Nzo district, is located 29^{o} E and 30^{o} S at an altitude of 1055 m above sea level. The temperature varies from 7 to 10°C in cool the dry season, when it can also be snowy and from 18 to 24°C in the hot wet season. The rainfall season is between October and March with the latter being the wettest month. Rainfall varies from 750 to 1050 mm per annum in hot wet season. Vegetation in Alfred Nzo is mostly temperate and transitional forest with scrub and some pure grassveld vegetation (Agriculture Geo-Referenced Information System, 2007).

Collection of secondary data

Secondary information on goat productivity and supply patterns were obtained from key informants consisting of the Department of Agriculture officials, the chairpersons of each of the four regional communities, the general manager of the UGP and the marketing manager.

Participatory rural appraisals

Participatory rural appraisals were conducted in October 2008. Focus group discussions were the main PRA tool used. Primary focus was put on issues related to goat production. Ranking of selection criteria for breeding goats and the constraints on goat production were obtained by consensus. All goat farmers from the selected communities were invited to a central point by chairpersons of each community with the help of a local extension officer working with the communities. The farmers were divided into smaller groups balanced in terms of age and sex to ensure heterogeneity. Efforts were made to ensure all members in each group participated in the discussions. Transect walks were made through the grazing areas and assessment of the amounts and state of the feed resources in the grazing lands were also made during transect walks. A visit to the abattoir was also made to assess the slaughter of goats and other operations. For each community, a focus group discussion, guided by a pre-prepared checklist, was conducted. The gender and distribution of farmers who attended the meetings in each of the four communities are shown in Table 1. The discussions specifically centered on the importance of goats, goat reproduction and selection criteria of goats, production constraints, goat supply pattern and markets and technical advice offered in terms of veterinary and extension

Table 1. Gender demographics of farmers who attended the PRAs meetings.

Community	Adult males	Adult females	Youth†	Total
Mount Frere	16	10	5	31
Mount Ayliff	15	18	7	40
Maluti A	20	15	11	46
Maluti B	10	13	3	26

†Youths were defined as unmarried respondents who were younger than 30 years of age.

Table 2. Reproductive indices of goats in Maluti A, Maluti B, Mount Frere and Mount Ayliff communities.

Respondent	Age at puberty (months)	Age at first kidding months)	Kidding rate (%)	Twinning	Pre-weaning mortality (%)	Flock mortality (%)
Maluti A	11	12	60	Rare	35	30
Maluti B	11	12	65	Rare	35	30
Mount Frere	7	10	75	Often	25	20
Mount Ayliff	8	10	70	Often	30	25
Key informants	8	10	70	Often	35	25

services.

Questionnaire interviews

At least 30 goat farmers were targeted per community for questionnaire interview to collect information related to goat production practices. Farmers were specifically asked about their goat herd size, reproductive aspects, mortality rates, selection criteria of does and bucks, and the source of does and bucks. The questionnaire also included information pertaining to available goats markets and goat supply patterns. Ten trained enumerators were used to conduct the interviews in the vernacular Xhosa language. A total of 123 head of households participated in the survey.

Statistical analysis

Statistical analysis was performed in several steps. First: survey data were subjected to simple descriptive statistics using the Chi-square test of the FREQ procedure (SAS, 2006). Then, the Kendall's W-test (NPAR1WAY procedure) was used to rank the goat production constraints and selection criteria for breeding goats (SAS 2006). An ordinal logistic regression (PROC LOGISTIC) procedure was used to examine the effect of different factors on selection criteria goats. The LOGIST procedure (SAS, 2006 was utilized with a model that included community location, breed type and flock sizes. Odds ratios were calculated to approximate the relative importance of the different factors on farmers' decisions.

