Breeding objectives for Red Maasai and Dorper sheep in Kenya – a participatory approach

E. Zonabend[*,†], T. Mirkena[*], J. Audho[†], J. Ojango[†], E. Strandberg[*], A. Näsholm[*], B. Malmfors[*], A.M. Okeyo[†] and J. Philipsson[*]

[*]Department of Animal Breeding and Genetics, Swedish University of Agricultural Sciences, Uppsala, Sweden,
[†]International Livestock Research Institute, Nairobi, Kenya.

ABSTRACT: The Red Maasai sheep breed is under threat due to indiscriminate crossbreeding and strategies are needed to conserve and improve the breed. The aim of this study was to understand farmers' preferences for important traits of flocks of Red Maasai, Dorper and crosses in two different areas, Amboseli and Isinya, in Kenya. Farmers identified three ewes that represented the best, average, and poorest within its breed group of each farm and gave reasons for their ranking. The most important traits were body size and growth rate and thereafter milk yield. The Red Maasai was preferred for its better reproduction and tolerance against diseases and drought. In the harshest area, Amboseli, all breed groups had about the same body weight, whereas in Isinya, where conditions are better and farmers are more market oriented, Dorper and crosses had superior weights.

Keywords: breeding objectives; participatory approach; Red Maasai sheep

Introduction

Red Maasai and Dorper sheep or their crosses are commonly found in Kenya and Tanzania today, where they are important for the livelihood of people. The Red Maasai is an East African fat-tailed sheep breed mainly kept by Maasai pastoralists as well as neighbouring tribes (Wilson, (1991); Baker et al., (1999)). It is renowned for its resistance towards endoparasites (Preston and Allonby, (1978)), relatively good tolerance to trypanosomes (Baker, (1995)) and drought tolerance. However, it has been ranked poorly for its body weight (Kosgey, (2004)). Until the mid 1970´s, purebred Red Maasai sheep were common throughout the southern pastoral lands of Kenya, probably numbering several million head. The synthetic Dorper breed from South Africa, on the other hand, was introduced to Kenya for its higher growth potential, better carcass quality and mothering ability (Kiriro, (1994); Kosgey et al., (2008); Kariuki et al., (2010)). Widespread indiscriminate crossbreeding followed because farmers failed to maintain a continuous crossbreeding programme. Many farmers therefore continued to "upgrade" their local flocks by crossing with Dorper, which subsequently proved unsuitable in many production areas (CGIAR, (2005)). As a consequence, the Red Maasai sheep breed is now under severe threat.

East Africa suffered from a severe drought in 2008-2009 and millions of livestock died. Interviews with Maasai farmers revealed that the Red Maasai sheep had a better survival rate compared to Dorper during the drought (Liljestrand, (2012)). A comparative study involving the same breeds at the International Livestock Research Institute ranch at Kapiti Plains Estate confirmed the higher survival rate of Red Maasai compared to Dorper and crosses (Ojango et al. (2013)). The same was confirmed by Okeyo and Baker (2005).

The status of Red Maasai sheep is becoming critical. There is therefore a need to conserve the breed by implementing a breeding strategy for improvement of the genetic potential and population of the pure Red Maasai sheep. Moreover, a controlled crossbreeding programme involving the same breeds is needed to sustainably improve livelihoods of their keepers. For this to succeed it is necessary to involve the farmers in a phenotypic characterization of the breed groups and to jointly define the breeding objectives. Such participatory approaches have been described elsewhere (Duguma et al. (2010)).

The aim of this study was to phenotypically characterize and to understand farmers' trait preferences and breeding objectives for their sheep flocks in two Maasai areas, Amboseli and Isinya, in Kenya, The areas represent two different but harsh production systems.

Materials and Methods

Pastoral livestock keepers from two Maasai communities living in Amboseli and Isinya locations of Kenya keeping sheep populations comprising Red Maasai, Dorper and crosses between the two breeds were involved in the study. Amboseli is characterized by dry, arid land with little or no pastures during certain periods of the year and smaller sized flocks of mixed livestock. Isinya on the other hand, has more productive pastures when the weather is favourable. The production system in Isinya is more commercially and market oriented. Isinya is also located nearer to main urban centres.

Experimental design and data collection. The study was based on structured interviews of the farmers about their sheep production and the different breed groups kept. The farmers were requested to classify their sheep into breed groups mainly based on morphology and coat colour and where possible, use their knowledge of the pedigree of each animal.

