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Review Article

Breeding Objectives and Trait Preferences of Farmers for Sheep in Ethiopia

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Abstract: Ethiopian farmers perform breeding by putting different objectives to satisfy the need and to fulfill trait such as body size, body conformation, mothering ability, lambing interval, age at puberty and fertility. Farmers put different selection criteria for both sexes. For example, selection criteria for are rams body size, coat color and tail type and for ewes body size, coat colour and mothering ability are best for selection criteria. There are different sheep breed in Ethiopia and their geographical distribution insured throughout the countries. Breeding practices confirmed by natural mating method and sheep are served randomly by any intact male in the flock. For effective utilization of existing sheep resource the production system determine its effectiveness according to its geographical distribution production and there are different production systems such as sheep-barley or sheep production system, mixed crop-livestock system and Pastoral production system. Ethiopia has large livestock population in Africa but the uses of the resource not proportional and the reason for this linked with different constraint. As we know the major constraints to sheep Production in Ethiopia are disease, feed shortage, market, water, and lack of trained personnel and absence of recording. So due this the current objective of the paper is to review breeding objectives and trait preferences of farmers for sheep in Ethiopia. To use existing sheep resources the farmer should use appropriate breeding strategies and this can used for many trait.
Keywords: Breeding Objectives; Farmers; Sheep; Trait Preferences; Ethiopia.
Abbreviations
CSA: Central Statistical Agency; ILRI: Institute of International Livestock Research; NL: Netherlands; EIAR: Ethiopian Institute of Agricultural Research; DAGRIS: Domestic Animal Genetic Resources Information System; BHS: Black Head Somalia.

1. INTRODUCTION

Ethiopia has largest population of livestock in Africa which accounts 65.35 million cattle , 39.89 million sheep, 50.50 million goats, 2.11 million horses, 8.98 million donkeys, 0.38 million mules, 7.70 million camel, 48.96 million poultry.and 6.96 million hives are estimated to be found in the rural and pastoral sedentary areas of the country. Out of this total sheep population, about 70.28 percent are females, and about 29.72 percent are males. On the other hand, the total sheep in the country 99.56 percent of local breeds and hybrid and exotic breeds that accounted for about 0.28 percent and 0.16 percent, respectively. But Among the sheep flock two years and older (52.52 of the total sheep), 48 percent are kept for breeding; about 3.61 percent for mutton and 0.03 percent of them were kept for wool production (CSA, 2020).

The sheep in the country is produced under an extensive low input subsistence system. Similar to other tropical countries, studies noted that productivity of indigenous sheep in terms of meat has been limited by poor genetic potential (Getahun, 2008). The difference in farmer's decision on breeding objective for sheep production is due to effect of regions (Lopes *et al.* 2012; Rose, 2014). These differences could be due to ecological, economic and cultural features of the different regions (Lopes *et al.*, 2013).

Thus, farmers followed terminal cross breeding strategies through using Bonga rams as breeding sire and selected local and Bonga cross female sheep as breeding ewes, selling Bonga cross ram lambs before mating in the study areas. (Zelalem, 2018). Farmers keep small ruminants the multi-functionality meat ((Belete, 2009; Yakubu *et al.*, 2020), religion, income, hides and skin, and cultural purpose (Yakubu *et al.*, 2020) of sheep as saving, insurance, meat and manure purposes and other important reasons include

for risk distribution, sacrifice and social heritages (Belete, 2009).

The problems of feed shortage was more sever in the highlands where sheep are dominantly reared and this may be due to presence of relatively higher density of livestock in the area as well as high intensity of annual and perennial crop cultivation which in turn causes shrinkage of grazing lands. The major reason for not practicing feed conservation techniques were lack of awareness, skill and experience (85%) and absence of surplus feed to be conserved feed (56.1%) (Belete, 2009). Concerning traits of preference for breeding, farmers in both sexes equally emphasized body size, body conformation, mothering ability, disease resistance, survivability, heat tolerance (adaptive), fertility, and temperament (Yakubu *et al*., 2020).