RESULTS

Goat ownership pattern

The farmers kept a variety of livestock species including cattle, sheep chicken and pigs for household consumption and income generation through sale. They also kept donkeys and horses mainly for transport and provision of draught power. Although the farmers were keeping other livestock species, goat farming was becoming lucrative because of the availability of a ready market, the UGP. The farmers in all the communities reported that goat production was potentially becoming a very good source of employment and incomes to the member households. Besides realizing income from sale of their goats to UGP, the farmers in the communities were involved in craft work, producing various leather products from goat skins for sale and thus creating employment, especially for the youth in the communities. Generally, goat flock sizes varied between five and 50 goats per household in Maluti A and Maluti B communities. In Mt Frere and Mt Ayliff communities, goat flocks varied between 20 and 200 goat per household. The farmers kept mainly the indigenous goat genotypes, small populations of Kalahari red and Saanen goats, the Boer goat and its crosses with the indigenous goats.

Reproductive performance

The farmers in all the communities practised the free range (extensive) goat production system with the natural rangelands being the main source of feed for their goats. Because of high incidences of thefts and predation, all the farmers reported that they herded their goats in grazing areas. The famers reported that they had no control over breeding of their goats and there was no selection of bucks for breeding purposes. Mating was random and normally occurred in the grazing areas. Twinning was not common in goats in Maluti A and B. The farmers in the two communities attributed this to inadequate feed supply except during the hot wet season where there was abundant food for the goats. Kidding rate varied with the community and also with the feed availability and incidence of diseases (Table 2). In most cases, the kidding rate was reported to be once per year. Kidding interval was between 7 and 9 months. Weaning was done at 3 to 4 months post partum. According to the farmers, weaned kids reached puberty at the age of 8 to 12 months. The key informants, however, reported that

Table 3. Selection criteria rankings for goat does in Maluti A, Maluti B, Mount Frere and Mount Ayliff communities.

Criteria	Rank (mean rank)[a]					
	Maluti A	Maluti B	Mount Frere	Mount Ayliff	Key informants	Sig[1]
Age at puberty	7(4.02)	7(3.86)	5(3.48)	5(3.54)	7(3.89)	*
Age at first kidding	6(3.98)	6(3.71)	7(3.92)	7(3.87)	6(3.82)	ns
Kidding rate	1(3.31)	2(3.32)	1(3.08)	1(3.11)	1(3.21)	*
Twinning rate	4(3.68)	4(3.51)	2(3.16)	3(3.39)	4(3.51)	*
Pre-weaning mortality	5(3.88)	5(3.64)	6(3.78)	6(3.64)	5(3.77)	ns
Disease resistance	2(3.45)	1(3.12)	3(3.33)	2(3.26)	2(3.27)	*
Tolerance to harsh environment	3(3.66)	3(3.44)	4(3.41)	4(3.48)	3(3.36)	ns

[a]The lower the rank, the greater the importance of the selection parameter. [1]Mean ranks of the different reasons (columns) are significantly different at $P \leq 0.05$ (*). Sig=Significance level.

Table 4. The odds ratio estimates of community affecting selection criteria for goat does.

Estimate	Selection criteria				
	Age at first kidding	Kidding rate	Twinning rate	Disease resistance	Pre-weaning mortality
Location					
Maluti A versus Maluti B		1.001	0.987		0.999
Mt Frere versus Maluti A		0.998	3.872		1.263
Mt Ayliff versus Maluti A		1.107	2.876		0.877
Breed type					
Indigenous versus exotic	0.132	0.378	0.442	3.023	2.875
Crossbreed versus exotic	0.993	0.108	0.773	1.378	1.897
Flock sizes					
Small versus large					0.134
Medium versus large					0.978

across the communities, the age at puberty was 8 months while the age at first kidding was 10 months. The key informants also reported that on average, 70% of the goats in all communities produced a viable kid every year.

In both Maluti communities, the farmers reported that if the kids were born in cold dry season, the age at puberty and age at first kidding were reported to be delayed due to the fact that there would be less feed available and hence growth rate is suppressed. The farmers also mentioned that they experienced preweaning mortalities especially at 2 to 3 months of age. On average, the farmers in Maluti A and B reported that they experienced mortality rates of up to 35% while those in Mount Frere and Mount Ayliff reported average mortality rates of 25 and 30%, respectively (Table 2). The causes of mortalities according to the farmers, were diseases, mostly haemonchosis, flea infestation, poor nutrition especially during the cold dry seasons and predation by wild animals.

