Proceedings, 10th World Congress on Genetics Applied to Livestock Production

Economic Analysis of Cross Breeding Programs for Indigenous Goat Breeds in Uganda

R. Onzima [*] [†], **A. R. Aheisibwe** [†], **B. K. Katali** [†], **E. Kanis** [*] **and J. A. M. van Arendonk** [*].
[*]Animal Breeding and Genomics Centre, Wageningen University, The Netherlands, [†]Kachwekano Zonal Agricultural Research and Development Institute, National Agricultural Research Organization, Kabale, Uganda

ABSTRACT: This study evaluates the economic viability and profitability of crossbreeding programs for improving indigenous goat breeds under smallholder subsistence production systems in Uganda. A survey was conducted among 156 households in 4 districts of South Western Highlands Agro-Ecological zone where cross-breeding programs have been implemented to assess the economic potential of improved and indigenous goats. Farm input and outputs in improved and indigenous goat production systems, coupled with information from secondary literature was utilized in an economic analysis to compare the two genotypes. Gross margin analysis revealed that cross breeding is overall beneficial, but under the smallholder subsistence system, the economic benefits are not significant. It is therefore concluded that to realize the full genetic potential of the crossbreds, the genetic improvement of the indigenous breeds needs to be accompanied by improved management.
Key words: cross breeding; goats; gross margin; genetic potential

Introduction

Agriculture is the main stay of the Ugandan economy, accounting for 43% of the national Gross Domestic Product (GDP). The livestock sub-sector, in particular, accounts for 4.7% of the national GDP and 12.7% of the agricultural GDP in 2009 (MFPED, 2009 unpublished). Goats are the second most important livestock to cattle in socio-economic contribution to the livestock sector of the agriculture GDP of Uganda, accounting for 8% of the total red meat production (Lapenga et al. (2009)).

Peacock, (2008), shows that the biggest growth in goat populations in sub-Saharan Africa is in smallholder mixed farming systems in the highlands of East Africa. In these areas, population pressure and land fragmentation have led to increasingly small farms unable to support cattle production. As a result, farmers are turning to small ruminant production, particularly goat rearing. The goat (*capra hircus)* is considered one of the key enterprises in poverty alleviation because of the low start-up capital and maintenance costs, ability to survive on marginal land and crops residues and thus can easily be integrated in the crop-livestock production system under most smallholder systems in Uganda. Moreover, the goat can readily produce usable quantities of milk and meat using family labour especially from women and children for the routine management activities (Papachristoforou and Markou (2006); Peacock, (2005)).

The goats in Uganda, like in several developing countries, are a source of meat, milk and income, hence ensuring nutrition and food security and, they are a source of insurance against vagaries of nature like total crop failure (Castel et al. (2010); Kosgey et al. (2008); Peacock, (2005)).

The goat population in Uganda is dominated by indigenous breeds mainly comprised of Kigezi, Mubende and Small East African (SEA) goats. The indigenous goats make up approximately 98% of the total goat population of 12.5 million (MAAIF and UBOS, (2009)). They are characterized by slow growth, small carcass weight and are generally not improved for commercial meat production. The government of Uganda, in an attempt to improve the indigenous breeds for meat, adopted a strategy of cross breeding with Boer goats, an exotic South African breed. This has had a limited impact on the livelihood of smallholder farmers for two reasons. First, there is low acceptance of the crossbreds because they are not adaptable to the agro-ecological conditions. Second, they require a more stringent management regime, which is beyond the affordability of the smallholder farmer.

The efficiency of Boer goats and their crossbreds in the smallholder farming systems is currently unknown to policy and technical people, and the current lack of acceptance of the breed is based on speculation and there is no formal analysis done on benefits of the breed to the farmer. The current study was, therefore, designed to evaluate the profitability of genetic improvement of the indigenous goats and exotic Boer goats, and their crossbreds using gross margin analysis.

Materials and Methods

Study area. The study was conducted in four districts of south western Uganda: Kanungu, Kabale, Kisoro and Rukungiri. These districts lie within the South Western Highlands Agro-Ecological zone of Uganda. The area is characterized by high population density and small land holdings due to fragmentation. Therefore, grazing land is a main constraint for production of goats (Wagoire and Kashaija, 2008, unpublished). In each district, three sub-counties were randomly selected from which respondents were chosen.

Study design and type of data. The study involved 156 households spread over the four selected districts where there have been strategic improvement programs for the indigenous goat breeds, mainly Kigezi goats. The farmers were mainly mixed crop-livestock and

largely subsistence farmers. The goats were kept for multiple breeding objectives, including animals being kept mainly for manure for improving soil fertility for crops. Both primary and secondary data were used in the study. Primary data were obtained using structured survey questionnaires, while secondary data were obtained using review of available literature from the districts on production, economic and demographic data, statistical publications from research stations and national databases. The required sample size was determined using three important parameters: degree of precision (reliability) desired for the survey estimates; the cost and operational limitations; and the efficiency of the design.

Inputs, outputs and analytical models. Primary data collected from households were analyzed to generate comparative statistics, and input and output data were then analyzed using gross margin (GM) analysis. The GM was calculated as the gross income of an enterprise minus variable costs (Putt et al. (1987)), presented as:

$$GM = \sum_{i=1}^{n} Y_i P_{y_i} - \sum_{j=1}^{m} X_j P_{x_j}$$

Where:

GM = gross margin in Uganda shillings of a livestock unit over a given period of time. In this study, 2012 was considered as a base year.

$\sum Y_i P_{y_i}$ = total gross aggregate income by summarised sale of *n* goats and products

Y_i = quantities of the products sold.

