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Some production parameters and their associated risk rates in traditionally managed local Zambian goats.

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Abstract

This paper describes the flock population dynamics and the pattern of some selected production parameters for goats kept and maintained under traditional management in the Luangwa valley. A monthly questionaire survey was conducted over a period of twelve months to monitor flock inventory, kidding rate, mortality, slaughter, sales and purchases pattern in a group of twenty-five randomly selected farmers. All the investigated parameters appeared to have been influenced by seasonal effects. The average annual flock composition was 516 goats which consisted of 26% suckling animals, 34% rearing animals, 35% breeding, females, 1% breeding males and 4% castrates. The breeding male to breeding female ratio was l: 36. Two peaks in kidding rates (31%, 30%) were observed during the hot, dry part of the year (August to October) and the warm, rainy season (February to April) respectively. The least kidding rates (15% and 18%) were in the hot, rainy season and the cool, dry season respectively. The average flock prolificacy for the whole period was 1.36. The overall mortality risk rate for all the flock during the study period was 21.9%. The seasonal mortality risk rate was highest (13.3%) for the same flock during the hot, wet Part of the year and the animals were at least (1.4%) risk during the hot and dry season. The selling pattern of the animals suggested that most farmers prefer selling the biggest animal in the flock and about 64.6% of the animals at risk of being sold were breeding males. This was followed by the rearing males (31.1%) and castrates (12.5. Similarly, the slaughter pattern suggested rearing males as being the most affected class with risk rate of 56.4% followed by castrates (48.6%), breeding males (18.8%) and rearing females (13.2%).

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1 Introduction

Goats have been known to contribute to the subsistance of small and marginal farmers in tropical Africa by playing an important role in income generation, capital storage, employment generation as well as improving household nutrition (FAO, 1991).

According to the Livestock Census of 1993, Zambia has an estimated goat population of 633,000, located mostly in the semi arid, drought prone and tsetse infested areas of Southern and Eastern provinces (DAPH, 1993). It is estimated that over 60% of the country's goat population are found in the Gwembe and Luangwa valleys of the semi-arid region (VIBETTI, 1990). These areas are characterised by low land productivity, poor crop production and cattle do not thrive because of trypanosomosis and poor nutrition. Goat production is one of the main occupations in these areas and is the way of utilising the marginal lands (LOVELACE, 1998).

Goats play an important socio-economic role in the traditional village life of most Zambian rural households. As other livestock, goats are kept as a symbol of wealth and regarded as capital resource measured in numbers, however, they are only sold to meet specific requirements (LOVELACE, 1989) and are an important source of income and for consumption. It is difficult to ascertain the actual contribution of goats to the Zambian national income as most goats are sold through informal markets and hence go unrecorded. In general, goats contribute to the stability of farm incomes because they can easily be bought following good crop performance and sold during crop failure, which is characteristic of the communal areas (LOVELACE, 1998).

The major constraints to goat production in Zambia are a combination of technical, economic, institutional and socio-cultural factors (CHILONDA, 1996). Goats are viewed as a poor man's livestock, rather than as a valuable animal. They are regarded as having low prestige and are mainly concentrated in poorer marginal areas on peasant farms. This study was undertaken to assesses the productivity and the potential role of goats in Zambia with a view to propose strategies for the realisation of goat potential in alleviating the shortage of food of animal protein origin in the semi-arid areas of the country.

2 Materials and methods

2.1 Selection of farmers and dala collection

The study area covers the drought and flood prone Luangwa district in the Zambezi valley, Southern province of Zambia. The valley lies between Latitude 16-18 degrees South and 26-29 degrees East of the Equator. Luangwa lies at the confluence of the Zambezi and Luangwa rivers. The area is described as semi-arid and is characterised by a short growing season of 80 to 120 days and hot humid temperatures and low rainfall (less than 500 - 800 millimeters average annual rainfall). The area experiences 30 to 50 days of drought during the growing season with a wide range of physical and chemical soil properties which are limiting to crop production. The typical vegetation is dominated

by Miombo woodland savannah covered by *Brachystegia* and *Julbernadia* trees with *Hyperrhenia* grasses.

A group of twenty-five farmers in the Luangwa district were randomly selected for this study. Assessment of flock inventory and productivity was carried out through a questionnaire survey conducted monthly over a period of twelve months from August 1996 to July 1997. The data was entered an Panacea (Pan Livestock Services Limited, UK) and analysed an Panacea and MS Excel.