Selection criteria for does

Farmers' decisions on selection criteria for replacement does in their goat flocks are shown in Table 3. Significant differences were found among the communities for all selection criteria except age at first kidding, pre-weaning mortalities and tolerance to harsh condition, irrespective of breed. While the ranking of the other selection criteria varied with the community location, the farmers in all communities, with the exception of Maluti B, ranked kidding rate as the most important factor considered in the selection of replacement does. Ranking of most criteria was similar in Mt Alyliff and Mt Frere. Disease resistance was ranked the most important criteria by farmers in Maluti B. Famers in Maluti A and Mt Ayliff ranked disease resistance as the second most important and this also concurred with what the key informants reported. Farmers in Mt Frere considered twinning rate as the second most important criteria for selecting goat does. Farmers in Maluti A, Maluti B and the key informants ranked age at puberty as the least important criteria. In contrast, farmers in Mt Frere and Mt Ayliff considered age at first kidding as of least importance.

The selection criteria for replacement does were influenced by breed type, community location as well as breed type (Table 4). The criteria of kidding rate, twinning rate and pre-weaning mortality for does selection were significantly ($P < 0.05$) affected by community location (Table 4). The odds ratio indicated that farmers in Mt Frere were putting more emphasis on twinning rate of dams in selecting their replacement does followed by

Table 5. Selection criteria rankings for goat bucks in Maluti A, Maluti B, Mount Frere and Mount Ayliff communities.

Criteria	Rank (mean rank)[a]					
	Maluti A	Maluti B	Mount Frere	Mount Ayliff	Key informants	Sig[1]
Body frame and morphology	1(3.41)	1(3.46)	1(3.44)	1(3.21)	1(3.13)	ns
Growth rate	4(4.21)	4(4.12)	2(3.69)	2(3.37)	4(3.78)	*
Breed type	6(5.31)	5(4.44)	4(3.90)	3(3.45)	5(3.97)	*
Progeny viability	8(5.91)	8(5.34)	8(5.13)	8(4.65)	7(4.37)	*
Testicular size	7(5.67)	6(4.61)	7(4.99)	7(4.34)	8(4.55)	*
Dam twinning ability	5(4.55)	7(5.02)	5(4.46)	6(4.12)	6(4.01)	ns
Disease resistance	2(3.62)	3(3.66)	3(3.74)	4(3.87)	2(3.17)	ns
Tolerance to harsh environment	3(4.11)	2(3.49)	6(4.76)	5(3.97)	3(3.44)	*
Overall merit	9(6.21)	9(5.91)	9(5.18)	9(5.01)	9(4.63)	*
Sig[1]	*	*	*	*	*	

[a]The lower the rank, the greater the importance of the selection parameter. [1]Mean ranks of the different reasons (columns) and communities (rows) are significantly different at $P \leq 0.05$ (*). Sig=Significance level.

Table 6. The odds ratio estimates of community affecting selection criteria of goat bucks.

	Selection criteria			
	Body frame and morphology	Growth rate	Dam twinning ability	Disease resistance
Location				
Maluti A vs. Maluti B	1.093	0.671		1.001
Mt Frere vs. Maluti A	0.999	14.438		1.016
Mt Ayliff vs. Maluti A	1.167	12.098		0.977
Breed type				
Exotic vs. Indigenous		24.105	4.021	0.008
Exotic vs. crossbreed		1.123	1.876	0.621
Flock size				
Small vs. large			0.013	
Medium vs. large			0.988	

farmers in Mt Ayliff. Mt Frere community also had high odds ratio of selecting for pre-weaning mortality indicating their concern on pre-weaning mortality than the other farmers. Breed type significantly ($P < 0.05$) affected selection criteria of replacement goat does. With regards to age at first kidding, kidding rate and twinning rate, famers favoured the exotic breeds than the indigenous breeds. However, the observed high odds ratio of selecting indigenous breeds over the exotic breeds for disease resistance and pre-weaning mortality indicates that famers were also concerned about the survivability of their animals in face of the prevalent disease. Nonetheless, little differences were observed when selecting between the crossbreeds and exotic with regards to the selection criteria under consideration. Flock sizes only affected pre-weaning mortalities with small flock sizes bearing the brunt of pre-weaning mortalities than the large flock sizes hence farmers with small flock sizes were concerned about pre-weaning mortalities than those with medium to large flock sizes.

