

## Goat Production under Traditional Management in Gaborone Agricultural Region in Botswana

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**Abstract:** An initial study covered the feed resources and nutritional ecology of Tswana goats kept under extensive communal management conditions in Gaborone Agricultural Region. Such goats feed on a variety of browses and herbaceous forages throughout the year. Only 30% of the respondent farmers provided their goats with supplementary feeds implying that most goats in Gaborone agricultural region rely solely on natural vegetation for their feed. A further study surveyed the production parameters of goats under extensive management by smallholder farmers over a 12 month period from February 2000 to February 2001. This survey covered 375 goats, comprising 87% females and 13.5% males (12% castrates and 1.5% intact). There were 168 kids. The mortality rate for the kids was 33.3% and that for adults was 5.6%. Disease accounted for 44.6% of the overall pre-weaning mortality. Of the 168 kids born during the period of study, 52.4, 45.2 and 2.4% were singles, twins and quadruplets (one birth), respectively. The average birth weight of the kids was 3.6 kg, while the average daily weight gain was 58g per day. The kids weighed 17.7 kg on average at the age of 240 days. The mean body weights were 8.6±0.6, 15.3±0.8 and 23.3±1.4 kg for the age groups 30-120 days, 121-240 days and 241-360 days, respectively. The net numerical growth in the herd was -17.6%, with a prolificacy rate of 93.3%.

**Key words:** Growth, reproduction, traditional management, Tswana goats

### Introduction

Rangelands in Botswana include many browse plants, among which are members of the families Leguminosae (*Acacia*), Capparidaceae (*Boscia*) Combretaceae (*Combretum*) and Tiliaceae (*Grewia*), which are rich in protein and minerals, and provide nutrients which are lacking in the herbaceous vegetation during the dry season. Herbaceous vegetation is more prone to seasonal variations than browse. The quality and quantity of forage intake by grazing animals are potential constraints on efficient production of livestock on rangelands and low intake is the most common factor.

Goat rearing is an integral part of the extensive farming systems in Botswana, playing an important role in the economy, especially among the smallholder farmers, to whom they provide ready income through the sale of live animals. The goat population in Botswana is about 2.7 million, with an average flock size of 33.7, comprising 51.3% nannies, 14% bucks, 17.1% castrates and 29.7% kids (MoA, 1995).

Tswana goats are characterised by fine, glossy and short coats. Horns and beard are common in both sexes. Despite their importance, there is little information on the productivity of those goats. The present study was conducted to document information on the production characteristics of range Tswana goats, to determine the current status of goat production by smallholder farmers in Kgatleng and Kweneng districts (study 1) and to monitor and document the reproduction, growth and production constraints of Tswana goats on communal grazing lands (study 2).

### Materials and Methods

**Study 1:** This was carried out in Gaborone Agricultural Region, consisting of Kgatleng and Kweneng Districts. The area is located in the southeastern part of Botswana, dominated by an *Acacia* and *Combretum* tree savanna. Soils are loamy to sandy loams. The climate is semi-arid and frost free throughout the year. Annual precipitation ranges from 450 to 500mm, most of which falls between November and April. Summer and winter temperatures range from 21 to 34°C and 2 to 20°C, respectively.

The objective of the study was to document the natural forages available to goats and the frequency of watering. One hundred goat farmers were interviewed in the two districts. A structured questionnaire was used to assess the frequency of watering, while the availability of natural vegetation was monitored every two months from June 1999 to April 2000.

**Study 2:** The study 2 was done between February 2000 and February 2001. The objective of the study was to gather information on the reasons for keeping goats, reproductive performance, constraints to production and milk utilisation. Ten respondent farmers were selected from the 100 farmers interviewed in the study 1. Five farmers were from Radiajana (Kgatleng) and the other five were from Metsimothane (Kweneng District). Data collection was by use of

a structured questionnaire administered to each farmer on one to one basis. Direct observation of goats involved counting and weighing. The goats were kept on the range during the day, foraging from 6 to 7 h before being housed for the rest of the day and all night.

