Trop Anim Health Prod (2011) 43:851–856
DOI 10.1007/s11250-010-9772-2

ORIGINAL RESEARCH

Breed and trait preferences of Sheko cattle keepers in southwestern Ethiopia

Takele Taye Desta · Workneh Ayalew · B. P. Hegde

Accepted: 9 December 2010 / Published online: 23 December 2010

Abstract Like their smallholder subsistence counterparts in developing countries, breed and trait preferences of Sheko cattle keepers have broad perspectives. Our study has documented breed and trait preferences of Sheko cattle keepers in southwestern Ethiopia—the natural breeding tract of Sheko cattle. Our results showed that due to their multifunctionality, cattle are the most preferred livestock species. Overall, farmers showed slightly more preference to local Zebus over Sheko breed. This is due to voracious feeding behavior of Sheko cattle, which make them less preferable in the face of worsening feed shortage, and due to aggressive temperament of Sheko cattle. This is despite Sheko's outperforming potential over local Zebus in their milk production, draft power, and hardiness. At trait level, overall milk production was consistently reported as the most preferred trait followed by fertility and traction. This trait preference rank has matched with the reported frequency count ranks for Sheko cattle use. However, breed preference rank has not matched with reported trait preference ranks because Sheko excels local Zebus in all the three most preferred traits, but it was ranked second. Therefore, to minimize these conflicting interests, breed management plans for Sheko cattle should target on strategies that help to solve feed shortage problem and to improve feeding practices, and on selection of less aggressive Sheko cattle. Therefore, these strategies should be considered in line with Sheko cattle conservation and genetic improvement programs.

Keywords Breed preference · Trait preference · Phenotypic ranking · Sheko cattle · Ethiopia

T. T. Desta (✉)
Wolayta Soddo Agricultural Technical Vocational Education and Training College,
P.O. Box 120, Wolayta Soddo, Ethiopia
e-mail: takele_taye@yahoo.com

W. Ayalew
International Livestock Research Institute,
P.O. Box 5689, Addis Ababa, Ethiopia
e-mail: Workneh.ayalew@nari.org.pg

B. P. Hegde
Haramaya University,
P.O. Box 138, Dire Dawa, Ethiopia

Present Address:
W. Ayalew
National Agricultural Research Institute, Livestock Program,
P.O. Box 1639, Lae 411 MP, Papua New Guinea

Introduction

Ethiopia is enriched with indigenous cattle genetic resources diversity (IBC (Institute of Biodiversity Conservation) 2004; DAGRIS (the Domestic Animal Genetic Resources System) 2007) and is known for its diversified livestock production systems. This is due to considerable agro-ecological variation, cultural and ethnic diversity, and a long-lasting agricultural practice. Ethiopia is the home for 32 recognized indigenous cattle breeds (DAGRIS (the Domestic Animal Genetic Resources System) 2007) and has a wealth of undocumented indigenous knowledge on cattle genetic resource management. Cattle farming in Ethiopia is subsistence-oriented. It is practiced as a way of life by smallholder farmers in the crop–livestock production systems of the highland areas and by pastoralists in the low lying moisture-stressed areas. Therefore, cattle rearing is common and an ancient practice among smallholder farmers and pastoralists in Ethiopia.

Like other livestock farming practices, cattle farming is managed by smallholder farmers and pastoralists mainly based on their own experience and knowledge. Therefore, there is appreciable indigenous knowledge base among Ethiopian farmers and pastoralists that can be used as a starting point for genetic improvement programs and to work on constraining environmental problems. Breed and trait preferences of livestock keepers usually vary across communities, production systems, and agroecological zones (Scarpa et al. 2003; Ouma et al. 2004; Roessler et al. 2008). This might result in re-ranking of preferences for a particular trait or breed in different production environments. This is indeed true because most economically important traits in livestock are influenced by variation in the production systems.