2.2 Data analysis

The goats were classified an the basis of sex as follows:

Class (Sex)
Suckling Males (SM)
Suckling Females (SF)
Rearing Males (RM)
Rearing Females (RF)
Breeding Males (BM)
Breeding Females (BF)
Castrated Males (CM)

The one year survey period was divided into the following climatic seasons for the purpose
of this analysis,

Season One:	August to October	(Hot and Dry)
Season Two:	November to January	(Hot and Rainy)
Season Three:	February to April	(Warm and Rainy)
Season Four:	May to July	(Cool and Dry)

Productivity parameters examined were kidding rate, prolificacy, mortality, slaughter, sales and purchases. The estimates of each of the parameters, mortality, sales and slaughter were calculated as risk rates. Daily incidence rates were calculated by dividing the number of individuals having the characteristics during the time interval of observation by the number of animal-days. These were multiplied by 91.25 days to convert them into seasonal incidence rates (For annual rates, daily rates were multiplied by 365). The number of animal-days is the sum of the number of days that each animal was present in the population during the period of observation (PAN Livestock, 1991). These rates are known as true rates.

Risk rates are calculated as proportions, providing a direct estimate of the probability as defined in statistics of an animal experiencing the event of interest during a time period (MARTIN *et al.*, 1987, ROTHMAN and GREEN, 1998). If the true rate is available the formula to convert it to a proportion (risk rate) is:

Risk Rate = $1 - e^{-rt}$

where e is the base of natural logarithm, r is the true rate and t is the time period of interest.

3. Results

3.1 Flock structure

The average annual flock structure for one year for all the 25 farmers is presented in Table 1. The average annual breeding male to breeding female ratio was 1:36. The starting flock was 543 goats, which consisted of 156 suckling animals, 157 rearing animals, 201 breeding females, 12 breeding males and 17 castrates.

Table 1: Average annual flock structure

Class		SF	RF	BF	SM	RM	BM	CM
Number	516	76	141	181	56	35	5	23
Percent	100	15	27	35	11	7	1	4

3.2 Kidding rate

Seasonal kidding rate is defined as the total number of kiddings in a season per total number of breeding females in that season. The highest kidding rate (KR) of 31% was recorded during season one (August/October). This is significantly different from the 15% and 18% KRs for season two and four respectively, but similar to the 30% KR in season three. The overall average KR was 94%.

Table 2: Seasonal kidding pattern

	BF	Kids	No. part	Kids/Part	KidsBF	PartBF(KR)
Season 1	193	67	59	1.14	0.35	0.31
Season 2	170	39	25	1.56	0.23	0.15
Season 3	172	85	52	1.63	0.49	0.30
Season 4	189	41	34	1.21	0.22	0.18
Overall the year	181	232	170	1.36	1.28	0.94

3.3 Prolificacy

Prolificacy is defined as the total number of births divided by the total number of parturitions.

Total parturitions	170
Total animals born	232
Prolificacy	1.36

3.4 Seasonal Mortality

$$\text{True rate (r)} = \frac{\text{Number of deaths x 91.25 days}}{\text{No. of animal-days in that group}}$$

The seasonal pattern of mortalities expressed as Risk Rates (RR) for the different classes of animals, is illustrated in Table 3. The overall RR for all classes of animals was 21.9%. All classes of animals were at a higher risk of experiencing the event in season two (13.3%). Mortality is more likely to be experienced by suckling animals as they have the highest risk rates.

Table 3: Seasonal mortality (% per season per class)

	SF	RF	BF	SM	RM	BM	CM	Overall %
Season 1	1.3	2.2	1.2	1.8	0	0	0	1.4
Season 2	19.9	5.6	9.8	24.5	21.6	20.8	3.5	13.3
Season 3	15.7	3.2	1.1	13.2	3.3	0	0	5.5
Season 4	4.7	3.2	1.6	4.0	2.5	0	0	2.7
Overall %	21.2	13.2	13.9	22.8	31.1	34.0	4.3	21.9

3.5 Seasonal Sales

The breeding and rearing males were most at risk of being sold from the flock as illustrated in the Table 4 below. Animals were more likely to be sold in season two (3.8%) and season three (2.3%) than during other seasons, however overall sales were low.

Purchases by the farmers for the whole 12 months were only 8 RF (6%) and 7 BF (4%) bought for increasing the size of the herd.

Table 4: Seasonal sales pattern (% per season per class).