P_{y_i} = farm gate price of goats and products over 1 year

$\sum X_j P_{x_j}$ = total of *m* variable input category costs

X_j = is the quantity of the j^{th} variable input per hectare or per unit of livestock used in production and management

P_{x_j} = unit cost of inputs used.

Farm gate prices of goats. The price received by a farmer for goats sold in a particular period was structured according to the various characteristics of goats to ensure that the value of goats reflects the attributes they possess. These characteristics include: body weight, age, size, breed and sex of the goats.

Costs of inputs. The costs of various inputs used in goat production were determined by costs of family labor, hired labor, material inputs such as drugs and vaccines, pesticides, feeds, housing facilities/structures, fencing, veterinary services, goats bought and raised on the farm and bucks used for breeding (buck service).

Results and discussion

The household characteristics are shown in Table 1. The study revealed that 97% of the selected households kept Boer goats and their crossbreds together with indigenous breeds. A small proportion (3%) kept only pure indigenous breeds. This could be attributed to the fact that the selected farmers had access to extension information and could use improved technologies from the research station. 96% of households were individual farmers, the other households belonged to cooperatives/ groups and goat production was jointly run by the members. Farming was considered the main source of income (88%), while small scale business and formal employment were other sources of income in the households studied. This corresponds to the national average, where farming and agriculture as a whole are the main stay of the population (MFPED, 2009). However, a large percentage (88%) was involved in goat production for sale. This represents a major paradigm shift where smallholder agriculture has been for subsistence. The fact that the farmers sell their goats has implications for the expected traits in the breeding goal.

Table 1: **Household characteristics of the farms**

Parameter	Variable	Proportion(%) n=156
Breed	Improved	97.0
	Local	3.0
Farm ownership	Individual	96.0
	Group	4.0
Income source	Farming	88.0
	Small scale trade	7.0
	Formal Employment	3.0
	Others (Savings & credit, Revolving fund)	2.0
Marketing of products	Subsistence	18.7
	Semi-commercial	78.7
	Commercial	2.6

Gross Margin Analysis. Table 2 presents the gross margins for improved and local goats. It shows that Boer goats and crossbreds (improved) generated a better margin compared to the indigenous goats, but the difference between the average profit from improved goats and the average profit from indigenous goats is however not significant ($p > 0.05$). Ayalew et al.(2003) found similar results with indigenous goats in Ethiopia. The slightly better gross margin observed in the improved breeds could be the result of heterosis and additive genetic effects. The gross margin per household was better for the improved goats compared to the indigenous goats.

Table 2: **Gross Margin for Improved and Local goat genotypes (Uganda Shillings, 000)[1] for 2012**

	Parameter	Improved	Local
a	Number of households	153	156
b	Live goat sales	31,608.00	29,093.50
c	Meat sales	1,257.00	835.00
d	Breeding service	12.00	0
e	Manure sale	70.00	20.00
f	Total income at year end (b+c+d+e)	32,947.00	29,948.50
g	Labour	40.73	40.94
h	Feed cost	7.55	7.93
i	Veterinary services	26.25	15.12

j	Breeding service	11.39	19.01
k	Housing	23.78	22.06
l	Total costs (g+h+i+j+k)	109.70	105.06
m	**Gross margin (f-l)**	**32,837.30**	**29,843.44**
n	Number of goats	796.00	939.00
o	Livestock units (LU)[2]	159.20	112.68
p	**Gross margin/household**	**214,622.88**	**191,304.10**

[1]All financial parameters are expressed in Uganda Shillings (Ushs ,000) (1 US dollar ($) =2500 Ushs at time of the study in 2012).
[2]Average body weight of improved goats = 50kg, Average body weight for local goat= 30kg, 1 LU= 250Kg

These findings confirm that there is potential for cross breeding to increase the genetic potential of indigenous breeds through crossbreeding in the short-term. However, the genetic improvement is not sustained under the smallholder farmers' condition. To realize the full genetic potential of the improved breeds, there is a need to accompany crossbreeding with an improvement in the production environment in terms health, feeding and housing. The costs of these inputs are not affordable by most smallholder farmers. This could partly explain why the farmers still maintained their indigenous breeds together with the improved breeds despite the extension and research information on improved goat breeds.

Conclusion

In conclusion, cross breeding of indigenous goats with exotic goats does not necessarily result in improved marginal benefit in goat production systems. Cross breeding benefits can only be realized with an improvement in the production environment of the smallholder farmers.

Indigenous goat breeds are preferred over the improved goats, therefore, interventions targeting selection programs within indigenous breeds has potential for sustainable impact on smallholder goat farmers.

References

Ayalew, W., Rischkowsky, B., King, J. M., et al.(2003). Agricultural Systems. 76: 1137-1156

Castel, J. M., Ruiz, F. A., Mena, Y., et al. (2010). Small Ruminant Research. 89: 207-210

Kashaija, I. N., and Wagoire, W. (2008). Report - Farming Systems Study

Kosgey, I. S., Rowlands, G. J., van Arendonk, J. A. M., et al. (2008). Small Ruminant Research. 77(1), 11-24

Lapenga, K. O., Ebong, C., and Opuda-Asibo, J. (2009). Journal of Animal and Veterinary Advances. 8(10): 2004-2008

MAAIF and UBOS. (2009). Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and Uganda Bureau of Statistics. Census report

MFPED. 2009. Ministry Finance, Planning and Economic Development - Uganda, Annual report

Papachristoforou, C., and Markou, M. (2006). Small Ruminant Research. 62: 193-199

Peacock, C. (2005). Small Ruminant Research. 60:179 -186

Peacock, C. (2008). Small Ruminant Research. 77: 225-238

Putt, S. N. H., Shaw, A. P. M., Woods, A. J., et al. (1987). ILCA (International Livestock Centre for Africa). ILCA 3: 83-92