Therefore, this has to consider knowledge of farmers' preference rankings for particular traits or breeds of interest. This is important for identification of animals with superior weighted average trait values and to select them as breeding stock (Williams 2005). However, these unique trait and breed values of indigenous cattle under subsistence production systems have not been well documented (Mwacharo and Drucker 2005). Therefore, identifying trait and breed preferences of farmers is the starting point to define and set up appropriate breeding goals that can address the interest of smallholder farmers (Bebe et al. 2003; Mwacharo and Drucker 2005; Roessler et al. 2008). Our study was, therefore, intended to elicit the knowledge of Sheko cattle owners on breed and trait preferences.

Materials and methods

The study area

Our study area, Bench Maji Zone (BMZ), is located in the humid agroecological zone of southwestern Ethiopia. It is the main breeding tract of the endangered taurine Sheko (Taye 2005; Taye et al. 2007; Taye et al. 2009). The altitude ranges from 850 to 3,000 m above sea level (masl). The annual temperature and rainfall range from 20°C to 40°C and from 1,200 to 2,000 mm, respectively. The breeding tract receives maximum rain from June to September (BMZARDMD 2004). Most parts of the study area fall in the tsetse belt of southwestern Ethiopia. Sheko cattle keepers practice crop-dominated mixed crop–livestock agriculture both in the lowland (<1,500 masl) and in the highland (>1,500 masl) agroecological zones.

Methods of data collection and analysis

Three study districts were sampled from BMZ based on relative distribution densities of Sheko cattle. Reconnaissance tour was made before the formal survey to develop the sampling frame. The data were collected using single-visit survey between August 2004 and February 2005. The dataset was generated from semistructured individual interviews of 129 Sheko cattle owners, 10 group discussion sessions, and a number of key informant contacts and informal talks.

Phenotypic ranking

Each Sheko cattle owner was asked by the first author, to rank his or her cattle breeds (Sheko and local Zebu) and his or her trait preference from the given list of traits in the questionnaire and other additional traits of the individual's interest. Breed ranking was based on the knowledge of phenotypic attributes. Similarly, the owner has made trait preference ranking based on his or her interest for a given trait.

Data summary and analysis

Breed and trait preferences ranks of Sheko cattle owners were calculated between agroecological zones and among districts. Milk yield (average daily milk yield and length of lactation), milk fat, traction, fertility (age at first calving, calving interval, and lifetime calf crop), adaptation, and growth were the six traits listed and included in the check list; however, farmers added coat color as additional trait. The weighted average rank for each trait of interest in each stratum was obtained by summing the product of each rank and its corresponding frequency and by dividing with the total number of respondents ranking that trait:

$$\kappa = \frac{\sum_{i=1}^{n} x_i f_i}{N}$$

where κ refers to the average weighted rank, x_i is the rank of preferred trait of interest (seven levels), and f_i is the corresponding frequency of responses for that particular rank; as usual, $\sum_{i}^{n}$ refers to sum of the products of all ranks and their corresponding frequencies, and $N$is the total number of respondents. To calculate the overall rank in the study area, the overall trait preference ranks across strata were pooled together. To cross-check with trait preference ranks, farmers were asked to list down the use of cattle in their locality. Descriptive statistics of SAS (2002) was used to summarize the data.

Results

Demographic structure of the respondents

Mean (±σ) reported family size of the respondents was 7.47±5.31 with a range of from 1 to 35. The mean (±σ)

Table 1 Reported number of livestock owned by the respondents

Species	Number	Mean	SD	Minimum	Maximum
Cattle	129	5.2	4.50	1	12
Chicken	89	4.5	4.41	1	25
Goat	24	3.0	1.92	1	8
Sheep	57	2.9	3.75	1	25
Donkey	6	1.2	0.41	1	2
Mule	5	1.2	0.45	1	2
Horse	15	1.0	0.00	1	1

SD standard deviation

reported age of the respondents was 38.59±14.45 years (range 17–87 years). The proportions of male and female respondents were 75.2% and 24.8%, respectively (N=129). The dataset on literacy level showed that 59.7% was illiterate, 11.6% was able to read and write, 21.7% attended primary school, 5.4% reached secondary school, and 1.5% attended informal religious schools.

Household livestock number

All the sampled 129 households keep Sheko cattle, whereas only 69.0%, 44.2%, 18.6%, 11.6%, 4.6%, and 3.9% of them keep chicken, sheep, goat, horse, donkey, and mule, respectively. The summary statistics of the reported livestock holdings are shown in Table 1 (N=129). Generally, considerable variation was observed in the number and mix of livestock species kept by the respondents.