Selection criteria for bucks

Rankings of selection criteria for replacement goat bucks are shown in Table 5. In all communities, the farmers including the key informants rated body frame and morphology as the most important aspect of selection criteria for replacement bucks. Disease resistance and tolerance to harsh environment were considered to be the second most important criteria by farmers in Maluti A and Maluti B, respectively. On the contrary, growth rate was ranked as the second most important aspect by farmers in both Mt Frere and Mt Ayliff. Key informants concurred with farmers in Maluti A that generally, disease resistance was equally important and hence was ranked second. The overall merit of the bucks received the lowest rank in all communities including the key informants. Selection of buck for progeny viability, testicular size and buck's dam's twinning ability reviewed low ratings (5 to 8) from all communities.

Table 6 shows the factors affecting bucks selection criteria. Location of community significantly ($P < 0.05$) altered the emphasis given to body frame and morphology, growth rate and disease resistance. The odds ratio indicated that farmers in Mt Frere goats were fourteen times more concerned with buck growth rate that Maluti A farmers. In addition, farmers in Mt Ayliff were twelve times more concerned with growth rate than the

Table 7. Ranking of goat production constraints by communities.

Constraint	Maluti A	Maluti B	Mount Ayliff	Mount Frere	Key informants
Inadequate feed availability	2	2	3	4	2
Haemonchosis	1[a]	1	1	1	1
Other diseases*	3	3	2	3	4
Inadequate vet services	4	4	5	5	3
Lack of technical advice	6	6	4	6	5
Buck availability	5	5	6	2	6
Infrastructure*	7	7	-[b]	-	7

[a]Rank 1 indicates the most important constraint within a community, [b] Constraint not mentioned, *Other disease: scabies, lung infections, abortions and heartwater, *Infrastructure: roads, telephones.

Maluti farmers. The odds ratio for location with regards to body frame and morphology and disease resistance, however, indicated that the selection criteria were relatively uniform across the communities. The odds ratio for breed type showed that the all farmers were concerned about the growth rates of the different breed types with the farmers favoring the high growth rates characterizing the exotic breeds. With regards to twinning ability, the odds ratio showed that farmers are inclined towards selection of exotic breed with high chances of twinning compared to the indigenous breeds. In contrast, the farmers were ten times more concerned with the poor disease resistance exhibited by the exotic breeds. With regards to flock sizes, the odds ratio showed that farmers concerns on buck's dam's twinning ability were relatively uniform between the medium and large flock. Dam's twinning ability was however more important in large flock than in small flocks.

Goat production constraints

Focus groups discussions indicated that a number of constraints were affecting goat production in different communities. Although the ranking of the constraints varied with community, gastrointestinal infection was ranked as the most important constraint in all communities (Table 7). Of particular concern, the farmers reported that they were incurring huge goat production losses due to haemonchosis caused by the barber pole worm (*H. contortus*). Autopsies conducted by the veterinary officers to determine the causes of death of their goats have indicated that haemonchosis was the major cause. Mortalities due to haemonchosis were being felt more in Maluti communities which are very far away from the veterinary and other technical services. The agriculture extension and veterinary officers working with the farmers also confirmed that haemonchosis was one of the most problematic disease affecting goats in the whole district. The farmers also mentioned that the problem of haemonchosis was being exacerbated by the unavailability of a government sponsored gastrointestinal parasite control programme for the goats unlike in sheep and cattle were a support scheme exists. Furthermore, the high cost of drugs was prohibiting the majority of the farmers from accessing the treatment required. Farmers in Mount Frere, however, reported that they were resorting to forming groups to raise funds for purchasing of drugs. Some farmers in Maluti communities were resorting to traditional medicines (for example, *Acacia elephantorrhiza*) to treat their animals. All farmers, however, mentioned that improvement of feed resources in the rangelands and reintroduction of grazing schemescould be critical in reducing the effects of haemonchosis on productivity of their goats.