**Growth rate:** The monthly body weights for each farmer's animals were obtained using a mobile weighing scale. The kids were divided into three age groups: 30-120, 121-240 and 241-360 days designated groups 1, 2 and 3, respectively.

The demographic parameters sort were those described by Charray and colleagues (1992). The prolificacy rate was calculated using the formula  $(X/Y)100$

Where: X=number of kids born including still-birth and Y=number of does kidding in that year

The fecundity rate was obtained from the formula  $(A/B)100$

Where: A=number of kids born during the year and B=average number of does.

**Data analysis:** The data were analysed for the differences in monthly live weights of the kids from the two districts using descriptive statistics (SAS, 1995), while a t-test was used to test differences in monthly mean live weights between males and females within and between districts. A one-way ANOVA was used to analyse the data on the weight gains.

## Results

**Study 1:** The availabilities of the browse and herbaceous species present in the area are shown in Table 1. Study 1 showed that the goats consumed the leaves, twigs and pods of woody plants as well as whole grass and forbs. Annual diets comprised 50, 35 and 15% woody plants, grass and forbs, respectively. In order to supplement the food that the goats obtained from the range, the farmers provided a variety of additional feed namely sorghum bran, urea molasses block, mineral lick, crop residues and iodised salt. During the dry season, most grasses are dried up and browse is the most important source of forage to goats in the study areas. Only 30% of the respondent farmers offered their goats supplements during the dry season. Seventy percent relied solely on natural ranges as a source of feed for their goats. The sources of drinking water for the goats were small dams (50%), streams (22%), pipe borne water meant for humans (14%) and boreholes (14%). Eighty four percent of the goats were watered once per day, 14% received drinking water once in 2 days, while 2% of the goats were given drinking water twice daily.

Table 1: Browse and herbaceous plants available in the Radiajana (Kgatleng) and Metsimothabe (Kweneng) of the Gaborone Agricultural District during 2000/2002

(Browse)		(Herbaceous)	
Scientific name	local name	Scientific name	local name
<i>Acacia erubescens</i>	<i>mhahu</i>	<i>Aristida congesta</i>	<i>seloka</i>
<i>A. fleckii</i>	<i>moloto</i>	<i>Anthephora pubescens</i>	
<i>Mellifera</i>	<i>mongana</i>	<i>Bothriochloa insulpta</i>	<i>pinholegras</i>
<i>A. nilotica</i>	<i>moha</i>	<i>Brachiaria marlothi</i>	
<i>A. robusta.</i>	<i>Mokha</i>	<i>B. nigropedata</i>	
<i>A. tortilis</i>	<i>mosu</i>	<i>Cenchrus ciliaris</i>	<i>selekangwetsi</i>
<i>Boscia albitrunca</i>	<i>motlopi</i>	<i>Chloris virgata</i>	
<i>Boscia foetida</i>	<i>mopipi</i>	<i>Dactyloctenium aegyptium</i>	<i>crowfoot/ngarara</i>
<i>Combretum apiculatum</i>	<i>mohudiri</i>	<i>Digitaria milanjana</i>	<i>namele</i>
<i>Hereroense</i>	<i>mokabi</i>	<i>Enneapogon cenchroides</i>	
<i>Imberbe</i>	<i>motswere</i>	<i>E. scoparium</i>	
<i>Dichrostachys cineria</i>	<i>moselesele</i>	<i>Eragrostis lemanniana</i>	
<i>Euclea undulata</i>	<i>mothakula</i>	<i>E. pallens</i>	<i>rantafole</i>
<i>Grewia bicolor</i>	<i>mogwana</i>	<i>Cynadon dactylon</i>	<i>motlhwa</i>
<i>Flava</i>	<i>morethwa</i>	<i>Eragrostis ridigior</i>	<i>rathathe</i>
<i>Maytenus senegalensis</i>	<i>motlhono</i>	<i>E. superba</i>	<i>mogamapodi</i>
<i>Peltophorum africanum</i>	<i>mosetlha</i>	<i>Heteropon contortus</i>	<i>seloka/speargrass</i>
<i>Terminalia serecia</i>	<i>mogonono</i>	<i>Renceletrum repens</i>	<i>sanyane</i>
<i>Ximenia americana</i>	<i>moretologawapodi</i>	<i>Tragus racemosus</i>	<i>segowa</i>
<i>Zyziphus mucronata</i>	<i>mokgalo</i>	<i>Urochloa trichopus</i>	<i>phoka</i>

