www.iaard.net eISSN:2456-009X
International Association of Advances in Research and Development
International Journal of Agriculture And Veterinary Sciences
International Journal of Agriculture and Veterinary Sciences, 2015, 1(1),23-28

A Review Work on Breed Types and Breeding Strategies of Sheep Production systems in Ethiopia

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Summary: the review work stated that an Ethiopian sheep breeding strategy is adopted over the last several decades which are largely focused on importing exotic breeds for cross-breeding. In Ethiopia, for breeding strategy, the physically identified sheep types are short fat-tailed, long fat-tailed, thin-tailed and fat-rumped sheep. The frequently mentioned indigenous sheep is fat-tailed, coarse hair type with the exception of the fat rumped hair type sheep that inhabit from eastern, southeastern and southern rangelands of the country. The breeding strategy of sheep farming in Ethiopian condition is showed that variations in the breeding strategies of the different communities and the strategy are mainly focused on selection and cross breeding. In the country the local sheep productivity is constrained by feed shortages, presence of diseases, poor infrastructure, lack of market information, technical capacity and absence of planned breeding programs and breeding policies. Institutions that are involved in research, extension and community services are so far having failed to have a negative influence on traditional sheep husbandry practices. Designing a suitable breeding scheme for smallholder livestock production systems have remained a challenge hitherto. Until now recent information showed that livestock breeding programs in Ethiopia is not conventional hierarchical breeding schemes. Farmers' and pastoralists' strategies are expressed in their indigenous breeding and management practices, breeding/production objectives, and marketing strategies.

Key words: Selection, Cross Breeding, Sheep, Constraints

1. Introduction

Ethiopia is known in livestock population and entry of domestic animal migration from Asia to Africa thus rolled for Ethiopia is the first and tenth in livestock populations in Africa and in the world, respectively. Such livestock species are cattle, sheep, goats, chicken, camels, horses and donkeys. Therefore, Ethiopia is one of the largest African countries for sheep and goats resources with have long genetic diversity for the livelihoods of rural poors Abegaz, [1]. From the total livestock populations, sheep are the second most important species of livestock in with the estimated number of 25.9 millions CSA,[2]. Therefore, physically, nine sheep breeds are identified Gizaw *et al*., [3]. Sheep are living banks for their owners and source of immediate cash and insurance against crop failure Tibbo,[4]. They are relatively drought tolerant, small in size, easily manageable, and saleable resources. But there performance is poor, so there is a need to improve their productivity through selection and breeding. Presently, community-based strategies is the need to knowledge and aspirate the local community Wollny, [5]. Further, designing and implementation of community-based breeding programmes require a good understanding of the production system and the alternative importance of the different constraints, breeding objectives of the farmers and identifying the superior genotypes Baker and Gray, [6]. Whereas, the majou production constraints are feed shortages, diseases, poor infrastructure, lack of market information and technical capacity, and an absence of planned breeding programs and breeding policies. Carcass weight per slaughtered animal remained at the bottom of the low and unimproved category at about 10 kg, with an average annual off-take rate of approximately 32% for the period 2000 to 2009 FAO, [7]. Therefore, the objective of this review paper was to know the sheep breeding practices and constraints in Ethiopia

2. Sheep Breeds and Breeding Strategies in Ethiopia

Breeds of Ethiopian Sheep: There are about 14 traditionally recognized sheep populations in Ethiopia. These populations are called sheep types in some literatures. Physical based characteristics of sheep types in Ethiopia are classified into short fat-tailed, long fat-taile, thin-tailed and fat-rumped sheep. Fat-tailed coarse hair type with the exception of the fat rumped hair type sheep is the frequent one that inhabit in the eastern, southeastern and southern rangelands of the country. Unlike others, afar sheep manifests a tail intermediate between the true fat-tailed and fat-rumped types of sheep, which may be the result of interbreeding between these sheep populations. The increasing numbers of long-thin tailed sheep found in the northwest and west of the country on the border area with the Sudan are indigenous to the Sudan and have come from across the border. Molecularly, these phenotypic 14 recognized indigenous sheep breed types are fallen into three breed groups: the fat-tailed hair sheep (3 breeds), the fat-tailed coarse wool sheep (2 breeds) and the fat-ramped hair sheep (1 breed). The DAD-IS database mentions three other breed types (AkaleGuzai, Barka and Bonga) but, these are not yet recognized at national level The first two breeds are found in Eritrea, but sizable populations of these are found in neighboring areas across the border in Ethiopia. The Bonga sheep type is found in the southwest of the country which is associated with the Horro sheep, but an increasing body of opinion puts it as distinct breed type on its own. Similarly, SisayLema's thesis (119) presents seven other breed types from the Amhara Regional State, one of which (Shewa/Legegora) are already known as a synonym for the Menz breed type.

