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Bottleneck analysis of sheep production systems in southern Ethiopia: Comparison of reproductive and growth parameters

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Abstract. Over the course of one year, 155 households with small ruminants were monitored and the life histories of adult ewes were recorded at two sites of southern Ethiopia, in order to compare reproductive and growth performance and identify entry points for future improvement. A more scrupulous health care, particularly of lambs, and strategic feeding to improve fitness of animals were detected as areas of potential change provided that economic analyses confirm their efficiency.

Keywords. Sheep – Ethiopian highlands – Mixed-production system – Performance parameters.

Analyse du goulot d'étranglement des systèmes de production ovine dans le sud de l'Éthiopie : Comparaison de performances de reproduction et de croissance

Résumé. Un suivi de 155 exploitations élevant des petits ruminants, complété par des études des carrières de brebis adultes, a été effectué dans deux zones du sud de l'Éthiopie afin de comparer les performances de reproduction et de croissance et d'identifier les éléments pertinents pour l'amélioration future. Les domaines où des changements sont à réaliser, à condition que les analyses économiques confirment leur efficacité, ont été identifiés : une conduite sanitaire plus attentive, particulièrement pour les agneaux, et une alimentation stratégique pour améliorer l'état physique des animaux.

Mots-clés. Ovins – Hauts plateaux d'Éthiopie – Système de production mixte – Indicateurs de performances.

I – Introduction

Small ruminant production in the Ethiopian highlands is under pressure. The demand for live animals is increasing due to the growing urban population, while farm areas are shrinking considerably as a result of an increase in the rural population. Reproductive and growth performance traits are of great importance when meat production for sale or household consumption is becoming the primary production objective (Kosgey *et al.*, 2003). The purpose of this study was to compare the reproductive and growth performance of sheep in two mixed-systems of southern Ethiopia, thereby identifying options for improving animal and therewith system productivity.

II – Material and methods

The study covered two locations, which were each considered to be representative of a production system. The Kofele area represents food-sufficient highlands, with a medium population density and better agricultural potential with higher flock sizes. The Adilo region represents the most densely populated areas that are food insufficient and with lower agricultural potential. Tethering and fattening of small ruminants is more common in Adilo. A one-year monitoring was conducted on 155 representative flocks in the two sites. The selection was based on a previous single-visit survey of 400 households (Legesse *et al.*, 2008). A total of 833 small ruminants were ear-tagged at the beginning. The flocks were visited bi-weekly.

Records were taken on reproduction, mortality and growth performance. The life histories covered 224 mature ewes, owned by participating households. The purpose was to assess the major events that occur during their life span, including way of entry, abortions and udder problems, so as to overcome limitations of a restricted monitoring period. Pre-weaning mortality was obtained by relating number of deaths before weaning to the number of animal-units (derived from the aggregation of the total number of days present for all individual lambs) from birth to weaning (*i.e.* 90 days). Annual reproductive rate was calculated as the number of lambs weaned per ewe of reproductive age per year. Analysis of variance was conducted on the factor location. Only data on sheep will be presented as goats, present in Adilo only, were less frequent.

III – Results and discussion

The comparison of reproductive and growth performance traits revealed significant differences between the two locations (Table 1). The older age at first lambing in Adilo may be attributed to the reported lack of breeding rams in the regions, aggravated by the common tethering practice. The higher birth, weaning and adult weights may further indicate that Kofele ewes are generally ahead in body development resulting in earlier puberty. The higher birth and weaning weights for lambs in Kofele could be due to better feed availability and lower twinning rate. The significantly higher litter size in Adilo sheep may be due to the selection of more prolific ewes by the farmers or further differences in management practices. The present performance values for growth and reproduction generally fall within the range of reported values for African sheep (Wilson, 1989; Dibissa, 2000; Mukasa-Mugerwa *et al.*, 2002; Tibbo, 2006).

Table 1. Reproductive and growth performance traits of sheep in the two study sites

Trait	Adilo			Kofele			P-value
	n	LSmean	SE	n	LSmean	SE	
Reproductive performance							
Age at first lambing (months)	24	14.6	0.8	81	11.8	0.4	0.0026
Litter size (head)	108	1.42	0.05	332	1.24	0.03	0.0110
Pre-weaning mortality rate (%)		19.5			20.0		n.s.
Annual reproductive rate (ARR) [†]		1.37			1.19		
Growth performance							
Birth weight (kg)	106	2.3	0.1	201	2.9	0.1	< 0.0001
Weaning weight (90 days) (kg)	60	10.9	0.3	131	11.8	0.4	0.0217
Adult ewe weight (36 months) (kg)	73	27.9	0.6	151	29.3	0.4	0.0416

[†]The average value of 10 months of lambing interval was considered for ARR calculations based on limited observations from the life-history survey and the monitoring, corresponding to literature values.

Eight percent of ewes in Kofele and 12% of ewes in Adilo were reported to have had at least one abortion in their life time. The frequency of udder problems reported in Adilo was also significantly higher ($P < 0.05$) than that in Kofele. The findings suggest that hygienic management in Adilo lagged behind that in Kofele presumably due to the restricted movement of animals and their housing with large ruminants during the night. Although feed shortage has been reported in Adilo, daily weight gains of lambs until weaning did not differ significantly between sites and were around 97 g for both.

IV – Conclusions

Improved post-weaning nutrition may shorten the period until first lambing in Adilo, whereas strategic feeding of the pre-mating ewes may advance prolificacy in Kofele. Lamb mortalities of

about 20% were a common constraint, calling for more rigorous care of the lambs to improve the overall productivity of sheep. Yet, an economic analysis is required to test if any change is worthwhile.

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