

Review Work on Breeding Objectives and Practices of Small Holder Sheep Production in Ethiopia

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Citation: Gebremariam B (2019) Review Work on Breeding Objectives and Practices of Small Holder Sheep Production in Ethiopia. J Vet Sci Ani Husb 7(1): 105

Received Date: January 16, 2019 **Accepted Date:** April 23, 2019 **Published Date:** April 25, 2019

Abstract

This review is aimed to review breeding objectives and practices of small holder sheep production in Ethiopia. Farmers are practicing animal husbandry in different production systems and agro ecologies which are classified as three major different production systems; highland sheep-barely, mixed crop-livestock and pastoral and agro-pastoral production systems. However, sheep production and productivity in the country is constrained by feed shortages, diseases, poor infrastructure, lack of market information, technical capacity, absence of planned breeding programs and policies. Farmers' need is not also fully identified. Moreover, the small flock size is one of the limiting factors in applying within-breed selection at the household level and in this situation a selection scheme at village level or even across villages is inappropriate. Breeding objective under production systems are also found varied based on the reasons for keeping sheep and the breeding goals of farmers. For selecting a breeding ram, farmers consider different traits like appearance, coat color, tail type/length, fast growth, libido, age, adaptation and pedigree. In addition to within breed selections, crossbreeding of indigenous breeds with sires from imported exotic breeds is carried out to improve production performances but this crossbreeding has been condemned because of its threat to the survival of the adapted indigenous breeds and mal-adaptation of the imported exotics to the local environment. This problem is stepped up by uncontrolled mating predominantly seen in most of the production systems. In general, the production systems are constrained with varied production constraints like poor housing, feeding, health care and marketing. In line with this, farmer need is not properly identified. Therefore, practicing improved husbandry practices rather than traditional husbandry practices, identifying traits of adaptive and economic value and using controlled breeding to avoid genetic erosion of indigenous sheep breeds are recommended as future lines of work.

Keywords: Sheep; Breeding Practice; Breeding Objectives

Introduction

In Ethiopia, the varied agro-ecology and diverse production systems allows the country to have large livestock resources. In highland and lowland areas, farm animals are important components of the agricultural farming system. However, the production system is subsistence and serves for diverse functions which contribute more to food security [1,2]. The demand for livestock products is increasing due to the growing urban population, while farmer easier shrinking considerably as a result of an increase in the population [3]. Moreover, the country is endowed with 29.33 million sheep, where females and males account 72.77% and 27.23%, respectively. From the total population of sheep, indigenous sheep share 99.78% [4]. Despite of this fact, the farm productivity of these indigenous sheep's under smallholder production system is low which in turn affects the national economy at large and lively hood of resource poor farmers in particular. This is being also gets worsen due to feed shortages, diseases, poor infrastructure, lack of market information and technical capacity and an absence of planned breeding programs and policies [5].

Ethiopian sheep productivity can be improved by improving the management of sheep and improving the potential by selecting best animal for future mating [6]. Sheep's in Ethiopia are used for sources of income, food (meat and milk), wool, skin, manure and others for small holder keepers in different farming system and agro ecological zone [7]. The nutrition of sheep is the most important factor affecting performances. Improving performances of sheep through nutrition is determined by consideration of availability of nutrients, type of feeding system and level of feeding management [8].

To develop sustainable genetic improvement schemes under small holder situation of developing countries like Ethiopia, knowing of indigenous animal breeding practice techniques is very important. However, the small ruminant production system in different agro-ecological zones has not been fully studied as well as the farmers' needs and production constraints [9]. Therefore, this is aimed to review the production system, breeding objectives and practices of small holder farmers.

Breeding Objectives and Practices of Small Holder Sheep Production in Ethiopia

Sheep production and management system

In Ethiopia, the small ruminant production system in different agro-ecological zones is not studied fully and farmers' needs and production constraints have not been identified. Improvement in small ruminant productivity can be achieved through identification of production constraints and introduction of new technologies or by refining existing practices in the system [10]. Farmers are practicing animal husbandry in different production systems and agro ecologies. The production systems are classified as three major different production systems; highland sheep-barely, mixed crop-livestock and pastoral and agro-pastoral production systems characterized by different production goals and priorities, management strategies and practices, and constraints [11-13].

