

**Review Article**

Challenges of Community Based Small Ruminant Breeding Program: A Review

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ABSTRACT

This paper is aimed to review the current research status and challenges of existing Community based small ruminant breeding programs in Ethiopia. The current and past research studies have been reviewed and discuss from the available literature such as the small ruminant production system, breeding programs, methods of the small ruminant breeding program, and current community-based sheep and goat breeding program in the country. The achievements of small ruminant genetic improvement program especially the sheep breeding program have been initiated using improving local sheep through crossbreeding (Awassi crossbreeding program using Menz sheep as dam's line) and improving local sheep through selective breeding (Establishment of an elite nucleus flock for Menz sheep). The disappointment with the crossbreeding and nucleus-based selection programs started the development of a participatory breeding program called a community-based breeding program. CBBP is a village-based breeding activity planned, designed, and implemented by smallholder farmers, either individually or in cooperatives, to effect genetic improvement in their flocks and conserve indigenous genetic resources. However, considering the past genetic improvement approaches and their suitability for Ethiopia's production system. Small

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ruminant breeding programs have been shifted from central nucleus schemes to community-based breeding programs. However, the implementation of CBBP in Ethiopia has faced different challenges. Some of the challenges are disease and poor animal health services, shortage of feed, poor market access, selling selected breeding rams and uncontrolled mating system, difficulty of pedigree and performance recording, year-round lambing/kidding patterns, unwillingness of farmers to keep all young rams/bucks until the time of selection, incompatible cooperative society proclamation, shortage of incentives for participant farmers are identified as main challenges of the program. Thus, possible solutions and recommendations for such challenges are: organizational capacity of cooperatives and monitoring system of national agricultural research system (NARS) need to be enhanced, availability of complementary services like affordable health service and access to adequate and quality feed resources, establishment of a better market link to ensure returns on investment and strengthening the financial capacity of cooperatives, periodic evaluation of on-going programs for drawbacks identification and adopt program activities as per evaluated information.

Keywords: Breeding program, community-based breeding, challenges, research status, small ruminant.

INTRODUCTION

Ethiopia is known for having the largest livestock population in Africa. Across the country, millions of cattle, donkeys, camels, chickens, sheep, and goats live and work alongside people. The relationships between people and animals are long-standing, close, and deeply embedded in culture and traditions (Haile *et al.*, 2018). Small ruminants are extremely important in the livelihoods of smallholder farmers in Ethiopia. However, the small ruminant sector is faced with various challenges. Its performance is generally low but the situation could easily be improved with targeted interventions on the most limiting factors within the value chain. Productivity per animal and flock off-take are both low (for example, estimates of the average annual off-take rate from sheep and goat flocks indicated values of 33% and 35%, respectively. Almost all the indigenous sheep and goat breeds in Ethiopia are primarily owned and managed by resource-poor smallholder farmers and pastoralists under traditional and extensive production systems. The population of sheep and goats in Ethiopia has been on an increasing trend.

According to CSA (2021), the total sheep and goat population in Ethiopia is estimated at 95.4 million where 42.9 million are sheep and the remaining 52.5 are goats. Almost all the indigenous sheep and goat breeds in Ethiopia are primarily owned and managed by resource-poor smallholder farmers and pastoralists under

traditional and extensive production systems. The indigenous small ruminant breeds are comparatively worthy for some traits like heat tolerance, disease resistance, and the ability to withstand poor management conditions. These indigenous breeds thrive and produce on sloppy, marginal, and often uncultivable extremely high and low lands. Unfortunately, a large number of these genetic resources have been lost due to uncontrolled traditional breeding practices and a lack of breed improvement programs. Any endeavor designed to correct the risk of uncontrolled traditional breeding practices and boost the productivity of small ruminants should largely depend on effective genetic improvement programs (Haile *et al.*, 2019). Different approaches have been followed for several decades to improve small ruminant (sheep & goat) genetic resources and to exploit the potential of the sector. These approaches are crossbreeding, nucleus-based selection, and community-based breeding programs were the different options implemented in Ethiopia to improve the performance of local breeds. Approaches of Crossbreeding failed due to incompatibility of introduced genotypes with smallholders' breeding objectives; management practices of the low-input production systems and environmental conditions. To many genotypes and environments to keep animals adapted to the environment or adapt the environment to the needs of animals. Approaches of central nucleus-based selection efforts also failed to impact the traditional and extensive small ruminant production systems that are owned and managed by resource-poor smallholder farmers and pastoralists (Abebe, 2018). In the last decade or so, a new approach--community-based small ruminant breeding programs have been suggested as an alternative to the conventional centrally managed and top-down breeding programs. This approach explicitly takes account of farmers' needs, views, decisions, and active participation, from inception to implementation.

There have been different attempts at developing small ruminant breeding programs either for selective breeding or crossbreeding in Ethiopia. Different institutions also follow varying approaches including nucleus and community-based schemes. The different efforts need to be harmonized, and pilot activities are taken to scale to bring about sustainable change to the lives of rural people. Therefore, this study aimed to review the current research status and challenges of existing Community based Small ruminant breeding programs in Ethiopia.