Table 1. Some Recognized Indigenous Sheep Breeds of Ethiopia

Breed Group Name	Breed Name	Synonyms	Distribution
Fat-tailed Hair Sheep	Afar	Danakil, Adal	Afar Region and parts of Dire Dawa and South Wollo with the Afar pastoralists
	Horro	Abyssinian, Ethiopian, Bonga, Wollega	Highlands of western Ethiopia (West Shoa, Wollega, Kaffa and Illubabor)
	Tukur	Lasta, Ethiopian Highland, Abyssinian	Highlands of northern Ethiopia (parts of Tigray,Gondar and Wollo)
Fat-tailed Coarse Wool (wavy wooled) Sheep	Arsi-Bale	Ethiopian Highland Abyssinian	Highlands of eastern and south-central Ethiopia (Arsi, Bale, Harangue, Sidamo and South Shoa)
	Menz	Ethiopian Highland, Abyssinian, Leg agora	Highlands of northern and central Shoa and some parts of Wollo
Fat-rumped Hair Sheep	Blackhead Somali	Blackhead Ogaden, Murle, Turkana, GabbraBoran	Rangelands of eastern, south-eastern, southern and south-western Ethiopia

Sources: 111thESAP-Proceedings

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2. Breeding Strategies and Genetic Improvement

Genetic improvement of livestock is a complex set which is required a high level of organization and technical sophistications. In other countries like Europe, animal breeding has been traditionally supported by the state and implemented by large national breeding programs. The sheep breeding strategies adopted in Ethiopia over the last several decades were largely focused on importing exotic breeds for cross-breeding. Several efforts have been made to this end since the early 1960s Tibbo, [4]. These have included importing of Bleu du Maine, Merino, Rambouillet, Romney, Hampshire, Morrisdale, and Awassi breeds. However, these genetic improvement programs is not produced a significant effects on sheep productivity on the farmers' and pastoralists' livelihoods and the national economy.

The major drawback in the cross-breeding programs is lack of a clear and documented breeding and distribution strategy. There has been very little consideration of the needs of the farmers and pastoralists from indigenous practices. Additionally they have had limited or no participation in the design and implementation of the breeding programs. Further, the breeding programs lacked breeding schemes to sustain cross-breeding at the nucleus centers and at the village level. The distribution of the improved genotypes of these programs was indiscriminate and unplanned, resulting in failure of the breeding programs and threatened to dilute the sheep genetic diversity in the country. The few sheep selective breeding programs initiated by the Institute of Agricultural Research in the 1980s, which included Afar and Horro sheep breeding programs, were limited to the formation of elite nucleus flocks and the programs have since been ended. There was no distribution scheme in place for the improved genotypes in the nucleus centers. Currently, selective breeding as a genetic improvement strategy is gaining momentum. There are breeding programs underway for Menz, Horro, Bonga, Washera, and Afar sheep. Furthermore, a number of studies have been conducted to design suitable breeding schemes for implementing selective breeding in smallholder farming systems in Ethiopia Gizaw and Getachew, [8]; Gizaw *et al*. [9]; Duguma, [10]; Gizaw *et al*. [11]; Haile, [12]; Mirkena, [13].

1.4.Conventional Breeding Schemes: The design of selective breeding schemes is a major determinant of the success of breeding programs in smallholder livestock production systems. Designing a suitable breeding scheme for smallholder livestock production systems has remained a challenge until now. Recently, livestock breeding programs in Ethiopia had adopted exclusively the conventional hierarchical breeding schemes. According to Solomon *et al*, [14] stated that crossbreeding sheep between Horro and Washera was carried out. Washera breed is a short-fat-tailed, short-haired, predominantly brown and polled sheep in Ethiopia. However, selection programs could be designed with a hierarchical structure involving single, two or three tiers or tier combination breeding activities together. The drawbacks of conventional hierarchical breeding schemes are not addressing fully farmers' preferences under low-input systems Gizaw*et al*., [11]; Gizaw and Getachew, [8]. The intangible approaches of the conventional breeding scheme are having wrong breeding objectives Kosgey, [15]. According to Kosgey *et al,* [16], less distribution of improved genotype to farmers and inappropriate selection objectives are the failure of D'man sheep breed improvement in Morocco. Insufficient involvement of the farmers and the shortage of financial and logistical resources for sustaining the Peul, Touabire, and Djallonké sheep breeding program in Senegal are additional reasons for the lack of success. The major advantage of the hierarchical breeding schemes is that they yield faster genetic progress is carried out in a controlled environment at nucleus centers with advanced selection tools. These selection tools include selection on the basis of the best linear unbiased prediction (BLUP) of the breeding values of the selected candidates. For the successful hierarchical programs, breeding objectives should be designed based on the indigenous breeding strategies of the farmers and pastoralists. Therefore, attempts have been made to design breeding schemes to transform the conventional nucleus breeding approach into a sustainable participatory breeding scheme Mueller, [17]; Gizaw*et al*., [11]; Haile *et al*., [12].