High land sheep production system

Barley is one of the major cereal crops that are largely produced in the central and south east mid and high altitude areas of Ethiopia. It is the fifth important cereal crop after teff, maize, wheat, and sorghum with annual production of about 1.2 million tons cultivated on an area of about 1 million hectares. Moreover, it is the most desirable crop in the high land where there is limited alternative crops. Hence, barley is cultivated in Ethiopia and used as feed for animals, malt and food for consumption [14]. Traditionally, barley is used for making local recipes and drinks such as "dabo," kolo, ganfo, kinche, baso; tela and other type of food. Its straw is good source of sheep and goat feed [15]. The system is found in the high land above 3000m.a.l. The major crops grown are barley and pulse. Temperature is the main factor determining productivity in the high land sheep barley production systems [8].

Mixed production system (crop livestock)

Sheep are raised in mixed crop livestock production systems. This system is based on cropping associated with livestock husbandry. This system is found where an altitude ranges between 1500 and 3000m.a.s.l. The area has adequate rainfall and moderate temperature and suitable for grain production. Sheep are more dominant in these production systems. The major commodity is meat while milk is subsidiary product in some areas [12].

Pastoral and agro pastoral production system

Pastoral systems are associated with agro ecological (AEZ) that are too dry to sustain crop production. These are characterized by little or no crop production and high mobility in search of grazing and water under Ethiopian condition. Pastoral system production is found at altitudes below 1500m.a.s.l. Goats are more dominant than sheep in these production systems [16]. Small ruminant is associated with the purely livestock based on nomadic and transhumant pastoral production system based in largely on range, primarily using natural vegetation in the low land of Ethiopia. The pastoralists have an indigenous mechanism of coping with the problems of feed and water shortage during dry season and during drought year, when grasses become depleted from the grazing land they lop the leaves and branch of tree and feed to their animals. Due to this reason the grazing area were divided in to wet and dry season grazing areas and drought reserves. During extended drought the pastoralists migrate to distant place in search of feed and water [17].

Agro- pastoral production system is characterized by less integration with crop production as compared to crop livestock production system. Producers in this system have permanent resident and the movement is limited in terms of both distance and duration. The system is characterized by high degree of dependence of wool and meat production. Some crop agriculture is practiced around the permanent home stead. This is also a low output system [18].

Urban and per-urban production system

Urban and pre-urban sheep production system has taken several production systems carried out on the standard ground level farm or garden, which is either on communal land or private property [19]. The range of urban and pre urban sheep and goat production activities are different from natural pasture, according to the characteristics of available land, feed, water, personally managed allotment, home gardens, fruits tree, long roadside reserves and green house [20].

Management of small holder sheep production

Management of sheep is necessary to increase the production and productivities. However, sheep production and productivity in Ethiopia are constrained by many factors like feed shortage, health problem, water shortage, housing and marketing constraints, and relatively poor road and transportation systems [21].

Sheep housing

There are several criteria's used by households to construct sheep house like considering light access, better ventilation, land for further expansion, wind direction and orientation [22]. Out of these all criteria's, site orientation and wind direction are vital components of house construction. Moreover, construction of the house with varied designs is dependent with culture, custom and material availabilities [23].

Flock size and breeding management

In Ethiopia, there are variations in flock size among different districts like Adiyi Kaka (11.3) and Horro (8.2) [11]. Moreover, breeding ewe (46.8%), male lamb (19.2%), female lamb (14.3%) of Menz and breeding ewe (49.2%), male lamb (19.2%) and female lamb (18.1) of Afar are found [24]. The small flock size is one of the limiting factors in applying within-breed selection at the household level and in this situation a selection scheme at village level or even across villages would be inappropriate. Given the small flock size, designing and implementation of community-based breeding programmes require a good understanding of production system used, different constraints in the system, clear understanding of breeding objectives and accurate methods of identifying the superior genotypes [25]. Under a controlled breeding system mating dates are recorded in order to trace back if the mated ewe conceived or not [26]. Controlled breeding activities are the basis for designing genetic improvement programs. The primary purpose of characterizing farmers' and pastoralists' breeding management practices is to assess the possibility of introducing controlled breeding activities under existing traditional practices. Breeding activities that influence implementation of controlled breeding activities include the size, structure and ownership patterns of the flocks, the herding practices and breeding ram ownership and use patterns [27].