**Study 2:** In farms used for study 2, there were an average of 20.7 goats per farm. The main reasons given for keeping goats were for security against crop failure, slaughter during funerals and weddings and payment of social dues, such as bride price. Most adult castrates were sold to butchers and other individuals as a source of cash income. Only 14% of the farmers kept goats for home meat consumption, 5% milked their does and 11% used the goats for bartering. There were only three breeding bucks out of 207 goats. Only three farmers kept an intact male, which was also loaned to other farmers for breeding purposes. Rotation of the breeding bucks among the farmers ensured that the does were mated only once per year. This was considered necessary to ensure that the breeding does have sufficient time to rebuild their bodies before the next breeding season. The intact males were the best ones, selected by the farmers as suitable for breeding. There were 168 kids born during the study period with an average of 16.8 kids per farmer and 1.1 kids per doe (Table 2). The average birth body weights for both males ( $3.9 \pm 0.1$  kg) and females ( $3.2 \pm 0.2$  kg) were observed. The body weight gain of  $59.8 \pm 0.6$  and  $55.7 \pm 1.8$  g/day for male and female Tswana goat, were observed respectively, during study 2. Kids in the Kgatleng had significantly lower ( $p < 0.05$ ) overall mean body weight than those in the Kweneng district in October while the body weights were similar for the other months. The overall mean live weight of males in the Kgatleng was 0.9Kg heavier than that of females while in the Kweneng district male body weight were 1.0Kg heavier than the females average body weight.

One third of the kids died before weaning. Most kids that had low birth weights ( $< 3.0$  kg) died before weaning. Diseases and parasites accounted for 44.6% of the deaths; predators, unknown causes and snake bites accounted for 26.8, 25.0 and 3.6%, respectively. Adult deaths accounted for 5.6% of the total mortality. Most of the wastage was experienced in singles (66.1%) while twins constituted 33.9% of the kids which died. The single batch of quadruplets were raised for the entire period of the study. More male kids (60.7%) died than females (39.3%). Labour and unavailability of feed constituted 30 and 50%, respectively, of the stated production constraints.

## Discussion

Most rangelands in Gaborone agricultural region offer potential for raising goats as is evident from the presence and availability of browse within the reach of goats, along with native grasses and a variety of other herbaceous forage, which is green in the rainy season. The availability and/or quality of fodder in the dry season limit the productivity of the goats. Although secondary metabolites such as tannins in browses may influence palatability and forage intake, Tswana goats are able to select a relatively high quality diet from the variety of foods available on the ranges. Similar observations were made by Ramirez and colleagues (1999) who reported that browse leaves contained more crude protein and calcium than grass and forbs, especially during the dry season.

With the male to female ratio of 1: 60 (compared to the recommended 1:40), one buck had 50% more breeding females than desirable (Malechek and Provenza, 1981). As breeding was spread across the 12 months of the year, the bucks were probably not over-stretched. The flock composition of 87% does, 11.6% castrates and 1.6% intact males observed in this study is similar to that reported by Mahanjana and Cronje (2000) in neighbouring South Africa who described a herd which consisted of 76.7% does, 15.8% castrates and 7.5% bucks. In both our study and those of Mahanjana and Cronje (2000) and Hussein and Horst (1996), does were preferentially retained in the system for breeding purposes. Castrates were either sold to the butchers for cash or slaughtered for home meat consumption, even though the main reason given for keeping goats was protection against crop failure.

Although goats are able to produce a relatively high milk yield per unit of live weight (Devendra, 1981), only 5% of the respondent farmers milked their goats. According to the farmers, the reason for not milking was to allow the growing kids to obtain adequate milk from their dams. This reason is similar to that reported by Hussein and Horst (1996) who noted that farmers in Bangladesh did not milk their goats so as to facilitate the kid's growth.