Livestock species preferences

The three most preferred farm animals reported by farmers in decreasing order of importance were cattle, sheep, and chicken. A majority of the respondents (93.8%, N=129) made cattle their first choice, whereas 3.1%, 2.3%, and 0.8% of the respondents, respectively, put sheep, chicken, and mule in their first order of preference. This implies that cattle are the most preferred farm animal species for Sheko cattle owners. Farmers reported that this is due to multiple functions of cattle and better economic value can be generated from cattle compared to other species. It was also noted that cattle are the only milking and draft animal in the study area.

Our results showed that a low proportion (4.6%) of the respondents reported livestock as their major source of income. A majority of the farmers (N=153), therefore, mainly depend on non-livestock income sources such as cereal production (59.5%), coffee production (31.4%), petty trading (5.9%), and causal work (3.3%). Therefore, for a large proportion of the respondents, livestock farming is a secondary income source. This type of farming system is common among smallholder farmers practicing crop-dominated mixed crop–livestock agriculture in Ethiopia.

Breed preferences

Only 3% of the respondents keep pure herd of Sheko, whereas the rest (97%) keep a herd consisting of Sheko, local Zebu, and interbreeds of local Zebu and Sheko. Our results showed that overall, 48.9% and 46.1% showed preference for local Zebu and Sheko, respectively, and the remaining 5% prefer Sheko–Zebu interbreeds. However, there is remarkable variation across strata (Table 2). The reported reasons for preference of breeds were milk yield, hardiness, draft work, and fertility for Sheko cattle, and docile temperament and low feed requirement for local Zebus.

This showed that a reasonable proportion of the respondents showed secondary preference to Sheko cattle. Focus group discussant in Gaizika village in Sheko district reported that they are on verge of losing the hardy and productive Sheko cattle from their herd. This is due to ever worsening feed shortage problem in their village, and this does not match with more feed requirement of Sheko cattle. They also confirmed that they replace Sheko with local Zebus despite Sheko's promising potential in milk yield, traction output, fertility, longevity, trypanotolerance, and its hardy nature. This feed shortage has resulted due to expansion of cropping land to feed the ever increasing population. This fast population growth rate was further aggravated by polygamy marriage, and this has reduced the grazing land. Moreover, they reported that involvement of children in education has increased, and this has reduced the labor force that needed to rear Sheko cattle. It was noted

Table 2 Reported breed preference proportion by districts and agroecological zones

Breed	District			Agroecological zone	
	Sheko (N=23)	Bench (N=89)	Shei-Bench (N=29)	Lowland (N=52)	Highland (N=86)
Sheko	65.2	47.2	27.6	57.7	39.5
Zebu	26.1	47.2	72.4	36.5	57.0
Interbreeds[a]	8.7	5.6	0.0	7.7	3.5

[a] Nondescript population obtained from mating of Sheko and Zebus

Table 3 Reported ranks of trait preferences within district and agroecological zone

Trait	Weighted averages of trait preference ranks (*N*)				
	District			Agroecological zone	
	Sheko (24)	Bench (79)	Shei-Bench (26)	Lowland (51)	Highland (78)
Milk yield	1.30 (23)	2.01 (77)	3.36 (25)	1.64 (50)	2.49 (75)
Growth	3.00 (12)	4.00 (62)	3.36 (25)	3.42 (31)	3.85 (68)
Adaptation	3.33 (9)	3.70 (73)	4.32 (25)	4.44 (25)	4.75 (67)
Fertility	2.83 (12)	3.27 (71)	3.08 (24)	4.37 (30)	3.12 (66)
Milk fat	3.00 (4)	4.30 (61)	4.20 (25)	5.26 (23)	4.91 (66)
Traction	3.00 (12)	3.38 (63)	4.00 (25)	3.42 (33)	3.19 (62)
Coat color	6.00 (6)	5.83 (46)	4.89 (19)	6.39 (18)	5.29 (59)

The lowest the rank, the most preferred the trait

that Sheko cattle are more appropriate for herding than tether feeding, and this requires more labor of herd attendants.