Feeding

In most production system, agro ecology and geographical regions, extensive free grazing in communal grazing land and stubble grazing are the most common practices of feeding sheep. The form of controlled feeding includes tethered grazing on private lands and marginal lands, cut and carry feeding of grass, tillers and weeds [28]. The major sheep supplementary feeds in Ethiopia are grains such as boiled bean, pea, and maize and non-conventional feeds like Atella and Areke which are the by-products of locally made beverages [11]. FAO (2002) reported that the supplementation of a basic concentrate diet containing 16 percent crude protein with a trace element and/or a vitamin mixture (A, D, E) significantly improves the daily gain and feed efficiency of male lambs. During dry seasons supplementation of animals with concentrates and industrial by-products cannot be afforded by most small holder farmers due to high costs and lack of accessibility [29]. The feed resources base for sheep and goat production in Ethiopia are natural grazing and crop residues, the quality and supply of these resources is seasonally variable. Shortage of feed supply, quality and quantity of feed are major nutritional challenge in the world in general and developing countries in particular time [30]. Grazing resources in the high land are diminishing due to increase cropping land, bush encroachment and over grazing resources in the pastoral areas [31].

All species of animals and all sexes except small ones graze and browse together in communal grazing range lands. In this type of herding young animals usually are less competitive and get lesser amount of feed compared to the large animals and hence are more vulnerable to the effect of feed shortage and malnutrition mortalities due to feed shortage and the malnutrition are common especially during the late dry season [32].

The main sources of water for sheep are from stream, rivers, natural ponds, water holes etc. The amount of these water sources decline in the dry season. The distances to watering points varied during the dry and wet seasons. The majority of small holders (86.67%) trek their animals 1 to 5 km per day in search of water during the dry season, but during the wet season distance for 96.11% of small holder is reduced to below 1 km and about 38.89 % of the farmers watered their animals in their home [33]. But still water shortage is a common problem for both human and sheep in most rift valley part of the country. It has been reported to be a limiting factor for animal's productivity in most mid and low land areas of southern region. In south eastern part of the country, there is also critical shortage water. However, there are breeds adapted to low land agro-ecologies through their physiological adaptation mechanisms [34].

Water problem both in quantity and quality can cause different problems like, constipation, drying off of digestive tract, low milks and low metabolic activities with lowered body condition. Water shortage is seen in most lands area in which a limited amount of rainfall in available [28].

Health care practice

Health of animal is affected by disease, management and stress. Disease of animal is categorized under zoonotic (transmittable from animal to human and vice versa) and non-infection (not transmit). For example anthrax disease a zoonotic disease can cause an economic loss for animal by lowering production performance of animal, decreasing production ability, degrading of skin and hide and mortality and morbidity of animal [35]. The important environmental challenge as a part of animal health program is the control of internal and external parasites. In general problems associated with animal health can largely prevent if proper management practice are followed. Therefore, the veterinarian involved in sheep health management program should have the necessary depth of knowledge about the elements that must be addressed in crucial on animal health control [36].

Respiratory Disease Complex (RDC) is among the most important diseases and associated complexes in small ruminants' husbandry and management [13]. Early mortalities (as high as 50% in lambs) are among the most important losses associated to managements like cold stress, starvation, miss-mothering, etc. [11]. Also it has mentioned that the major constraint of sheep production in Menz and Afar areas are feed shortage/frequent drought and disease each with varying intensity [37]. Similarly,

disease problem was the first and the most important production constraint of Gumez sheep in North Western Lowland of Amhara region [38].