However, there are different research are conducted concerning small ruminants specially, sheep breeding objectives and trait preferences of farmers in Ethiopia. But now there is no review on the title. Therefore, the aim of this paper is

- To review the breeding objectives and trait preferences of farmers for sheep

2. LITERATURE REVIEW
2.1. Farmers Breeding Objectives in Ethiopia
Farmers developed breeding objectives for enhancing sheep production and reproduction. Crossbreeding local ewes with Bonga rams improved growth and reproductive performances as well as survival rates of lamb, hence increased flock productivity as compared to local lambs in Southern Ethiopia (Zelalem *et al*., 2020). The study conducted at southern parts of Ethiopia farmers do breeding by seeking different traits and some of them considered were growth rate, body size, coat, twinning rate and color in Alicho Worero, Damot Pulasa, Ezha and Arbegona districts Zelalem, 2018).

Similarily, the body size and twining rate were reported as farmer breeding objectives of Afar, Bonga, Horro and Menz sheep (Merkena, 2010; Haile *et al*., 2011 and Gut *et al*., 2014). The above traits choosen as breeding objectives (Growth rate, body size, coat color) may be to generate more income by sale of surplus sheep marketed at an earlier age. The breeding strategy of farmers in Alicho Worero, Damot Pulasa, Ezha and Arbegona districts aimed to improve growth rate and reproductive performance of local sheep through crossing local ewes with Bonga Ram and improving income gain through sale of fast grower Bonga cross lambs at early ages. Moreover, farmers in Damot Pulasa exercise purchasing of best local breeding ewes from market for breeding purpose (Zelalem, 2018). The terminal sheep crossbreeding with Bonga sires as Best fit practice in SNNPRS, Ethiopia (Bereket *et al*., 2017).

The purposes of keeping sheep by farmers in Meket and Gidan district of North Wollo Zone was generating income followed by saving and meat. This indicates that sheep are highly valued and reared mainly for income, saving and meat production (Tarekegn *et al*., 2020).

2.2. Sheep Breed and Their Geographical Distribution in Ethiopia
Ethiopian sheep breeds located at different agro-ecological zone and geographical area of the countries which are adapted. For example, *Bonga breed*: located at north shea zone of Amhara Region; *Arsi-Bale breed:* located at W. Harerghe zone, Borena zone of Oromia and Sidama zone; *Washera breed:* located at North and Western Shao, West and East Gojam and Agew Awi zones of Amhara State; *Farta breed:* located at South Gondar zone of Amhara State; *Horro breed:* located at East Welega, West Welega, Illubabor, Jimma and West Shoa zones of Oromia; *Menz breed*:located at North Shoa zone of Amhara State; *Tikur breed*: located at North Wollo zone of Amhara State; *Afar breed*: located at Afar State; *BHS breed:* located at Somali State, lowlands of Bale, Borena and South Omo zones, part of east Harerghe); *Gumuz breed*: located at Benishangul-Gumz State; lowlands of North Gondar (Solomon *et al*., 2011).

Abergelle breed: located at Central zone of (Tanqua-Abergelle) Tigray State (Zelealem *et al*., 2012); *Begait breed:* located at North-Western of Tigray Regional State (Gebregiorgis *et al*., 2016); *Highland sheep breed*: located at Eastern zone of Tigray (Atsbie-Wonberta district) (Gebreyowhens and Tesfay, 2016); *Elle (Ille) breed*: located at Southern zone of Tigray (Raya-Alamata) (Mulata *et al*., 2014).

2.3. Farmers Selection Criteria in Ethiopia
The preferences of big body size/body conformation, high lamb weight at birth and fast lamb growth as the preferred attributes are expected when the main purpose of keeping sheep is for cash source. The animals with big sizes are highly demanded in the market and fetch good local market prices (Solomon *et al*., 2014). The smallholder farmers have been practicing selection of breeding rams and ewes within their own flock using different criteria. The primary selection criteria for breeding rams were body size, coat color and tail type. Similarly, body size and coat color were two of the most important breeding ewe selection criteria. The selection decisions are mainly based on physically observable attributes of sheep and adaptation and wool yield traits were the least considered selection criteria for both sexes (Abebe *et al*., 2020).