LITERATURE REVIEW

Small Ruminant Breeding Programs in Ethiopia

As a resource base and contribution almost all the indigenous sheep and goats breeds in Ethiopia are primarily owned and managed by resource-poor smallholder farmers and pastoralists under traditional and extensive production systems (Abebe,

2018). As a research and development efforts productivity per animal is not showing improvement. Reporting the low production and productivity performance of Ethiopian sheep and goats is almost common. About 10 kg per slaughtered carcass weight from sheep was reported. Various attempts have been made to improve the productivity of small ruminants in Ethiopia where the majority of the efforts tended to improve productivity through cross-breeding. The performance of (F1) generation from exotic breeds and the indigenous sheep breeds were variable. There are areas where the crosses performed and failed. As a small ruminant research focus area, intervention strategies were believed to improve the production and productivity of the livestock sector (Mirkena *et al.*, 2011). The genetic improvement strategy for the small ruminants, in the Livestock development master plan, was suggested to be through: investing in genetic selection, reduction of mortality in the young and adults (Vaccination and parasitic control programs), and securing the availability of sufficient quality feed.

Small ruminant breeding programs in Ethiopia are three programs: 1) Crossbreeding and distribution of crossbreed rams from stations/ ranches; 2) Selective breeding involving central nucleus schemes; and 3) The recent community-based breeding programs (Haile *et al.*, 2018). The small ruminant breeding strategies adopted in Ethiopia over the last few decades largely focused on importing exotic breeds for crossbreeding and since the early 1960s substantial efforts have been made (Tibbo, 2006). These have included importing exotic sheep breeds such as Bleu du Maine, Merino, Rambouillet, Romney, Hampshire, Corriedale, Dorper, and Awassi sheep, and Saanen, Anglo-Nubian, Toggenburg, and Boar goats. These introductions and crossbreeding were implemented by different governments (research organizations and universities), non-government institutions (for example FARM AFRICA), and projects like the Ethiopian sheep & Goat Productivity Improvement Program (ESGPIP).

According to the report of Gizaw *et al.* (2011), genetic improvement programs produced no significant effects on sheep and goat productivity or farmers' and pastoralists' livelihoods and the national economy at large. The major limitation in the small ruminant cross-breeding programs in Ethiopia has been inadequate and poor quality feeds/forages, lack of appropriate documentation, breeding and dissemination programs, diseases and poor veterinary service, lack of infrastructure, termination, and weakness of small ruminant improvement projects. There has been very little consideration of the needs of the farmers and pastoralists, their perceptions, and indigenous practices. Additionally, they have had limited or no participation in the design and implementation of the breeding programs. Furthermore, the breeding programs lacked breeding schemes to sustain cross-breeding at the nucleus centers

and the village level (Gizaw *et al.*, 2010). The distribution of the improved genotypes of these programs was indiscriminate and unplanned, failing the breeding programs and threatening to dilute the sheep and goat genetic diversity in the country (Haile *et al.*, 2018). The indigenous small ruminant genetic resources of Ethiopia have high within-breed genetic variations and desirable characteristics. However, there has been little effort to improve their genetic merit using the within-breed genetic variation. 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 discontinued (Gizaw *et al.*, 2013). There was no distribution scheme in place for the improved genotypes in the nucleus centers. The studies done by (Gizaw *et al.*, 2013; Getachew *et al.*, 2016) on sheep crossbreeding based on exotic sires among indigenous breeds in Ethiopia reported were:

- The history of exotic breed introduction, research, and development efforts in crossbreeding in Ethiopia such as Merino (Italy), Romney, Corriedale, Hampshire (Kenya), and Dorper (South Africa).
- The performance of crossbreds under on-station and on-farm management (Growth performance, reproductive performance, and lamb survival).
- Farmers' perception of breed improvement showed keen interest to adopt and implement breeding programs when they found them working and benefitting them, choice of breed for crossbreeding overlooked interests and preferences of farmers mainly for physical appearance, farmers are interested in adoption of sheep crossbreeding due to the fast growth of crossbreds compared to their local sheep breeds in the Awassi×Menz and Farta×Washera crossbreeding attempts in the highlands of the Amhara region).
- The benefits and adoption of sheep crossbreeding- A survey-based economic evaluation of Awassi×Menz and Awassi×Wollo crossbred sheep was performed and the extent of diffusion of Awassi crosses from three crossbreeding villages in Angolelana Tera, Menz Gera, and Legambo districts were studied.

Achievements of Small Ruminant Genetic Improvement

Improving local sheep through crossbreeding: Awassi crossbreeding program was initiated in 1980 using Menz sheep as dam's line. Evaluate the performance of Awassi× local crossbreds. Produce 50% and 75% Awassi×Menz sheep crossbreds. The crossbred ram dissemination strategy may have to shift to the distribution of 50% Awassi crossbred rams, rather than 75% crosses and farmers in some areas (e.g. Menz & Wollo) welcomed the crossbred rams to be mated with pure Menz. A model crossbreeding village has been established. Large sustainable Awassi×local crossbred

population established (Gizaw *et al.*, 2011). Breeder farmers with crossbreeding skills have been created, farmers producing seed stocks, besides slaughtering sheep. Model villages are serving as a source of high-grade breeding rams for others and farmers' livelihoods highly improved from the sale of breeding rams (Birr 1000/head).