Trait preferences

Except Shei-Bench district that has shown first preference to fertility, milk yield was consistently reported as the most preferred trait (Table 3) followed by fertility and traction. However, fertility is not included among the most important three traits in the lowland. Milk fat and coat color were ranked by a few number of respondents in Sheko district.

Coat color preference of farmers is mainly related to adaptation to the local environment (less attraction to biting flies) and esthetic value (in form of beauty trait) attached to brighter colors that have economic benefits from market perspectives. The main coat colors preferred by the respondents were red, patchy red and white and roan. The less preferred coat colors were black and dark brown and were reported to increase the landing of biting flies on the animal.

Utility pattern

Farmers were asked to list down the importance of keeping Sheko cattle. The reported functions of Sheko cattle are summarized in Table 4. High proportions of the reported three functions were matched with the most preferred three traits during trait ranking.

Discussions

Variation was observed in the number of livestock species kept by Sheko cattle owners in our findings, and this is in agreement with the report of Lanyasunya et al. (2006) for Kenyan smallholder farmers in Ol-Joro-Orok. This shows the value attached to different livestock species by their owners (Bebe et al. 2003; Lanyasunya et al. 2006). The average number of cattle kept by respondents (5.2) reported in our findings is similar to the national average reported by Ouma et al. (2007). Our findings showed that the multiplicity in trait functions makes cattle the most preferred livestock species. A comparable work conducted in Kenya by Lanyasunya et al. (2006) also reported that smallholder farmers preferred cattle and more specifically dairy cattle because milk production is the primary reason to keep cattle. This is in agreement with our findings, because milk is the most frequently reported cattle use and ranked first by Sheko cattle owners.

Preferences for cattle breeds expected to vary across individuals (Ruto et al. 2008), which is also observed in our findings. Commonly found local Zebus were preferred over Sheko, and a similar interest was reflected in the findings of Ayantunde et al. (2007) who studied herders' perception in southwestern Niger. Farmers noted that they are more familiar with commonly found breeds' performance and behavior. Moreover, it was reported that the marketing system is influenced by the amount of information found about any particular breed in the community. Therefore, the

Table 4 Reported functions of Sheko cattle

Function	Frequency	Percentage
Milk	127	17.7
Income source	121	16.9
Calves[a]	107	14.9
Draft	103	14.4
Social security	99	13.8
Manure	73	10.2
Dowry	44	6.1
Beef	17	2.4
Hide	15	2.1
Blood	6	0.8
Ceremonial use	5	0.7

[a] Important to increase the herd size

more numerically abundant the breed is, the more is the information about its qualities. Farmers also reported that if the breed is numerically abundant, it gives more chance for selection of elite animals upon buying.

Except Shei-Bench district, the highest preference was obtained in our studies for milk yield, which was reported as the function of average daily milk yield, milking ease, and length of lactation. Secondary preference for milk in Shei-Bench district is mainly due to the remoteness of the district, which makes it less accessible for marketing of milk and milk products. Moreover, some individuals living in its administrative capital partly engaged in cattle rearing and hence produced milk for their family consumption instead of buying from smallholder farmers. High preference for milk is common for smallholder farmers who keep cattle primarily for milk production to feed their family and to earn additional income. Similar findings were reported by Mwacharo and Drucker (2005) and Lanyasunya et al. (2006) for smallholder farmers in Kenya and Stein et al. (2009) from results of comparative studies of indigenous cattle breeds (including Sheko) kept by smallholder farmers in Ethiopia. However, our finding for milk yield ranking is inconsistent with the findings of Kassie et al. (2009) for smallholder Horro cattle owners in the central Ethiopia where milk is only used for home consumption and selling milk is considered as social taboo.