Other diseases mentioned included scabies, lung infections, abortions and heartwater. Increased incidence of abortions and kid mortalities were reported at the beginning and middle of the wet season. All the communities ranked this disease as third most important except Mount Ayliff who ranked them as second most important. The farmers reported that they were being supplied with drugs from the Department of Agriculture to treat their cattle and sheep which are on the helminthes control programme. However, they did not get any help with their goats as they were considered less important mainly due to unavailability of formal markets for the goats and because of general consumer perceptions of goat meat in South Africa. It was, therefore, becoming difficult to control the haemonchosis in sheep due to cross infections. Furthermore, private veterinary services were not only inaccessible, but their services were often expensive.

Inadequate feed sources was mentioned as the second most important by farmers in Maluti A and B communities and the key informants because of the mountainous nature of their grazing lands. Transect walks in all the communities indicated that although the sizes of the rangelands were large, they were in poor condition and in some places completely barren. The farmers also reported poor rainfall patterns as the major reason for inadequate feed resources. In Maluti A and B, rainfall was reported to be persistently erratic, both in timing and spatial distribution causing extended periods of droughts that have resulted in dwindling feed resources in their rangelands. In Mount Frere and Mount Ayliff, however, the PRAs established that two small streams and vleis doted around the areas were good sources of feed for their goats especially during the dry season. In Maluti communities, the farmers reported that inadequate feed resources was causing reproductive disorders among the goats, increasing age at puberty, kidding intervals,

Table 8. Goat supply pattern and average prices.

Respondent	Hot wet season	Cool dry season	Av wt (kg)	Price/goat, UGP (Rand)	Price/goat, local (Rand)	Income/farmer/year (Rand)
Maluti A	25	15	25	400	600	1500
Maluti B	20	15	20	320	650	1300
Mount Frere	40	20	33	528	800	2500
Mount Ayliff	30	15	30	520	800	2000
Key informants	25	20	25	400	700	1500

UGP: Umzimvibu Goat Project; Av wt: Average goat weight.

abortions and reduced chances of twinning. However, snowfalls in the mountains during winter helped by providing moisture to the grass especially during the dry season.

Although, other communities ranked buck availability as less important, farmers in Mount Frere mentioned unavailability of bucks in their flocks as a major reproduction constraint. The farmers said they were relying on bucks from other flocks to services their does. The farmers, however, indicated that they were in the process of raising money as a group to purchase bucks. Other constraints mentioned included limited or no veterinary and technical services and the poor infrastructure with regards to roads and communication. Although, they were not ranked in Mount Ayliff and Mount Frere communities because of the closeness of communities to towns, farmers in Maluti communities have to contend with poor roads and communication networks. It was therefore difficult for extension workers to reach the communities to provide services especially during the hot wet seasons.

When asked how goat production could be improved in their areas, the farmers mentioned that improved veterinary services could help in disease prevention and control. Secondly, they reported that improved extension services could enhance provision of technical advice on good husbandry practices and information on crossbreeding to upgrade existing goat stock. Finally, the farmers said that improved nutrition of their goats, e.g. by supplementation during the dry season could improve the body condition and reproductive performance of their goats. However, according to the local agriculture extension officer responsible for these areas, the unavailability of adequate human resources and transport was making it difficult to reach out to all the farmers to provide technical support. In addition, it was observed that the farmers tended to have a dependence syndrome and therefore needed to be weaned so that they can pull together their own resource and invest in profitable goat production activities.

Goat marketing and constraints

The farmers were contracted to supply UGP with 200 goats every week. The farmers reported that on the scheduled days during the week, transport would be made available for collection and transportation of available goats to the abattoir. According to the key informants, individual farmers in the communities were supposed to brand their goats with community initials and to tag their goats for traceability and identification purposes. The farmers were then paid for their goats on live weight basis at 16 rand / kg live weight. On average the farmers will therefore earn between 300 and 500 rand per goat as the majority of their goat weighed between 25 and 30 kg irrespective of age (Table 8). The farmers supplied UGP with greater numbers of goats during the hot wet season when feed is abundant. The farmers used the income from sale of their goats to purchase drugs for treatment of their livestock, to purchase new goats and to pay school fees for their children among other household needs. Discussions with the key informants and the farmers, however, indicated that the communities were failing to meet the target number of goats they were contracted to supply. The major reason for failure to meet the target was that the target was too high and unsustainable considering the many household uses of goats and production constraints they were facing. The local extension officer working with the communities also reported that poor goat reproduction, low goat numbers, high goat mortalities and poor management practices were prohibiting the farmers from supplying adequate goat numbers to the UGP.