Each farmer was asked in advance to select three ewes that had lambed at least once, that represented the best, average, and poorest fraction within each of the three breed groups (i.e. Red Maasai, Dorper and crosses). Every farmer provided three reasons in order of importance for the ranking of each ewe, the life history of the ewe, and what price (in Kenya Shillings; 1 USD = 84 KES) they would be willing to pay for the specific ewe if they were to purchase it for breeding purposes. In a second stage, the farmers ranked all the 9 ewes across breed groups from 1 (most preferred) to 9 (least preferred). In cases of farms with only six ewes selected, results were re-scaled to correspond to rank values between 1 and 9.

Additionally, for all ewes selected, linear measurements, body weight, dentition (age), body condition score and colour were recorded. Based on farmer recall, the date of last lambing, parity number, number of lambs born and weaned, milk yield per day, source of sire and dam, and disease incidents were also noted. A total of 147 ewes belonging to 19 farmers, 10 from Amboseli and 9 from Isinya were evaluated.

Statistical analyses. All analyses were done using the R project (R Core Team, (2013). Q-Q plots and histograms of residuals for all traits clearly resembled a normal distribution. Thus, linear models were used to analyse all the records and for all the traits. The linear model used was as follows:

$$y_{ijkl} = \mu + Location_i + Farmer_j\,(Location_i) + Breed_k + Rank_l + BreedLocation_{ki} + e_{ijkl}$$

where y_{ijkl} is the Body weight (kg), the Body length (cm), the Heart girth (cm), the Body Condition Score (1.0-5.0), the Milk yield (litre) or the Price if buying (Price) in Kenyan Shilling (KES); μ is the overall mean; $Location_i$ is a fixed effect of the ith Location (Amboseli, Isinya); $Farmer_j\,(Location_i)$ is the fixed effect of $Farmer_j$ nested in $Location_i$; $Breed_k$ is the fixed effect of the is the kth Breed (Red Maasai, Dorper or Cross); $Rank_l$ is the fixed effect of the lth Rank of the ewe (Best, Average or Poor); $BreedLocation_{ki}$ is the fixed interaction effect between $Breed_k$ and $Location_i$; and e_{ijkl} the random residual effect.

Results and Discussion

Effects of location and breed. Results from analysis of variance showed that there were significant effects of location, farm within location, breed, rank (best, average, poor) and the interaction between breed and location (Table 1). For body weight and price, all factors in the model were significant, and for the other traits most factors were significant. In a preliminary analysis, the effect of interaction between breed and ranking was investigated but found to be non-significant.

Table 1: Levels of significance, for the traits Body weight (BW), Body Condition Score (BCS), Milk yield (MY) and Price[1], in analysis of variance.

Trait	LOC[2]	Breed	Rank	Farmer(LOC)	BreedLOC
BW	***	***	***	**	*
BCS	❖	ns	***	**	ns
MY	***	***	***	***	ns
Price	***	***	***	***	***

Significance levels: *** = p < 0.001; **= p< 0.01; *= p< 0.05; ❖ = p < 0.1; ns = non significant
[1]Price in Kenya Shillings where 1 USD = 84 KES
[2]LOC = Location

In Table 2 least squares means are shown for the different breed groups by location. Generally, body weight and price were considerably higher in Isinya, whereas body condition score and milk yield were slightly higher in Amboseli. This may be because of a longer tradition of milking sheep in Amboseli than in Isinya. For body weight, the Red Maasai ewes were 1.6 kg heavier in Isinya than in Amboseli, whereas Dorper ewes and crosses weighed 5.9 and 6.7 kg more in Isinya, respectively. This clearly illustrated the interaction between location and breed, showing only slight breed differences in body weight in the harsher environment whereas the Dorper and the crosses were clearly superior to Red Maasai in the more fertile, yet harsh, area of Isinya. Thus, the Dorper sheep performed better under a more suitable environment as provided in Isinya, whereas Red Maasai did equally well under harsh environments, although no drought occurred during the experimental period. This supports the position that indigenous breeds are generally better adapted to unpredictable, harsher climatic conditions as discussed by Drucker et al. (2001).

Table 2. Least Squares Means ± Standard Error for Body weight (BW), Body condition score (BCS), Milk yield (MY) and Price[1] by levels of location by breed[2] and rank.

Level	BW	BCS	MY	Price[2]
Amboseli				
RM	36.7±0.93	2.9±0.60	0.4±0.04	3740±136
D	39.2±1.12	3.9±0.72	0.6±0.05	4090±165
X	35.7±0.79	2.6±0.50	0.4±0.04	3440±116
Isinya				
RM	38.3±0.98	2.3±0.25	0.2±0.03	4560±382
D	45.1±1.17	3.0±0.30	0.4±0.04	8460±456
X	42.4±0.98	2.4±0.25	0.4±0.03	5890±382
Rank				
Best	43.7±0.70	2.9±0.09	0.6±0.02	6340±221
Average	40.6±0.70	2.7±0.09	0.4±0.02	5160±221
Poor	34.4±0.70	1.9±0.09	0.2±0.02	3580±221

[1]Price in Kenya Shillings where 1 USD = 84 KES
[2]Breed: RM = Red Maasai, D = Dorper, X = Cross

Prices followed the same pattern as for body weight. Red Maasai ewes were on average valued at 820 KES (22%) more in Isinya compared to Amboseli, whereas Dorper and crossbred ewes in Isinya were regarded as having approximately twice the value of equivalent ewes in Amboseli. These results show that the Isinya farmers have ewes with higher body weights and also that they have better market opportunities given their close proximity to the commercial market.

