Participatory definition of trait preferences for designing village breeding schemes for goats in harsh environments of Ethiopia

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ABSTRACT: There is critical need to improve productivity of indigenous goat breeds in order to sustain supply of food and income to communities living in harsher areas that are coming to relay more and more on the drought tolerant commodity; goats, due to changing climate. To this end, a community-based goat breeding project is being implemented in 5 zones of Ethiopia by ILRI and its partners. Designing of the breeding programs proceeded phenotypic and molecular characterization of the indigenous Ethiopian goat breeds. The characterization studies revealed that ample genetic diversity exists between and within the indigenous goat breeds pointing hug potential to tap for improving productivity amid a changing climate. Participatory definition of trait preferences was undertaken to pave the way for deriving economic weights of traits to develop selection indices.
Keywords: Goat breeding; Traits preference; Village breeding schemes

Introduction

The goat population in Ethiopia is estimated to be around 24 million, more than 75% of which are found in the arid and semi-arid zones of the country (Gebreyesus et al., 2012), where other livestock species could hardly survive and which are getting more and more difficult for crop production emerging as most vulnerable to the adversities of climate change. The indigenous goat breeds are very well adapted to the rigorous environmental conditions and low input systems in these areas utilizing low quality shrubs and remaining productive under an escalating disease pressure (Feki, 2013). However, there is critical need to improve productivity in order to sustain supply of food and income to communities that are coming to relay more and more on the drought tolerant commodity, goats, due to changing climate. Productivity improvement is also crucial to minimize the contribution of the goat population to climate change through GHG emissions and land degradation so that more meat and milk can be produced with lesser number of animals kept. Centralized pure-breeding and cross breeding programs in the tropics have generally failed. They overlooked the significance of livestock in the tropics, which transcends economic considerations and enters the social, cultural and ritual realm (FAO, 2009). Community based breeding programs have now emerged as promising approach in the tropics where-in farmers actively participate from the designs to the implementation of breeding programs. Characterization of the genetic resources, description of the production systems and participatory definition of farmers' selection criteria is the key step in designing community-based breeding programs (Kosgey et al., 2006). The project "Harnessing Genetic Diversity for Improving Goat Productivity in Ethiopia" is led by the Biosciences eastern and central Africa - International Livestock Research International (BecA-ILRI) Hub and is financed by the Swedish International Development Cooperation Agency. The project is implemented in a R4D approach aiming at generating knowledge on the genetic diversity, productivity and utilization patterns of Indigenous Ethiopian goat breeds and the institutional arrangements within which they are kept as an input for design sustainable breeding program. In-depth description of the indigenous goat breeds and the production systems within which they are kept have been undertaken. Selection criteria for male and female animals have been defined in participation with famers across the operational sites. Revealed (Market monitoring) and stated (Choice experiments) methods were employed to derive economic weights of traits to develop selection indices. This paper documents the methodology adopted, results and implications of participatory definition of trait preferences in selecting breeding animals.

Materials and Methods

Description of the study areas and production systems. The project "Harnessing genetic diversity for improving goat productivity in Ethiopia" is implemented in five different zones; namely North Gonder, Wag-Abergelle, Tankua-Abergelle, West Shoa and Konso found in the Amhara, Tigray, Oromiya and Southern Regional States of Ethiopia. The altitude in these areas ranges from 600 at Konso to 2300 a.s.l. in West Shoa. Agro-pastoralism with seasonal movements is practiced as the dominant production system in all the sites except at West Shoa where a mixed crop-livestock production system is practiced.

Data. A total of 600 goat keeping households were surveyed across the study sites for the participatory definition of selection criteria/breeding objectives and description of the production system. Across the sites, 1268 mature ($\geq$ 4PPI) male and female goats where sampled for phenotypic characterization. Blood samples were also collected from 650 animals representing all so far identified goat breeds of Ethiopia for Molecular characterization.

