Comparison of economic values without and with risk for breeding objective traits derived from producer's preferences

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Introduction

In the tropics, goat improvement programmes that are based on exotic breeds have seldom been successful due to, inter alia, the inappropriateness of the resulting genotypes with the farmers' breeding objectives and the production and marketing systems (Ayalew et al., 2003; Kosgey et al., 2006). There has been inadequate involvement of farmers at every stage in the planning and operation of breeding programmes, and their practices, behavior, values and objectives have rarely been integrated (Sölkner et al., 1998; Kosgey et al., 2006; Bett et al., 2009c). Only few studies on breeding programmes have incorporated farmers' preferences into breeding objectives (Tozer and Stokes, 2002; Nielsen and Amer, 2007) or have expected outputs consistent with the farmer's objectives and driven by incentives from the market to justify the farmer's investment (Kosgey, 2004; Bett et al., 2009a). Uncertainty over future product prices is also an important component to be considered when developing breeding objectives (Kulak et al., 2003). This involves including producers' risk preferences in the definition of breeding objectives because of its influence on the cost-benefit analysis of the breeding programmes and selection decisions (Kulak et al., 2003; Pruzzo et al., 2003). The objective of this paper was to assess the influence of incorporating risk in estimation of economic values for breeding objective traits derived from producer's preferences.

Materials and methods

The Dairy Goat Association of Kenya (DGAK) programme established by the German Technical Cooperation (GTZ) in collaboration with the Ministry of Livestock and Fisheries Development in 1992 was taken as a case study. However, it should be noted that the results of this study can be applied in other programmes applying similar breeding strategies. The programme utilizes imported German Alpine male goats as the foundation stock for crossbreeding with the Kenyan local goat breeds (the Galla and Small East African). A 2-way crossbreeding strategy was adopted where local goats were improved through upgrading to 87.5% Alpine blood level.

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In the DGAK programme, four genotypes are present, namely (a) original stock or local goat breeds with 0% German Alpine blood level (OS-0%), (b) F1 crossbreds with 50% German Alpine blood level (F1-50%) (c) F1 backcross to 75% German Alpine blood level (R1-75%) and (d) R1 backcross to 87.5% German Alpine blood level (R2-87.5%). Based on these, four schemes were defined. Scheme 1 only utilizes OS breeds. The scheme also produced purebred local females and males (OS-0%) for own replacements, which were accounted for. Additionally, young F1 (50%) female progeny produced in this scheme were assumed to move to scheme 2 as breeding stock. The other schemes 3 and 4 are similar to scheme 2, but utilised R1 and R2 crosses, respectively.

Component traits identified through ranking techniques from farmer's perception (Bett et al., 2009b), were used for estimation of economic values with and without risk (see Bett, 2009). Risk was incorporated following the procedures of Robinson and Barry (1987) and Kulak et al. (2003). Both deterministic and stochastic simulation models were used in the study. In addition, some of the economic parameters were derived using Contingent Valuation procedures (Bett et al., 2009a).

Results and discussion

Returns from crossbreeding were optimal in scheme 3 (75%) and about 46% more than when smallholder farmers kept local goats under improved husbandry conditions (scheme 1). This suggests that crossbreeding would improve the profitability of the smallholder farms, but not beyond 75% grade level. Upgrading to 87.5% (scheme 4) resulted in a 2% loss in profitability whereas producers would sacrifice 23% of their profits to remain in scheme 2 (50%). Optimal EVs for DMY were predicted in scheme 4 and EVs for the rest of the traits were most favorable in scheme 2. This trend in profits and EVs indicates that output from milk as a single trait is significant but not very dominant. Larger EVs predicted for LW in all the schemes plus ADG in schemes 1, 2 and 3, provide more proof and eliminates the assumption that dairy goats in the smallholder farms can be targeted for single purpose roles. Sale of animals for meat or breeding have been reported as equally, if not, more important objectives for keeping dairy goats (Ayalew et al., 2003; Bett et al., 2009b). Desirable EVs predicted for DMY at 87.5 % grade level can be associated with additive effects resulting from upgrading towards the breed with superior dairy merits. However, a general decline in magnitude of EVs when crossbreeding was done beyond 50% (scheme 2) could be explained by a significant deterioration in the performance of backcrosses (R1 and R2), due to lack of adaptation to tropical conditions (Cunningham and Syrstad, 1987).

Variance of profit is one component that distinguishes simple profit models from certainty equivalent profit (risk-rated) models (Kulak et al., 2003). Variances on input and output prices for the five years period (2003 to 2007) used were relatively high. Higher fluctuations mean greater uncertainty (Pruzzo et al., 2003) and, therefore, a greater risk to the smallholder farmer. Relatively low differences (< 0.5%) in profits were estimated when both models were used, an indication that simple profit models can satisfactorily be used to predict profitability. However, larger differences in EVs for traits, ranging from -28% to +19%, were predicted when both models were applied. These noticeable changes suggests that not accounting for risk overestimates EVs for traits and risk should, therefore, be taken into account. In agreement with the findings in this study, Kulak et al. (2003) observed that risk makes a large difference in EVs for traits, but may have small effects on the ratios of EVs and the magnitude and direction of genetic change. Vandepitte and Hazel (1977) also argued that only an error larger than ± 50% in EV for a trait produces a considerable loss in relative efficiency of a selection index.

Table 1: Economic values (EVs) for traits without risk (derived from simple profit models) and with risk (certainty equivalent profit models, Arrow-Pratt coefficient values λ=0.002)

		Traits[†]				
Scheme[‡]	Profit[α]	DMY	ADG	MW	LW	NKW
Without risk						
1	3233.83	39.73	51.89	-24.64	74.76	21.51
2	4662.47	41.27	64.85	-27.55	84.51	24.02
3	6038.02	49.50	51.94	-24.08	77.65	22.90
4	5910.03	49.69	45.41	-23.24	71.40	21.40
With risk						
1	3221.78	28.67	45.42	-19.97	63.17	18.39
2	4641.01	29.82	56.33	-22.32	71.01	20.53
3	6024.03	35.91	45.42	-19.49	65.59	19.56
4	5886.39	36.05	39.94	-18.80	60.34	18.29

[‡]See text for definition of schemes
[α] Estimated on per doe per year basis
[†]DMY, average daily milk yield (kg); ADG, average post-weaning daily gain (kg); MW, mature weight (kg); LW, 12-month live weight (kg); NKW, number of kids weaned

Conclusion

The results in this study show that it is possible to incorporate risk and use preference information elicited from the producers to define the breeding objectives and, therefore, estimate EVs for traits of importance. Use of both simple and certainty equivalent models showed clear comparisons in profits and the intensity of producers risk aversion on EVs for traits; DMY was the most affected trait. This means that certainty over future product prices is an important factor that should be considered in the estimation of EVs, especially for traits that are expected to dominate the selection index.

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