The overall preference of the respondents put fertility as the second most preferred trait. However, fertility was ranked first in Shei-Bench district. This is because Shei-Bench is the main breeding stock supplier district in the study area. Moreover, due to its remoteness (inaccessible to motorized transport), there is less market demand for milk. The highest ranking for fertility in Shei-Bench district is in agreement with the work of Ndumu et al. (2008) on farmers' trait ranking of Ankole cattle in Uganda and Kassie et al. (2009) findings from cattle buyers' trait ranking in the central Ethiopia. Our finding for high ranking of fertility under smallholder conditions is in line with the work of Ouma et al. (2007) that reported fertility as important trait to increase herd size in the pastoral system. Fertility was reported by Sheko cattle owners as combination of traits consisting of age at first calving, calving interval, and lifetime calf crop, and this definition partly agrees with the definition of Carvalheira et al. (1995) for on-station comparative studies of Landim and Africander cattle in southern Mozambique.

The overall preferences have placed traction on the third rank, and this is in agreement with the work of Bebe et al. (2003) on smallholder dairy systems in the Kenya highlands. Our findings, however, disagree with the report of Tano et al. (2003) that has placed traction at first rank in bulls due to its direct link to crop production. However, Ouma et al. (2007) has reported that traction is the least preferred trait by pastoralist. In our study area, slush and burning system is used for crop production by some farmers, which do not require traction power. Therefore, this might partly contributes for lowering the preference to traction. Moreover, traction in Ethiopia mostly linked to cereal crop production, and since the study area is dominated by permanent cash crop (e.g., coffee) and root and tuber crops (taro, cassava, enset), this might also contributed for relatively low preference of traction. Traction is, however, preferred than adaptation traits, and this might be due to trypanotolerance character of Sheko breed (Taye 2005; Lemecha et al. 2006; Stein et al. 2009), which has made farmers less sensitive to the importance of adaptation traits.

Growth rate ranked as the fourth important trait because size of the animal determines the market value. Slow growing animals are usually culled from the herd, and such types of bulls are castrated at younger age to prevent them from mating. This is in line with the report of Lemke et al. (2000) because slow growth is considered as unfavorable characteristics. On the other hand, fast growth is an indicator of high productivity (Roessler et al. 2008).

Conclusion

Trait preference of smallholder Sheko cattle owners is multifaceted. Therefore, this indicates that remarkable heterogeneity exists even among fairly comparable production systems. This showed that farmers' traditional breeding goal is broad and this can be achieved by using animals that are averagely good in multiple traits. Breed preference of farmers is in line with most frequent reported cattle uses; however, it contradicts with reported trait preference ranks. This conflicting interest is especially due to feed shortage; therefore, working on this environmental constraint is useful to maintain the productive and hardy Sheko.

Acknowledgments The study communities contributed their knowledge and time for the success of this study. The Ministry of Agriculture and Rural Development (Ethiopia) and the International Livestock Research Institute provided financial support for this study as MSc research project of the first author.

References

Ayantunde, A. A., Kango, M., Hiernaux, P., Udo, H. M. J., Tabo, R., 2007. Herders' perceptions on ruminant livestock breeds and breeding management in southwestern Niger, Human Ecology, 35, 139–149.

Bebe, B.O., Udo, H.M.J., Rowlands, G.J., Thorpe, W., 2003. Smallholder dairy systems in the Kenya highlands: breed preferences and breeding practices, Livestock Production Science, 82, 117–127.

BMZARDMD. 2004. Annual report of Bench Maji Zone Agricultural and Rural Development Main Department (BMZARDMD).

Carvalheira, J.G.V., Blake, R. W., Pollak, E. J., Van Soest, P. J., 1995. Comparison of Landim and Africander cattle in southern Mozambique: II. Female fertility, reproduction, and beef offtake, Journal of Animal Science, 73, 3527–3533.

DAGRIS (The Domestic Animal Genetic Resources System), 2007. In http://dagris.ilri.cgiar.org/distlist.asp?SC=1&GC=&BN=&RC=&SRC=&CC=70.

IBC (Institute of Biodiversity Conservation), 2004. The State of Ethiopia's Farm Animal Genetic Resources: Country Report, A contribution to the first report on the State of the World's Animal Genetic Resources, May 2004, Addis Ababa, Ethiopia.

Kassie, G. T., Abdulai, A.,Wollny, C., 2009. Valuing traits of indigenous cows in central Ethiopia, Journal of Agricultural Economics, 60(2), 386–401.