Marketing

In Ethiopia marketing of livestock production is under developed. The major problem are traditional management systems which are not market oriented, developed marketing system and poor infrastructure, poor financial facilities, presence of cross border trade, producers do not have accesses to market information, the system lacks market orientation, which would have been an important of driving force for increasing production of sheep [36,39]. The market structure and infrastructure itself has considerable negative effect on sheep marketing and quality of production problems such as seasonality of market demand, rough road, long distance trekking before slaughter and lack of feeding, watering and resting structure through the course of trekking contribute to the poor body condition and poor meat quality on animals. Sheep are exposed to several factors during the transportation to the market. Managing in limited space, frequent fluctuation of temperature, traveling for long distance trekking, road quality are the various stressing factors. These factors apart from their stressing effect can cause death of animals [40].

Breeding objectives and practices of sheep production

In Ethiopia the main objective of sheep production is to maximize outputs like meat, milk, wool, skin per unit input. The quality of animal products must target the requirements of the end-user or target market. This may be an export or domestic market. Meat is the most important product of small ruminants particularly sheep in Ethiopia. Milk is also a highly valued product in mixed agricultural areas. The quantity of meat produced depends on the number and weight of surplus animals at age of sale. Skin is the other valuable byproduct from sheep used for meat but there is no clear definition of skin quality within a breed. Breeding objective under production systems are varied based on the reasons for keeping sheep, the breeding goals of farmers and pastoralists can be defined. The main breeding goal of farmers in the High land sheep-barley production system for Menz sheep is to improve their market value through increased meat production (improved growth rates and conformation). The same is true for farmers in the perennial crop-livestock system for the Bonga breed and for farmers in the cereal-livestock system for the Horro breed. The breeding goals of the Afar pastoralists are to increase milk yield and meat production [41].

Breeding objectives

Reports indicate that in Ethiopia particularly in Menz 65.5% of the farmers keep rams for breeding and fattening, 24.1% for breeding only, 3.5% for breeding and socio-cultural benefit [24]. Sheep's are source of income and food for Ethiopian farmers. The animals are kept for selling meat and milk but also for own leisure. The difference between rearing big animals compared to small animals is the economical value. A cow is very big to slaughter and cannot easily be sold for right value compared to sheep that more easily can be sold. The only existing income source for the farmer is the animals and if the flock would die the farmer has to start from zero. Farmer can have multiple goals with the livestock and may need a gradually growing herd that can manage animals being disposed if something unexpected happens. This means that an unproductive animal, which do not require hard labor, may be kept in the flock only for insurance motives [42].

Breeding practices

In the northern part of Ethiopia of Northern Wollo Habru 77% and in Gubalafto 63% of the population practiced selection for breeding ram and ewe. Lambing interval, mothering ability, coat color and twining with index of 0.22, 0.19, 0.17 and 0.15 are the selection criteria for ewe [43]. For selecting a breeding ram criteria to be considered are appearance or body size, coat color, tail type/length, fast growth, libido, age, adaptation and pedigree [37]. In Selale area and East Hararge indicted that traits like appearance was the most considered characters in selection of rams [44,45]. Breeding ewe can also be selected based on parameters like, twining ability, lamb growth, lamb survival, age at first lambing and lambing intervals [11]. Like that of ram, appearance is the most considered factor for selecting ewe [37]. Across all the production systems, overall appearance is the most preferred attribute for selecting both breeding rams and breeding ewes. The next most important were fast growth and coat color for rams and mothering ability for ewes [46].

Open-nucleus breeding practice is a practice which allows an in-flow of high potential breeding animals from lower-tier flocks for pure-breeding to nucleus flocks in the ranches as a strategy for genetic improvement of sheep in Ethiopia. The practice could be utilized for conservation of genetic resources (including breeds, desirable genes, genotypes, etc) through improvement and proper utilization. This practice can serve for both pure-breeding and crossbreeding, and dissemination of improved genetic materials allowing conservation and improvement of the indigenous sheep breeds [47].

In Ethiopia, sheep crossbreeding has been used as a way for genetic improvement by importing exotic breeds. However, recently, this crossbreeding has been condemned from two perspectives. First, crossbreeding is considered a threat to the survival of the adapted indigenous breeds by diluting their adaptive genetic potentials. Second, crossbreeding as a strategy failed to sustain genetic improvement as there is lack of policies and regulations to control and avoid inbreeding depressions as well as loss of biodiversity. Crossbreeding can be considered "a necessary evil in livestock improvement", but its negative impacts on indigenous

breeds can be ameliorated through rational crossbreeding strategies. These Strategies for genetic improvement could follow three pathways: (i) selection between breeds (or strains), (ii) selection within breeds (or strains), and (iii) crossbreeding or synthetic breed development [48].