Community-Based Breeding Schemes: Failure of the conventional breeding schemes has led to community-based breeding schemes being suggested as viable options for the genetic improvement programs of small ruminants in low-input, smallholder production systems Sölkner *et al*., [18]; Kahi *et al*., [19]; Kosgey and Okeyo, [20]; Gizaw and Getachew, [8]. The significant involvement of a women's group in Northern Togo, involvement of farmers in the selection and control of inbreeding in south and Southeast Asia, and use of the indigenous Tzotzil selection criteria in southern Mexico are the exemplary one Perezgrovas, [21]; Kosgey*et al*., [16]. A community-based breeding program refers to village-based breeding activities planned, designed, and implemented by smallholder farmers, individually or cooperatively, to effect genetic improvement in their flocks and conserve indigenous genetic resources. The process could be facilitated, coordinated and assisted by outsiders (development and research experts in governmental and non-governmental organizations). Unlike the conventional top–down approach, community-based breeding strategies basically need a detailed understanding of the community's indigenous knowledge of farm animals regarding breeding practices and breeding objectives. The community-based breeding strategies are involved with local community at every stage, from planning to operation of the breeding program Baker and Gray, [22]. The breeding structure of such a program is commonly single-tiered with no distinction between the breeding and production tiers, i.e., the farmers and pastoralists are both breeders and producers. A community-based breeding program is designing suitable breeding schemes that enable communities to implement breed improvement activities under uncontrolled village breeding practice. This includes procedures for the selection and use of superior breeding stock and prediction of genetic progress under village conditions.

The Basis for Designing Community-Based Breeding Program: The bases for designing community-based breeding programs are the farmers' and pastoralists' indigenous breeding strategies and the resultant mode of livestock production. Farmers' and pastoralists' strategies arise from their indigenous knowledge of animal breeding and managements. The indigenous strategies of the farmers and pastoralists take into account the production environment, long-standing tradition of livestock production practices, management skills, socio-economic and cultural factors, and the availability of inputs and services. The mode of livestock production system is a target area needs to be characterized and understood in order to design a suitable breeding program. Community-based sheep breeding requires a full description of the existing environment, the current level of productivity, breeding objectives, and the selection Criteria of sheepherders, available indigenous knowledge, breeding practices and full participation of farmers and pastoralists Sölkneret al., [18]; Kosgeyet al., [16]. The approach to designing breeding programs should attempt to fit new breeding strategies into the indigenous breeding strategies of the target farmers and pastoralists, rather than forcing exotic methods and products as is the case with the conventional top–down design of breeding programs. Sheep production in Ethiopia is generally of a subsistence nature. Sheep are reared in extensive systems with no or minimal inputs; they are kept virtually as scavengers, particularly in mixed crop–livestock systems. Extensive systems of production share common characteristics, such as small flock sizes, communally shared grazing, uncontrolled mating, absence of recording, low productivity per animal, relatively limited use of improved technology, and use of on-farm by-products rather than purchased inputs. Market-oriented or commercial production is almost non-existent. Livestock production systems in Ethiopia are crudely classified into mixed crop–livestock, pastoral, and agro-pastoral systems based on the contribution of livestock to the total household revenue, the type and level of crop agriculture, the type of livestock species, and the extent and length of movement. However, there are diverse production systems with diverse breeding, production, and marketing objectives and strategies among groups of farmers Gizaw*et al*., [11]. A summary of the characteristics of the major sheep production systems in

Table 2: Characteristics of village-based breeding schemes and their feasibility under village conditions in Ethiopia