Zelalem (2018) reported that body size, coat colour and mothering ability were the three traits considered for ewe selection in study area. In Damot Pulasa and Arbegona districts twining was considered as an important selection criterion. However, polled

(hornless) was also a characteristic considered in Arbegona district. The studies of Gameda (2010), Tadele (2010), Haile *et al.* (2011) and Gutu *et al.* (2014) also showed that body size, coat color and mothering ability were selection criteria for Bonga sheep.

In case of breeding males, the common selection criteria were body condition, coat color in all the four districts but horn was only in three districts (Alicho Worero District is an exception) and tail in only one district (Damot Pulasa). The possible reason for body size and/or body condition as selection criteria may be the association of this trait with growth rate as farmers were interested is fast growing lambs to generate more income (Zelalem, 2018).

2.3.1. Selection Criteria of rams

The characteristics used in selecting breeding ram are based on body confirmation, performance history and color. Ram selection using performance history is significantly different across small ruminant density groups with sheep dominant site having higher percentage (33.8) than other groups. Body confirmation is given higher priority may be due to its phenotypic expression in offspring and its economic importance. While performance history is given least priority may be due to the small flock size in most households as a result they use limited animals for mating. Color has been given little attention may be due to the presence of few dominant colors (red, white, white and red in different proportion of mixtures) in the study area (Belete, 2009).

However, in Meket and Gidan district for selecting breeding ram the color was ranked first, growth character was ranked second, appearance and libido was ranked third and While adaptability ranked last in the study area. So, breeding rams were selected based on their coat color, growth character, appearance and libido (Tarekegn *et al.*, 2020). Similarly appearance, color and mating ability were the most preferred traits by farmers to select breeding rams in east gojjam zone (Abera *et al.*, 2016). Similar traits were preferred for males by the farmers in Horro in western and south-western Ethiopia (Zewdu *et al.*, 2012).

2.3.2. Selection Criteria of Ewes

Selection criteria of breeding ewe at Meket and Gidan Districts of North Wollo Zone farmers were selected breeding ewes based on age at sexual maturity, color, lamb growth, lambing interval, pedigree and tail type/ length. The most preferred color in the area was white followed by red while black color was not wanted because the market value of sheep in the study area was depends on the coat color of sheep (Tarekegn *et al.*, 2020). Across all the study districts, appearance, tail type and color were the most important traits for the farmers in East Hararghe zone (Wossenie, 2012).

2.4. Breeding Practices

Ethiopia harbours a huge and diverse sheep population which is distributed across different ecological zones of the country (Gizaw, 2008) and the available within and between breed diversity of the sheep population is expected to result in higher selection response if functioning breeding programs are in place (Gizaw *et al.*, 2007). Natural mating was identified as the method used to breed sheep and female animals are served randomly by any intact male in the flock. Reason for uncontrolled mating was because of communal grazing and watering point and lack of sufficient number of rams (Demeke *et al.*, 2015). Similarly, Tesfaye (2008) stated that reason for uncontrolled mating in Menz and Afar areas was because of communal grazing land and watering point.

2.5. Sheep Production Systems in Ethiopia

In Ethiopia there are two main categories of sheep production systems. The first and the most common system is the traditional smallholder management system. The second, which is limited in scope and area coverage, is the private commercial and parastatal production system (Markos 2006). In the traditional subsistence smallholder management system, sheep are kept as an adjunct to other agricultural activities along with other livestock species. There is no specialised system with defined breeding objectives. The common trend, however, is that the majority of people in the highlands keep small flocks and practice mixed crop-livestock agriculture, whereas those in the sub-moist, cold, very high altitude areas and in arid lowlands keep large flocks in pastoral production system. When closely examined, three different production systems can be identified (Markos, 2006).