In Ethiopia mating is predominantly uncontrolled in most of the production systems. However, controlled mating is practiced to some extent to match lambing time with wet season and to avoid indiscriminate breeding in the pastoral production system. In the northern part of Ethiopia (Tigray region) 16.83% control mating had been practiced. Means to control includes culling (59.1%), either through sale or slaughter of unselected animal, herding /hand mating (34.3%) The methods for control mating include separating males from females at all times, especially during dry season, and castration [39,49]. In the south-east lowlands and north-western of the Somali Region in eastern Ethiopia, respectively indicated that controlled breeding to capture both the desired selection criteria and to match lambing with the rainy season enhances the survival rate of the offspring [50,51].

In Ethiopia breeding males are not reared together with female sheep instead smallholder farmers get the service from neighbors' or use communal rams. Some farmers have breeding rams originated from the same flock and few purchase from market. The ratio of rams older than one year to ewe flocks is 1:6. Majority of small holder farmers practice selection for breeding rams and breeding females [11]. Birth is the major form of sheep breed acquisition across all production systems and sheep acquisition in the form of gift is one method of sheep gaining [52]. The selected rams for breeding start mating few ewes at the age of 12-18 months. After two years, one ram can serve fully 20-30 ewes and can serve up to 3.1 years of mean age after which it will be usually disposed through sale or slaughter [22,39].

Culling in sheep flocks is an important tool for development. It helps to remove undersized animals and breed those closest to the desired ideal type. Selection criteria should be developed and followed when culling animals. For example, ewes that do not conceive after two successive mating should be culled. Sheep with defects, poor udders, bad conformation, etc are culled. Culling should be stringent and used as a means of improving the genetic quality and productivity of a flock. Following such criteria could mean 10-20% culling annually. These animals can be sold to enter the meat market. Flock size can be maintained by replacing culled animals by ewe lambs in the flock [53]. The major mode of culling and disposal of flock is selling followed by slaughtering and death [52].

Conclusions and Recommendations

Even though there is large population of sheep having great role both to the lively hood of resource-poor farmers and the national economy at large; the current level of on farm productivity in the smallholder production system is low. Sheep production and productivity in the country is constrained by poor management and husbandry practices like feed shortages, diseases, poor infrastructure, lack of market information and technical capacity, and an absence of planned breeding programs and policies. The farmers breeding objective is to increase cash income through increased quality of marketable animals, to insure food security during crop failure and meat production by improving growth performance without undermining adaptation and survival traits. Moreover, breeding objective under production systems are varied based on the reasons for keeping sheep, the breeding goals of farmers and pastoralists. The main breeding objective of farmers in the High land sheep-barley production system for Menz sheep is to improve meat production, growth rates and conformation. The same is true for farmers in the crop-livestock production system for the Bonga breed. The breeding goals of the Afar pastoralists are to increase milk yield and meat production.

In Ethiopia the adopted breeding strategies over the last several decades are focused on importing exotic breeds for cross-breeding. However, the strategies at farming communities are varied in different areas and there are different production systems. This underlines the need to characterize the breeding practices and objectives of a community as bases for designing breed

Improvement programs under small holder condition. The main breeding practice of smallholder sheep producer uses natural mating system (majorly uncontrolled) due to lack of technological advice and infrastructure. However, controlled mating is practiced to some extent to match lambing time with wet season and to avoid indiscriminate breeding in the pastoral production system. Therefore, practicing improved husbandry practices rather than traditional husbandry practices should be considered to improve husbandry practices such as feeding, housing, breeding, care, protection against disease and others. Selecting appropriate ewe and ram for the purpose of improving the breeding objective as well as its practice is important. To minimize the failure of sheep breed improvement programme it is important to consider breed management system and trait preferences of the community.

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