Breeding scheme	Description	Applicability/feasibility
Within flock selection	• Program designed based on individual sheep/goat herders • Recording and selection takes place within each sheep herder's • The sheep herders produce breeding nucleus animals • Provide improved stocks to producers who do not practice selection • The scheme can operate with sheep keepers having at least 150 breeding females	• Suitable for areas with large flocks and individual grazing • Requires that producer farmers and pastoralists appreciate genetic improvement and are willing to pay for breeding animals with higher genetic merit • Buying breeding stocks from breeders may not be feasible for poor farmers • Returns on investment for the breeder farmers
Ram circles	• Farmers organize themselves into ram circles • Each year they use a significant proportion of the young males selected from their group • Breeding males are moved from farm to farm on a daily basis • Breeding males are evaluated based on the performance of their progeny in each participating farm	• High accuracy of selection is achieved • Operationally very DIFFICULT
Two tier cooperative scheme	• The scheme involves cooperation among farmers • They form a nucleus flock by contributing their best females • Recording and selection takes place only in the nucleus • The nucleus produces replacement rams for the cooperating flocks	• Suitable for smallholder mixed crop–livestock systems with communal grazing • Operationally difficult • Requires land and barns and separate herding for the nucleus flock • Extra maintenance costs of the nucleus flock
Dispersed nucleus scheme	• The scheme involves cooperation among farmers • Top females are identified within each member's flock • These females are mated to selected males • Male progeny are retained for evaluation and eventual replacement	• Requires hand mating of the best males and females in each flock • Nucleus flock has to be herded separately from the other flocks • Operationally not easy
One tier cooperative scheme Gizaw*et al.* [9]; Haile *et al.* [12]	• The scheme involves cooperation among farmers • In a one tier structure, no nucleus flock is established • All young males of the cooperating flocks are recorded • Breeding males are selected from among the young males born in the flocks of the cooperating farmers • Males can be evaluated within the cooperating flocks or maintained and evaluated in a separate place before being re-distributed among the farmers	• Suitable for smallholder mixed crop–livestock system with communal grazing systems • Suits the existing breeding structures in most parts of Ethiopia, particularly in mixed crop–livestock production systems • Extra cost of recording of the base flocks

Ethiopia and the types of sheep reared is described in Gizaw, [23]. Major Challenges of Breeding Strategies: Livestock genetic resources and their genetic diversity are gradually disappearing. Small ruminant productivity in Ethiopia is low than exotics EARO, [24]. Generally, technical and non-technical constraints limit have a role for animal productivity

EARO, [25]. Small ruminant population of Ethiopia is one of the largest resource in Africa IBC, [26]. Most of the small ruminant population of the country is kept by smallholder farmers in a traditional way EARO, [24]. In Ethiopia, the small ruminant production system is not well studied and farmers' needs and production constraints have not been identified EARO, [24].

Major constraints are feed shortages, diseases, poor infrastructure, lack of market information and technical capacity, and an absence of planned breeding programs and breeding policies. Research, extension and services so far have failed to have a positive influence on traditional sheep husbandry practices. For instance, the carcass weight per slaughtered animal remained at the bottom of the low and unimproved category at about 10 kg, with an average annual off-take rate of approximately 32% for the period 2000 to 2009 FAO, [27].

Among the technical constraints, poor nutrition both in quantity and quality, diseases and low genetic potential for higher production are the main ones. An estimated 82% of the total contribution of animal genetic resources to global food and agricultural production comes from only 14 species Workneh, [28]. The level of threat to maintenance of animal genetic diversity in Ethiopia is not known. However, the existing threats are: Interbreeding, Uncontrolled crossbreeding, Neglect .Droughts and consequences of drought-associated restocking schemes; Political instability and associated civil unrest, Changes in producer preferences, usually in response to changes in socio-economic factors leading to change in breed use. The less recognized sheep breeds like the Dangille or Washera in north-western highlands and the Bonga sheep in south-western Ethiopia have great potential for commercial mutton production. The important known causes of loss of animal genetic diversity in Ethiopia are neglect, recurrent drought, political instability and weak development interventions. Little comprehensive effort has been exerted to systematically conserve and wisely utilize animal genetic resources in Ethiopia. The only substantive attempts were the establishment of breeding ranches for cattle, sheep and recently goats.

4.Conclusion and Recommendations

In Ethiopia cattle, sheep, goats, chicken, camels, horses and donkeys are the common farm animal species. From the total population, 14 sheep breeds are traditionally recognized and characterized. The major focusing area for characterization was based on four physical characteristics like short fat-tailed, long fat-taile, thin-tailed and fat-rumped sheep. In Ethiopia the adopted breeding strategies over the last several decades is focused on importing exotic breeds for cross-breeding. However, the strategies at farming communities are varied in the different areas. The used selective breeding schemes are conventional and community-based breeding schemes. This underlines the need to characterize the breeding practices and objectives of a community as a basis for designing breed improvement programs. The production constraints are feed shortages, diseases, poor infrastructure, lack of market information and technical capacity, and an absence of planned breeding programs and breeding policies which are the most future focusing area.

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