The farmers also reported that their goats had small body frames and were therefore, fetching low prices. Currently, however, the farmers in the four communities were no longer supplying the UGP with goats because of the goat pricing system they perceived to be unfavourable. The farmers reported that if they were to sell the goats to the community members and other private buyers, each goat would fetch between 600 and 800 Rand depending on size and colour patterns, which they say was far much higher that what the UGP was offering (Table 8). Although, the chairpersons of the six communities sat in the board running UGP, their involvements is of little significance when it comes to decision making. The farmers, therefore, felt that there were being sidelined in decisions related to the overall operations of the UGP, especially with regards to price determination. The farmers, therefore, felt that they were no benefits to be realized from the projects and hence had stopped supplying it with goats preferring selling goats among themselves and other private markets. Currently UGP abattoir is lying idle with no business taking place. A visit to the abattoir also confirmed that no

slaughter of goats was taking place. The marketing manager also confirmed that they were no longer getting regular supplies of goats from the communities.

DISCUSSION

In communal production systems, the value of livestock species increases in relation to its adaptation, capacity to make socioeconomic contributions, capacity to fill market opportunities and potential for increasing productivity (Webb and Mamabolo, 2005). There is a considerable potential for increased goat production, provided that proper management is employed. Much will depend, however, on recognition of their value as small domestic animals. In the current study, although the farmers kept cattle and sheep, they also had large goat flocks. The value of their goats was, however, not being recognized due to the unavailability of reliable market channels. This prompted the government to intervene and set up the UGP with the objective of facilitating marketing of goats for the farmers. With availability of a reliable market, farmers could now realize profits from sale of the goats.

The potential productivity of goats in some of the communities was being strongly constrained by poor reproduction rates due to inadequate feed resources, particularly in Maluti communities. The high ranking given to this constraint by the key informants and direct observations of the rangelands during transect walks also confirmed the concerns of the two communities. In many communal production systems, the quality and quantity of forage tend to vary with the harsh environmental conditions that sometimes prevail, leading to nutritional inadequacies (Sangaré and Pandey, 2000; Alexandre and Mandonnet, 2005). In such conditions, nutrient deficiencies or even underfeeding may occur (Silanikove et al., 1996). Inadequate feed resources was reportedly causing reproductive disorders among the goats, increasing age at puberty; kidding intervals, abortions and reduced chances of twinning. Similar observations were made by Walkden-Brown and Bocquier (2000). The findings that inadequate nutrition, coupled with high levels of parasite infestation, was contributing to high reproductive and productive wastage in the goat flocks regardless of size and management also concurs with Alexandre and Mandonnet (2005) who observed that such wastage slows down genetic progress as selection intensities are substantially reduced. Although the farmers reported that use of supplementary feeding could significantly improve goat productivity, a majority of the farmer, however, could not afford commercial concentrates. However, the communities were observed to have various tree species, particularly *Acacia karroo* and *Acacia mensii.* Although the farmers were aware that their goats sometimes browsed on these tree species during the dry season, they were unsure whether these trees could be used as supplements in place of the commercial feed concentrates. Through research, strategies that utilizes the local feed resources, such *A. karroo* and *A. mensii*, as potential feed supplements for the goats need to be developed to improve goat production.