2.5.1. Sheep-barley or sheep production system

Sheep-barley or sheep production system prevails in high altitude areas (above 3000 m.a.s.l.) where sheep are the main source of cash income, meat, manure, skins and coarse wool for traditional cottage industry to produce blankets, rugs and mattresses by the local handcrafts. In extreme altitudes, precipitous terrain, recurrent droughts, cold temperature and windy climate limit crop production to sheep-barley or just sheep production. Sheep breeds of this system (for example, the Menz breed) are perceived to be the hardiest sheep types evolved under stressful environments. The sheep breeds thrive well with slow growth rate but considerably high annual reproduction rate under gastro-intestinal parasite infestations, recurrent drought and grazing scarcity (Lemma, 2002).

2.5.2. Mixed crop-livestock system

Mixed crop-livestock system, which covers areas in altitudes between 1500 and 3000 m in which sheep are kept in small flocks as a source of cash income, meat, manure, skins and in some areas for coarse wool. The sheep flocks are kept along with other livestock species (cattle, goats and equines) in rather

reduced communal grazing areas, unsuitable for cropping, or fallows, waterlogged land and steep slopes (Mengistu, 2000). The major crops grown include barley, wheat, and pulse (Weldeyesus *et al.*, 2016). DAGRIS (2006) indicated that 75% of the sheep population in Ethiopia is found in the highland agro ecological zone dominated by mixed crop-livestock agricultural production systems.

2.5.3. Pastoral production system

Pastoral production system is located in arid and semi-arid lowland areas below 1500 m.a.s.l. in which livestock rearing is the mainstay of people. Livestock and livestock products provide subsistence, either directly as milk, milk products, meat and blood, or indirectly in the form of purchased cereals through sales of animals. Sheep are raised mainly for cash income (mainly through export) and meat, except in isolated areas where they also keep them for milk (for example, in Afar and parts of Tigray regions). Other important species in this system include cattle, goats and camels. Constant or partial herd mobility is a strategy to achieve feed and water. Pastoralists have no permanent home and, hence move with their herds within their traditional territory (Mengistu, 2000).

2.6. Constraints to sheep Production in Ethiopia

Generally, the constraints of sheep production were feed shortage, water scarcity, drought and disease prevalence. Feed shortage, disease prevalence and predators were the first three constraints in mixed crop-livestock system. Water scarcity, feed shortage and poor productivity of sheep were the major sheep production constraints in agro-pastoral system. Drought, feed shortage and water scarcity were also the most important constraints ranked by pastoralists. Poor productivity and disease prevalence were also most important constraints in agro-pastoral and mixed crop-livestock systems, respectively (Helen *et al.*, 2015).

2.6.1. Diseases

The study conducted at Eastern Ethiopia farmers stated major diseases in pastoralist/agro-pastoralist were sheep pox, skin disease (dermatitis), Coenurosis, Pasteurellosis and abortion. Although vaccination was limited to few common diseases and the service was provided by the government only during seasonal outbreak. But, in mixed crop-livestock system, Pasteurellosis, respiratory problem, Fasciolosis and Anthrax were reported as major diseases affecting sheep productivity and survival (Helen *et al.*, 2015). Dhaba *et al.* (2012) reported that prevalence (74%) of diseases and parasite infestation (Helminthiasis), Tsetse fly infestation in the lowland are major constraint at Ilu Abba Bora Zone of Oromia Regional State.

Bloating and FDM (Foot and Mouth disease) were also among the sheep disease, which affect sheep production under traditional management system. Coenerosis (Zarty), Ovin Pasteurellosis (Mieta), Ovine

Pleuropneumonia (Samba), Fasciolosis (Tselam kebdi), black leg (Halafyo), Bottle Jaw and Anthrax (Megerem)Internal parasite like interties and external parasite such as Menge mites, ticks, fleas and lice are affecting sheep production (Weldeyesus *et al.*, 2016).