Farmers' choice of traits. Among the best animals, and based on the choice of animals in the herd, body size and growth rate were considered as the most important traits, especially for Dorper (Figure 1). Milk yield was ranked as the second most important trait after body size traits regardless of breed. Red Maasai was slightly more appreciated for its good reproduction and mothering ability. This was the case, even though the Dorper was introduced to, and initially promoted in Kenya partly due to good mothering ability (Kiriro, (1994)). Red Maasai was also more appreciated than the other breeds for its drought tolerance and disease resistance. It is noteworthy that no Dorpers were chosen for these adaptive traits.

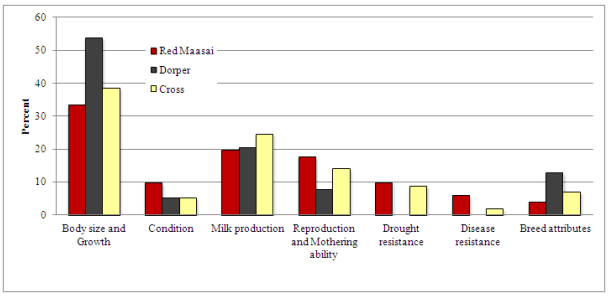

Figure 1: Relative importance of traits per breed group as rated by farmers for their best animals

For ewes that were considered to be among the poorest animals, the reasons low body weight and milk yield were cited most commonly (Figure 2). There were no major differences between breeds although low body size was mentioned slightly more often for Red Maasai. For ewes selected as the best or the poorest, the farmers cited body condition score more frequently for the Red Maasai than for the other breed types.

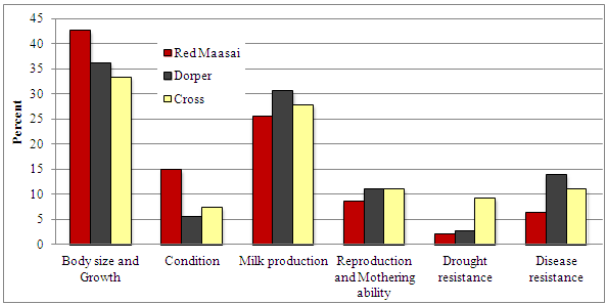

Figure 2: Relative importance of traits per breed group as rated by farmers for their poorest animals

Farmers' preferences were confirmed by the objective measurements of their choices of best, average and poor animals (Table 2). Animals ranked as best were 3.1 kg heavier than the average ewes and 9.3 kg heavier than the poor ewes. Body condition scores did not differ significantly between the best and average ewes but were much lower for the poor ewes. Milk yield was highest among the best ewes, lowest among the poor ewes, and intermediate among the average ewes. Farmers expressed willingness to pay almost twice as much for a ewe classified as being best compared to the poor ewes, and to pay about 23% more than for an average ewe.

As would be expected, farmers' preferences when ranking the animals across breeds, differed between the locations (Table 3). For the Amboseli farmers the Red Maasai and Dorper ewes were equally preferred, and crosses least preferred. In Isinya, the Dorper ewes were clearly the breed of choice and Red Maasai the least valued, again reflecting the better environment for Dorper and the crosses in that location, having also an existing market for slaughter lambs.

Table 3. Ranking of ewes[1] across breeds, Red Maasai, Dorper and Crosses by location among the selected ewes (lower rank is better).

Location	No. of ewes	Mean rank		
		Red Maasai	Dorper	Cross
Amboseli	72	4.73	4.68	5.37
Isinya	75	5.61	4.24	4.96
Overall		5.17	4.46	5.17

[1] Scale 1(best) to 9 (worst)

When assessing breeding objectives and designing breeding programmes it is critical to ensure farmers are actively involved in the whole process (Kosgey, (2004)). In this study farmers evaluated body size and growth rate as the most important traits to include in the breeding goal definitions in both locations and for both breeds. Milk yield was also ranked as being highly important. In breeding goals for the Red Maasai it would be important to improve its maternal traits as well as to continue to improve its renowned disease and drought tolerance. Similarly, such maternal traits would be worth including in the breeding goal for the Dorper.

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