Through workshops and meetings with the local veterinary officers and autopsies done to determine the causes of mortalities in their goat flock, the farmers were able to identify haemonchosis as the most problematic disease. Similar observation was made in communal goat flocks by Bath et al. (2001) and Vatta et al. (2001). The challenge of haemonchosis was being exacerbated by the unavailability of a government sponsored helminthes control programme for the goats unlike in sheep and cattle. As observed elsewhere (Bath et al., 2001), the high costs of drugs meant that the majority of the farmers could not access the treatment required. Observations that farmers in Maluti communities had turned to local herbal remedies as an alternative to the expensive and often inaccessible commercial drugs were also made in Kwazulu-Natal (Kunene and Fossey, 2006). Some research has been conducted on the efficacy of herbal medicines such as *Acacia elephantorrhiza* in treating animal diseases (McGaw and Eloff, 2008; Maphosa and Masika, 2010). More research needs to be done, however, on the potential of some tannin containing forages such as *Acacia* spp as both protein supplements and antihelmintics. As expected, the reported high prevalence of haemonchosis and unavailability of drugs was resulting in high goat mortalities especially at the beginning of the wet season, low growth rates, delayed onset of puberty, generally low goat productivity as reported elsewhere (Awemu et al., 1999; Sebei et al., 2004).

Considering the formidable combination of malnutrition, environmental stress, long-term and often massive larval challenge and limited relief by way of effective antihelmintic treatment imposed in the natural selection process of indigenous goats in many communal production systems, one would expect the goats in the study areas to be inherently resistant to haemonchosis and other gastrointestinal infections (Waller and Thamsborg, 2004). However, the continued use of the same buck over several breeding season as reported by the farmers was causing unchecked inbreeding. Consequently, resistance to diseases in the goat flocks was declining resulting in high kid mortalities as most of the kids were born thin, weak, deformed and with very low body weights. Although kidding rate was reported to be once per year with some exceptions, variations were observed with feed availability and incidence of diseases. Under normal circumstances (no drought), goats should be kidding at least three times in two years (Devendra, 2006). Kidding rate contributes largely to the productive efficiency of goat flocks and it has been reported to be affected by nutrition, diseases and genotype (Banerjee et al., 2000). When asked how, in their opinion, goat production could be improved in their areas, farmers in Mount Frere and Mount Ayliff mentioned that provision of new bucks could help in improving reproductive capacity of their goat flocks.

Secondly, the farmers reported that improved extension services could enhance provision of technical advice on good husbandry practices and information on crossbreeding to upgrade existing stock. Nevertheless, it

seems any effort in the upgrading of the existing stock to improve goat production for food security should take into consideration the indigenous knowledge, socio-economic situation, attitudes and the general perceptions of the communal farmers (Ayalew et al., 2003; Kunene and Fossey, 2006; Dossa et al., 2007). There are common concerns about the inappropriateness of genotypes that are not consistent with small farmer resource endowment and management and prevailing breeding systems that are currently used in the traditional livestock production systems typical of communal farmers (Dossa et al., 2007).

Goat farmers worldwide consider a number of factors that forms an index for selection of both bucks and does replacements although their selection strategies are premised on their own perceptions. However, translating farmers' perceptions into index traits can be difficult because of the absence of measurable, defined traits to represent their perceptions (Anderson, 2003; Bett et al., 2011). For example in the current study, although farmers ranked kidding rate as the most important criteria in the selection of replacement goat does, they rated disease resistance and tolerance to harsh conditions as second and third most important. It is, however, not clear how components of adaptation, such as disease resistance and tolerance to cold can be measured. Nevertheless, farmers in the three communities who ranked disease resistance highly could have been influenced by the high cost of drugs and other medications. Given the harsh pedo-climatic and socioeconomic condition prevalent in smallholder farming areas in the Eastern Cape, the animals need to be adapted to the environment and capable of coping with rampant disease and low-input conditions (Collins-Luswet 2000; Andrew et al., 2003). Adaptive traits such as resistance to disease have rarely been considered in conventional expert-derived breeding objectives for marginal areas (Gicheha et al., 2007). However, sustainable livestock production requires a trade-off between increased productivity and adaptation (Olesen et al., 2000; Nielsen et al., 2005, 2006).