	SF	RF	BF	SM	RM	BM	CM	Overall %
Season 1	0	0	0	0	0	0	0	0
Season 2	0	1.6	1.5	1.5	16.2	37.3	10.2	3.8
Season 3	0	3.2	1.2	0	12.7	28.8	0	2.3
Season 4	0	1.3	0.5	0	2.5	0	0	0.8
Overall %	0	6.2	3.3	0.9	31.1	64.6	12.5	6.9

3.6 Seasonal slaughter

The overall seasonal slaughter record during the period reveal that the rearing males are most likely to be at risk of being slaughtered followed closely by castrates. Suckling animals are least likely to experience the event. The highest number of goats slaughtered belonged to the rearing male class (39%), breeding males (25%) and castrated males (19%). The animals were most often slaughtered in seasons two and three, the wet seasons.

Table 5: Seasonal slaughter pattern (% per season per class)

	SF	RF	BF	SM	RM	BM	CM	Overall %
Season 1	0	0	0	0	3.8	0	17.1	1.0
Season 2	1.2	4.0	2.5	3.1	18.1	11.0	19.3	5.2
Season 3	0	6.3	1.2	0	23.8	0	22.5	4.8
Season 4	0	3.2	1.1	0	24.2	0	0	3.4
Overall %	0.6	13.2	4.9	1.8	56.4	18.6	48.9	13.9

4. Discussion

Goat production in Zambia is mainly at subsistence level, which involves the production of a few goats to meet the domestic needs mainly for meat and family cash income. Goat management is minimal with the animals being allowed to browse freely during daylight hours and confined within fences or huts at night. Tethering is common especially during the rainy season to prevent damage to crops (LOVELACE *et al.*, 1993). There are no special attempts to control reproduction and animals receive virtually no veterinary care. The average annual breeding males: breeding female ratio was 1:36 which is favourable under the extensive production system and is different from the figures of 1:12 for Swaziland (LEBBIE and MANZINI 1989). The recommended male to female ratio for goats under traditional production system is 1:25 (WILSON and DURKIN, 1988).

The annual flock composition is dominated by female animals with breeding, rearing and suckling females contributing 35%, 27% and 15% respectively. All classes of male animals constituted only about 23% of the flock. This is similar to the findings in Mali for goats kept under traditional management (WILSON and LIGHT, 1986). Studies in Swaziland also reported similar flock composition of 70°,% females and 30% males (LEBBIE and MANZINI, 1989).

Two peak kidding rates were recorded in this survey. One during August/October season (31%) and the second in February/April (30%) season. The peak in August/October could largely be due to improved conception rates as a consequence of better nutrition during the early part of the dry season. This period coincides with part of the dry season when animals have unlimited access to crop residues from harvested fields. During the rainy season, farm crops are protected and goat grazing is limited sometimes by tethering. Kidding in the dry season is also advantageous because the level of some diseases, e.g. worm infection, especially gastrointestinal nematodes, is lower (Nalubamba, 1996). The average litter size was 1.36 kids (Table 2). This is similar to that reported for large African goats in Sudan (WILSON, 1976).

There was high variation in mortality with risk rates ranging between 13.3% and 1.4%. About 13.3 per cent of all classes of animals were at risk of dying during season two (November to January)) and this period coincides with the hot, wet season of the year in Zambia. The young suckling animals were the most vulnerable group as they suffered heavily both from disease and predators. The predators reported by farmers were in

Order of importance, crocodiles, dogs, hyenas and baboons. The variations in mortality could be attributed to seasonal effects and the extensive nature of the management under which the goats are kept.
The animals suffer from insufficient feed, inadequate disease control and prevention measures which characterise the extensive production system. Insufficient nutrition due to restricted feeding increases disease susceptibility (MAIGA, 1992). During the rainy season, which is the crop growing season, goats are usually allowed to feed for shorter periods of time and several forms of restricted feeding like confinement without supplementation are practiced. This results in low growth rate even death. Kids are the most vulnerable group of the flock and any attempt made to ensure their survival is bound to increase productivity and economic returns to the farmer.

The majority (35%) of the animals sold belonged to the rearing male class with most marketing activities being conducted during the November/January period. This period coincides with a number of festivities in Zambia and goats are offen used for social occasions and therefore the animals are in high demand. The farmers report that they prefer to sell the biggest goats (LOVELACE *et al.*, 1998). The highest risk rate (3.8%) for all classes of animals was observed during the November to January season (Table 4).The period also coincides with the rainy season, which is accompanied by shortages in the staple foods especially maize. Many goat keepers therefore sell their animals in order to earn some income to purchase food. The month of January is also the time when school children go back to school after long holidays. The parents need cash to pay for their children's school fees and buy school uniforms and goats are easily convertible into cash. The rainy season is a period of increase in disease, especially gastrointestinal worms, so some farmers sell to avoid losses due to diseases.