Table 1. Ranks given to traits as criteria in selecting bucks and does in the study sites

Traits		Ranks* (in specific sites)				
		West Shoa	Konso	Wag Abergelle	Tankua Abergelle	North Gondar
Traits for bucks	Body size/Conformation	1	2	2	2	1
	Coat color	2	6	1	1	3
	growth rate	3	1	3	5	2
	Libido	4	4	5	4	5
	Drought tolerance (Active browser)	5	5	7	6	-
	Disease resistance	6	3	-	-	-
	Mother history (for fertility)	7	-	4	3	4
	Kid's quality (for body weight)	-	7	6	-	-
Traits for does	Twining ability	1	4	2	4	2
	body size/conformation	2	2	3	5	1
	Frequent Kidding	3	5	4	6	3
	Coat color	4		5	3	5
	Growth rate	5	1	6	-	4
	Mothering ability	6	-	-	1	6
	Drought tolerance	7	-	7	-	-
	Disease resistance	-	3	-	7	-
	Milk production	-	6	1	2	-

**Rank 1: Ranked by highest proportion of households at a site; Rank 7: Ranked by lowest proportion of households at a site*

Statistical analyses. Indexes were calculated for ranking data from individual households for site according to a formula: Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual reason (attribute) divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall reasons. Indexes so generated were then used to rank the pooled importance of each attribute as selection criteria in each of the five sites.

Results and Discussion

Trait preference for bucks. Table 1 shows the relative importance of different traits in male and female breeding goats as ranked by farmers across the sites. Results from the trait preference ranking for bucks shows that body size and conformation is among the top ranked attributes across sites. This shows that male goats are mainly kept for sale across the sites. High priority was also attached to coat color in selecting bucks at all the sites. This could be in response to the marketing system reported across the sites to be based on visual appraisal of animals' size, conformation and coat color and not based on body weights. Similar preferences to coat color where reported in Eastern Ethiopia in selecting male goats (Gebreyesus et al., 2013).

Adaptation traits, including grazing ability, disease resistance and ability to walk long distances were also mentioned as important preference reasons. The production system's conditions of complete dependence on utilization of natural resources, lack of inputs and the rigorous environmental conditions make adaptation traits the pervasively most important attributes both for survival and production.

Trait preference for does. Reproductive performances including twining ability and frequent kidding were among the top ranked attributes for does in all the sites. Similar results were reported by Feki (2010) in the Afar areas of Ethiopia. Milk yield has been top ranked as selection criteria in Tankua-Abergelle and Wag-Abergelle sites, while the attribute was not even considered at the remaining sites where-in a taboo against consumption and sale of goat milk was reported.

Conclusion and way forward

The study shows that trait preferences reflect the general production environment and market preferences operating in specific sites. Results also show that adaptation traits need to be put into consideration apart from productive traits in designing breeding programs for harsh environments. Based on the results of the participatory breeding goal definition experiments and the on-going on-farm productivity monitoring studies, village selection schemes are now being designed where-in selection takes place right at the village flocks and selected genotypes co-evolve with the environmental stress at specific production systems to maintain adaptability and hardiness while improving productivity.

Literature Cited

FAO, 2009. Contributions of smallholder farmers and pastoralists to the development, use and conservation of animal genetic resources; proceedings of the intergovernmental technical working group on animal genetic resources for food and agriculture, 5th session. 28-30 January 2009, Rome.

(available at http://www.fao.org/ag/againfo/programmes/en/genetics/angrvent2009.html)

Feki Misbah, 2013. Community – Based Characterization of Afar Goat Breed around Aysaita district of Afar Region. MSc thesis, Jima University, Ethiopia.

G. Gebreyesus, A. Haile and T. Dessie 2012. Participatory characterization of the Short-eared Somali goat and its production environment around Dire Dawa, Ethiopia. *Livestock Research for Rural Development. Volume 24, Article #184.*

G. Gebreyesus, A. Haile and T. Dessie 2013. Breeding scheme based on community-based participatory analysis of local breeding practices, objectives and constraints for goats around Dire Dawa, Ethiopia. Livestock Research for Rural Development. Volume 25, Article #48.

Kosgey I.S., R.L. Baker and J.A.M. Arendonk, 2006. Successes and failures of small ruminant breeding programmes in the tropics: a review. Small Rumin. Res. 61:13–28.