**Reproductive performance:** The number of kids born per doe during study 2 was less than half of births reported for Goudelopean Creole goats by Alexandre and colleagues (1999). The fact that the Tswana goats bred all the year round and experienced a long dry period characterised by low availability of forage may have been responsible for their low prolificacy. Compared to other local breeds like the Boer goat, Tswana goats have lower twinning rate. This characteristic may also be environmentally induced as Tswana goats, having evolved in a harsh arid environment, might have adapted to producing single kids to reduce demand for milk.

**Growth Performance:** Most kids that had low birth body weights ( $< 3.0$  kg) died before weaning. A similar trend was reported by Kusiluka and colleagues (1998) who reported high mortality in East African goat kids with birth body weights less than 3.0 kg. The birth body weights for both males and females were lower than those reported by Van Nierkerk and Casey (1988) for Boergoat kids in South Africa where female and male weighed 5.7 and 5.9 kg, respectively at birth.

Table 2: Type of births of Tswana kids under communal system in Kgatleng and Kweneng districts in the Gaborone agricultural district

Location	Name	Total	Singles (%)	Twins (pairs) (%)	Quads %	Female %	Male %
Kgatlang	A	19	11 57.9	4 42.1	-	10 52.6	9 47.4
	B	10	10 100	-	-	4 40.0	6 60.0
	C	12	12 100	-	-	5 41.7	7 58.3
	D	23	5 21.7	7 60.9	1 12.4	8 34.8	15 65.2
	E	13	7 53.8	3 46.1	-	11 84.6	2 15.4
Kweneng	F	11	5 45.4	3 55.5	-	7 63.6	4 36.4
	G	21	9 42.9	6 57.1	-	12 57.1	9 42.9
	H	23	13 56.5	5 43.5	-	12 52.2	11 47.8
	I	28	12 42.9	8 57.1	-	17 60.7	11 39.3
	J	8	4 50.0	2 50.0	-	4 50.0	4 50.0
	Total	168	88 52.4	76 45.2	4 2.4	90 53.6	78 46.4

Births: Females (%)=39.3; Males=60.7; Single=66.1; Twins=33.9

The body weight gain of for male and female Tswana goat, respectively, is lower than (65.2g/day) observed by Van Nierkerk and Casey (1988) for Boergoats. The difference, among others, appear to be genetic as Boergoat bucks are widely used for crossbreeding with Tswana does to take advantage of the faster growth of the former. The differences could have resulted from a number of factors including general management standards and availability of forages. The overall mean live weight of males in the study 2 was heavier than that of females (Table 2). A similar trend was reported by Sibanda and colleagues (1997) in Matebele goats where males were 0.3 kg heavier than females. The non significant difference in monthly weights are in contrast to observations made by Hussein and Horst (1996) who noted significant difference ( $p<0.05$ ) in mean live weights of males and females in different months for Black Bengal goats. However, the effect of district (location) on different sexes was significant ( $p<0.05$ ) with females in Kgatleng being 2Kg heavier than females in Kweneng. This indicated that there was need to improve growth of traditionally managed Tswana goats through supplementary feeding.

**Constraints and demographic parameters:** High mortality rate of kids resulted from diseases in study 2. Mmia and colleagues (1996) reported 49.2% disease related deaths in Black Bengal kids and adult goats in Bangladesh. Diseases have also been reported to be a limiting factor in goat production in the humid Tropics (Ogebe and colleagues, 1995). Unknown causes of mortality could possibly be attributed to poor mothering which may cause deaths of kids within 24-48 h of birth. Deaths due to poor mothering ability and hypothermia were made on East African kids (Kusiluka and colleagues, (1998). Non-availability of food was stated by 50% of the respondents as a limiting factor for Tswana goat production. This observation is similar to that made by Manteca and Smith (1994), Wilson and Murayi (1988) and Mmia and colleagues (1996).

Predators accounted for 26.8% of the wastage of kids. Most of the respondents did not have good housing for their animals. Consequently predators, especially jackals, snatched kids wandering outside the kraals. In some cases farmers reported predators attacking their animals even while they were in the kraal. Most farmers were unable to herd their goats because of old age and scarcity of labour although most of the attacks occurred when animals were out foraging. Similar loses were reported in South African communal grazing lands where local farmers are unable to follow up their flock to the grazing areas because of old age (Mahanjana and Cronje, 2000).