Although selection of dams for twinning ability and rate was rated averagely in Maluti A and B, High rankings given to these criteria by farmers in Mt Frere and Mt Ayliff showed that to large extent these farmers are more businesslike and are always inclined towards increasing their flock sizes. The odds ratio also indicated that farmers in Mt Frere and Mt Ayliff were putting more emphasis on twinning rate of dams in selecting their replacement does. This also points to the observations made that farmers in these two communities were better resourced than those in Maluti A and B. Additionally, farmers in the two communities were located close to towns and therefore had more access to veterinary and other agricultural extension service provision service provisions.

Morphological traits unique to each breed were emphasized in the selection criteria of goat bucks as they were ranked as the most important objective by farmers in all communities. Differences were however evident in the ranking of the second most import trait. Farmers in Maluti A and B ranked disease resistance as the second most important criteria. In contrast, farmers in Mt Ayliff and Mt Frere ranked growth rate of the buck as the second most important criteria. Odds ratio also showed that community location had an influence of decisions regarding selection of buck with the famers that had access to resources being able to emphasize on the growth rate instead of the adaptive traits. This observation is in contrast to some reports stating that adaptability traits such as survival rates and reproductive performances were the most important criteria, while increasing growth rate was of less value (Upton, 1985; Franklin, 1986). However this concurs with Kosgey et al. (2006) who reported that large-herd farmers gave economical traits more consideration than small-herd farmers, which in the current study characterized farmers in Maluti A and B.

To enhance goat production and marketing, the Umzimvubu Goat Project was developed as a brainchild of the communities working together with the municipality and the department of agriculture who had observed the difficulties faced by farmers in marketing their goats as they had large goat flocks. Despite the envisaged benefits from the UGP, the farmers were not meeting the target number of goats they were contracted to supply. The finding that the farmers were no longer willing to supply the project with goats mainly due to the unfavourable goat pricing system could be attributed to the failure of the farmers to adapt quickly to the changeover from an informal market to a formal market which requires certain standard to be met and to survive in that competitive market. Farmers sold goats which were poorly conditioned and much older than what was required, therefore they were downgraded. Historically, indigenous goats were primarily utilized for traditional and religious purposes where quality was based mainly on colour patterns and size; larger animals often being preferred, and, depending on the ceremony, male or female goats may be required (Roets and Kirsten, 2005). Through regular meetings and workshops, farmers need to be assisted in understanding the importance of age, body conformation score, weight, accurate record keeping and animal identification to ensure that their goats meet required quality specification so that they get satisfying prices for their goats. Research on the potential of the available local feed sources as supplements could also aid in developing appropriate intervention strategies that could improve goat productivity and quality to promote consistence in supply. Effective transfer of scientific knowledge is critical in this endeavor. Improvement of the goat prices and involvement of the farmers in determining the prices could also aid in changing the farmers' perceptions of the UGP. The farmers should also be regularly supplied with information regarding preferred characteristics of goats, market trends and price patterns so that they can plan breeding and fattening programmes consistent with the best seasonal prices and consumers' preferences. The farmers and the key informants, however, all agreed that the UGP was a unique opportunity with the potential to benefit the farmers in the long term.

Farmers in Maluti communities also reported that

unavailability of reliable road and communication networks was hampering progress in their communities. Mount Frere and Mount Ayliff communities did not have that problem because they were located close to towns and services. Although they were generating some income from the sale of their goats and other livestock, the communities could not raise sufficient funds to pay for the improvements to their roads and where hoping that the government would help in this regard. The key informants also concurred that although there was need to provide services to these communities, poor roads and unavailability of transport was hampering their efforts.

Conclusions

The study highlighted some goat reproduction performance levels, production and market constraints faced by farmers in the four communities. Farmers cited inadequate nutrition, haemonchosis, lack of veterinary and extension services and unavailability of goat genetic resource base to upgrade existing stock as major constraints to goat productive and supply. The study also highlighted some of the selection criteria used for identifying replacement bucks and does and their rankings. Differences between communities with regards to the rankings of the selection criteria were also examined. Observations were made that location of community, breed type and flock sizes were major factors influencing decision making with regards to the selection criteria. It is therefore imperative to extension strategies in the improvement of goat production should take into consideration the various constraints faced by farmers and all the factors peculiar to different groups of farmers in different regions which my influence their decisions making processes in their flock improvement programmes.

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