Lanyasunya, T.P., Wang, H.R., Mukisira, E.A., Abdulrazak, S.A., Ayako, W.O., 2006. Effect of seasonability of feed availability, quality and herd performance on smallholder farms in Ol-Joro-Orok location/Nyandarua district Kenya, Tropical and Subtropical Agroecosystems, 6, 87–93.

Lemecha, H., Mulatu, W., Hussien, I., Rege, E., Tekle, T., Abdicho, S., Ayalew, W., 2006. Response of four indigenous cattle breeds to natural tsetse and trypanosomosis challenge in the Ghibe valley of Ethiopia, Veterinary Parasitology, 141, 165–176.

Lemke, U., Thuy, L.T., Valle Zárate, A., Kaufmann, B., 2000. Characterization of a model for conservation of autochthonous pig breeds on smallholder farms in north Vietnam. Project Report for GTZ/Sectoral Project, Tropical Ecology Support Program TOEB, Stuttgart, Germany.

Mwacharo, J.M., Drucker, A.G., 2005. Production objectives and management strategies of livestock keepers in south-east Kenya: Implications for a breeding program, Tropical Animal Health and Production, 37, 635–652.

Ndumu, D.B., Baumung, R., Wurzinger, M., Drucker, A.G., Okeyo, A.M., Semambo, D., Sölkner, J., 2008. Performance and fitness traits versus phenotypic appearance in the African Ankole Longhorn cattle: A novel approach to identify selection criteria for indigenous breeds, Livestock Science, 113, 234–242.

Ouma E., Abdulai, A., Drucker, A., Obare, G., 2004. Assessment of farmer preferences for cattle traits in smallholder cattle production systems of Kenya and Ethiopia. Conference on International Agricultural Research for Development, Berlin, October 5-7, 2004.

Ouma, E., Abdulai, A., Drucker, A., 2007. Measuring heterogeneous preferences for cattle traits among cattle-keeping households in east Africa, American Journal of Agricultural Economics, 89(4), 1005–1019.

Roessler, R., Drucker, A. G., Scarpa, R., Markemanna, A., Lemkea, U., Thuye, L. T., Zárate A. V., 2008. Using choice experiments to assess smallholder farmers preferences for pig breeding traits in different production systems in north–west Vietnam, Ecological Economics, 66, 184–192.

Ruto, E., Garrod, G., Scarpa, R., 2008. Valuing animal genetic resources: a choice modeling application to indigenous cattle in Kenya, Agricultural Economics, 38, 89-98.

SAS 2002. SAS version 9.00, SAS Institute Inc. (Cary, North Carolina).

Scarpa, R., Ruto Eric, S.K., Kristjanson, P., Radeny, M., Drucker, A. G., Rege, J. E.O., 2003. Valuing indigenous cattle breeds in Kenya: an empirical comparison of stated and revealed preference value estimates, Ecological Economics, 45, 409–426.

Stein, J., Ayalew, W., Rege, J. E. O., Mulatu, W., Malmfors, B., Dessie, T., Philipsson, J., 2009. Livestock keeper perceptions of four indigenous cattle breeds in tsetse infested areas of Ethiopia, Tropical Animal Health and Production, 41, 1335–1346.

Tano, K., Kamuanga, M., Faminow, M., Swallow, B., 2003. Using conjoint analysis to estimate farmer's preferences for cattle traits in West Africa, Ecological Economics, 45, 393–407.

Taye, T., 2005. On-farm phenotypic characterization of Sheko breed of cattle and their habitat in Bench Maji Zone, Ethiopia, (unpublished MSc Thesis, Alemaya University).

Taye, T., Ayalew, W., Hegde, B.P., 2007. On-farm characterization of Sheko breed of cattle in southwestern Ethiopia, Ethiopian Journal of Animal Production, 7(1), 89–105.

Taye, T., Ayalew, W., Hegde, B.P., 2009. Status of Ethiopian indigenous Sheko cattle breed and the need for participatory breed management plan, Ethiopian Journal of Animal Production, 9(1), 1–12.

Williams, J.L., 2005. The use of marker-assisted selection in animal breeding and biotechnology, Revue scientifique et technique Office International des Épizooties, 24(1), 379–391.