There is a high level of awareness of the negative effects of internal and external parasites on the health of animals. Despite this awareness the majority of farmers did not dip their goats nor drench them with anthelmintics. It was observed that farmers have a wrong perception that goats seldom fall sick. All the respondents listed parasite infestation as a major constraint to Tswana goat production. Farmers in both districts did not mention any land tenure related problems unlike those reported by Mahanjana and Cronje (2000) in South Africa who attributed their failure to practice controlled breeding to the communal land tenure system which does not allow fencing of grazing lands. Tswana goat production in the communal system may be improved by introducing preventive health care programme, as it is compulsory with cattle in Botswana. This would reduce disease incidence in goats and hence reduce kid mortality as well create a conducive environment for goats to fully express their growth potentials.

### Acknowledgement

The authors are thankful to the Botswana College of Agriculture for funding the project and all farmers that participated in the project.

## References

- Alexandre, G., J.C. Mainand, J. Fleury and M. Naves, 1999. Productive performance of Guadeloupean Creole goats during the suckling period. *Small Ruminant Res.*, 34:155-160
- Charray, J., J.M. Humbert and J. Levif, 1992. Manual of sheep production in the Humid Tropics of Africa. CAB International. Wallingford, Oxon OX10 8DE. U.K., pp: 142-143
- Devendra, C., 1981. The potential of sheep and goats in the less developed countries. *J. Animal Sci.*, 51: 461-473
- Hussein, S.S. and P. Horst, 1996. Study on growth performance of Black Bengal goats in different periods. *Small Ruminant Res.*, 21:165-171
- Kusiluka, L.J., M. Kambarage, L.J.S. Harrison, C. Daborn and J. Matthewman, 1998. Causes of morbidity and mortality in goats in Mogorogoro District, Tanzania. The influence of management. *Small Ruminant Res.*, 29: 169-172
- Mahanjana, A.M. and P.B. Cronje, 2000. Factors affecting goat production in a communal farming system in the Eastern Cape region of South Africa. *South African J. Animal Sci.*, 30:149-154
- Malechek, J.C. and F.D. Provenza, 1981. Feeding behaviour and nutrition on Rangelands. Proceedings of the International symposium on Nutrition and systems of goat feeding. Tours, France. 12-15 May. 1981, 1: 411-428
- Manteca, A. and A.J. Smith, 1994. Effects poor forage condition on the behaviour of grazing ruminants. *Tropical Animal Health and Production*, 26: 129-138
- Mmia, M.M., A. Ali and A.K.F. Bhuiyan, 1996. The reproductive performance of Black Bengal, Barbari x Black Bengal and Anglo-Nubian. *Indian Veter. J.*, 73: 1048-1052
- Mo, A., 1995. Botswana Agricultural Statistics. Government Printers, Gaborone, Botswana
- Ogebe, P.O., B.K. Ogunmodede and L.R. McDowell, 1995. Growth and reproductive characteristics of Nigerian Southern goats raised by varying management systems. *Livestock Res. Rural Development* 7: 183-190
- Ramirez, R.G., E. Rios and J. Garza, 1993. Nutritional profile and intake of forage grazed by Spanish goats in a semi-arid land. *J. Applied Animal Res.*, 3: 113-112
- Sibanda, L.M., L.R. Ndlovu and M.J. Bryant, 1997. Factors affecting growth and survival of Matebeleland goat kids in semi-arid environment under smallholder management. *J. Applied Sci. Southern Africa*, 3: 27-42
- SAS., 1995. User's guide: Statistical Analysis System procedures. SAS Institute, Inc, Cary, NC
- Van Niekerk, W.A. and N.H. Casey, 1988. The Boergoat. II. Growth, nutrient requirement, carcass and meat quality. *Tropical Animal Health and Production*, 21: 355-361
- Wilson, R.T. and T. Murayi, 1988. Productivity of the small East African goat and its crosses with the Anglo-Nubian and the Alpine in Rwanda. *Tropical Animal Health and Production*, 20:219-228