2.6.2. Feed shortage

Sheep in the tropics primarily graze natural pastures or utilise crop residues and their by-products, whose supply and quality fluctuate seasonally. In the highlands of Ethiopia, the communal grazing land is diminishing due to encroachment by cropping land because of increased food demand due to the human population growth (Dibissa, 2000). Overgrazing, nutrient depletion due to limited recycling of dung and crop residues in the soil, low use of chemical fertilisers, declining fallow periods, soil and organic matter burning, soil erosion and deforestation are all major concerns (Desta *et al.*, 2000). Morever, the shortage of feed caused by seasonal fluctuation of forage availability in the tropics due to animals lose weight during the dry season (Ermias *et al.*, 2002).

On other hand, lack of pastureland, human population pressure claiming more land for cropping and the cultivation of marginal and eroding land for crops instead of grazing (Demeke *et al.*, 2015). Weldeyesus *et al.* (2016) reported that feed shortage in both quality and quantity is a series problem and the increased livestock population and poor management of the grazing land cause the degradation of both private and communal grazing lands. The prolonged dry season leads to depletion of the potentiality of the grazing land and aggravates the effect of over grazing on their productivity.

2.6.3. Water shortage

Water shortage is the major factor in most of lowland areas and to a limited extent in mid altitudes. In eastern, north-eastern and south-eastern part of the country there is also critical shortage of water; however, there are breeds adapted to lowland agro ecologies through their physiological adaptation mechanisms (Belete, 2009). Restrictions of water may result in poor nutrition and digestion, because there is a relationship that exists between water intake and consumption of roughages, particularly during dry season. Long distance travel of small and large ruminants in searching of water was another problem (Mesay *et al.*, 2013).

2.6.4. Lack of trained personnel and absence of recording

Despite the contribution of the livestock sector to the household and national economy, trained manpower is very limited. Specialisation in sheep is missing and trained personnel in one species may be on call to contribute in every species as necessary (Markos, 2006).

2.6.5. Marketing constraints

The sheep sellers in Burie woreda of west Gojjam get market price information mainly from traders or their neighbors. There is no public market information source in the area for the producers, traders or consumers in general. This reduces the marketing system transparency and efficiency (Yenesew, 2010). In the sheep markets there is no weighing or grading of animals at the time of sale. Buyers and sellers judge the sheep they buy/ sell through physical observation only is affect marketing of sellers (Ramesh *et al.*, 2012). There is no precise method to know the quantity (in kg) as well as the quality (fat or lean meat) of produce sold or bought. This will affect the production of quality sheep and sheep productivity in the smallholder system. The implication of long transportation is a major issue in the marketing of shoats in Kenya (Juma *et al.,* 2010).

3. CONCLUSION AND RECOMMENDATIONS

Farmers do selection and breeding for improvement of genetic of animal and upgrade the economic trait of sheep. As different research conducted in sheep breeding objectives and trait preferences of farmers in Ethiopia, most commonly used trait in both sexes equally emphasized body size, body conformation, mothering ability, disease resistance, survivability, heat tolerance (adaptive), fertility, litter size, tail length and fattness, weaning weight and temperament has taken great emphasis on farmer. The farmer selection criteria for sheep consider age at sexual maturity, color, lamb growth, lambing interval, pedigree and tail type/ length on economical point of view. But, farmers face many constraints to use the genentic potential of sheep. Genetically, improved sheep of indeginous bonga cross breed perform better than others pure breed.

Based on above conclusion the following recommendations are forwarded:
- To use genetic potential of highly performing indeginous sheep effectively farmer should use appropriate breeding strategies and this can use for many trait.
- Farmer should experience with selecting breeding sheep based on record keeping and thereby farmer can prevent genetic linked diseases.
- Farmer should look through what he/she's objective of breeding and selection criteria that enforce to follow as such.

Conflict of Interest

Author declares there was no any conflict of interest exists.

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