Most goat owners who practice extensive production systems prefer to maintain a manageable flock size. The major management practice used to achieve this objective is by early culling of males not required for other production purposes. According to this survey, the rearing and breeding males constitute the highest in terms of the total number of animals slaughtered in a season. This finding is in line with the findings of WILSON and DURKIN (1988) who established that under rural production systems, more males of breeding and rearing age are sold off or slaughtered for home consumption.
The male goats grow faster than the female goats (CARBES, 1985) and hence reach slaughter weight faster so that they are more frequently slaughtered. The female goats are mostly retained for breeding since the greater the number of breeding female goats, the faster the increase in flock size due to increased number of parturitions (WILSON, 1989). However the farmers reported slaughtering females after 5-6 kids, or females whose offspring are weak sometimes due to inherent genetic characteristics.

5 Conclusion

There is potential for improvement in goat production in the semi-arid areas, but efforts should concentrate on reducing risk factors that could cause mortality and other forms of losses. This can be achieved through improved management. This should be accompanied by increased incentive from an improved marketing system.

6 References

CARBES A.B., 1985: Factors affecting the growth of sheep and goats in Africa. In:Wilson, R.T. and Bourzat, D. (Editors). Small Ruminants in African Agriculture. ILCA, Addis Ababa, Ethiopia,. pp. 34-44.

CHILONDA P., 1996: Roles of Cgoats in communal areas of Southern Africa. MSc Thesis, University of Ghent, Belgium.

DAPH, 1993: Department of Animal Production and Health, Government Republic of Zambai, Annual Report, Lusaka, Zambia.

FAO, 1991: Small ruminant production and the small ruminant genetic resource in tropical Africa. Food and Agriculture Organisation, Animal Health Paper 88, Rome Italy, pp 231.

LEBBIE S.H.B. and MANZINI A., 1989: The productivity of indigenous goats under traditional management in Swaziland. In: WILSON R.T. and AZEB MALEKU (Editors), African Small Ruminant Research and Development. ILCA, Addis Ababa, Ethiopia, pp 39-50.

LOVELACE C. E.A,1989: Small ruminants in Zambia. A Review. University of Zambia Research report.

LOVELACE C.E.A., VAZ Y., MUKUKA J., SIMUKOKO H. and CHITAMBO H., 1998: The marketing chain for goats from farms in the Zambezi Valley in Zambia. The Proceedings of the BSAS/KARI International Conference an Food, Lands and Livelihoods, Nairobi Kenya. Published by BSAS, Edinburgh, pp30-31.

MAIGA S., 1992: Small ruminant morbidity and mortality in the Delta of Niger, Mali. *Small Ruminant Research* 9, 181-188.

MARTIN S. W., MEEK A. H. and WILLEBERG P., 1987: Veterinary Epidemiology-Principles and methods. Iowa State University Press, USA, pp. 48-59.

NALUBAMBA K. S., 1996: The epidemiology of gastrointestinal nematodes in goats in the traditional grassland of Zambia. MSc Thesis, University of Zambia, Lusaka.

PAN Livestock Services, 1991: Livestock Production Efficiency Calculator-User Guide. PAN Livestock Services Ltd. Reading, U.K. Pp 63-66.

ROTHMAN K. T. and GREENLAND S., 1998: Modern Epidemiology. Lippincott-Ravar Publishers, pp 29-46.

VIBETTI Y., 1990: Characterization and production constraints identification among Gwembe Valley Goats. BSc Thesis, University of Zambia, Lusaka.

WILSON R.T. and DURKIN J. W., 1988: Small ruminant production in central Mali: Reproductive performance in traditionally managed goats and sheep, *Livestock Prod. Sci.* 19, pp. 523 - 529.

WILSON R. T., 1989: Reproductive performance of indigenous small ruminants under various management systems: a review. *Animal Reproductive Science* 20, pp. 265-286.

WILSON R.T., 1976: Studies on the livestock of southern Darfur, Sudan. IV. Production traits in goats. *Trop. Anim. Hlth Prod.* 8, pp. 221-232.

WILSON R. T. and LIGHT. D., 1986: The livestock production in central Mali: Economic characteristics and productivity indices for traditionally managed goats and sheep. *J. Anima. Sci.* 62, pp. 567 - 575