Improving local sheep through Selective breeding: Information concerning the Establishment of an elite nucleus flock for Menz sheep at Debre Birahn agricultural research center (Fig.1). Improve yearling weight and develop elite nucleus flocks of purebred Menz sheep. The use of the well-designed breeding program and selection practice within local sheep breeding was maintained at Debre Berahn and Amed Guya sheep breeding and multiplication ranch, especially Menz sheep breeding. After Improving yearling weight and developing elite nucleus flocks of purebred Menz sheep; the research center has disseminated the improved Menz sheep genotype to villager flocks/Farmers (Gizaw *et al.*, 2011; Abebe, 2018),



Fig.1: Menz sheep improved through selection (Abebe, 2018)

According to the report done by Gizaw *et al.* (2011), appropriate site selection and discussions were held with farmers on its potential for indigenous sheep production and genetic improvement, the center provides the best rams to village flocks are disseminated. 40 improved rams were selected from the research center and then framers were allowed to rank those rams based on farmer's selection criteria. Among 40 rams; 26 rams were selected by farmers and distributed to 50 farmers. Farmers agreed to use rams in common, rotate within and among groups, culling of unwanted

rams, and collaborate on data recording. Crossbreeding based on indigenous sheep breeds (Menz, Bonga, and Washera local sheep breeds) to evaluate the performance of Menz sheep crossed with Bonga and Washera sheep (Fig 2). The center has compared the growth performance, carcass yield, and reproductive performance of pure Menz and their 50% cross with Bonga and Washera. The performance of 50% Washera crossbreds was evaluated in Eastern Amhara (North shewa, North Wello, and South wello areas) (Gizaw *et al.*, 2014). There was major finding of 50% Washera x Menz crossbred lambs were heavier at birth weight (Bwt), 50% Bonga x Menz crosses were heavier at weaning weight (Wt), and also superior performance in Yearling weight (Ywt) and carcass weight (Cwt). Finally, the research work has been shifted to the stakeholders, and establishing a model village for Washera/Bonga crossbreeding and 50% crossbred rams from both genotypes were distributed to farmers (Gizaw *et al.*, 2014).



Fig. 2: 50% Bonga×Menz crossbred ram (left) and ewes (right) at Debre Berhan (Gzaw *et al.*, 2013)

Overview of Community-based Breeding Programs (CBBPs)

CBBPs have Participatory breeding that decentralized breeding plans and programs. It is an Improvement program carried out by communities of smallholder farmers often at subsistence level. Community-based breeding considers proper farmers breeding objectives, infrastructure, participation, and ownership. CBBPs is built on a bottom-up participatory approach. Have proved highly successful in Bolivia, Ethiopia, Mexico, and Peru. The same approach can be used in other countries, to improve the incomes and livelihoods of poor communities in remote areas. The community-based breeding

program has been operated successfully in smallholder sheep and goat producers in a mixed crop-livestock production system (Haile *et al.*, 2018).

Community-based breeding increases the productivity and profitability of indigenous breeds without undermining their resilience and genetic integrity, and without expensive (and potentially diversity-reducing) interventions. The Implications of Community-based breeding programs are an attractive option to achieve genetic improvement of small ruminants in low-input systems (Haile *et al.*, 2019). A clear methodological framework on how to design and implement community-based breeding programs ensures the technical feasibility of the programs.

According to (Haile *et al.*, 2011; Getachew, 2018; Haile *et al.*, 2018), the steps for setting up community based-breeding programs (CBBPs) are described and summarized in the following steps:- Identification of target sites and understanding the production system, definition of breeding objectives, choice of selection criteria and recording system, development of a genetic evaluation and breeding structures and its organization, Creation of an enabling environment and monitoring and evaluation of the program.

Current Research Status and Challenges of The Community-Based Small Ruminant Breeding Program

The disappointment with the crossbreeding and nucleus-based selection programs started the development of a participatory breeding program called a community-based breeding program, CBBP (Gizaw *et al.*, 2011; Haile *et al.*, 2011). CBBP is a village-based breeding activity planned, designed, and implemented by smallholder farmers, either individually or in cooperatives, to effect genetic improvement in their flocks and conserve indigenous genetic resources. The program would be coordinated and assisted by stakeholders like development and research experts in government and non-government institutions (Gizaw *et al.*, 2013). CBBP involves the local community at every stage (from planning to operation) and takes their indigenous knowledge of breeding practices and objectives into account than the conventional crossbreeding and nucleus-based selection. However, considering the past genetic improvement approaches and their suitability for Ethiopia's production system. Small ruminant breeding programs have been shifted from central nucleus scheme to community-based breeding programs (Bruh and Gebretnsae, 2020).

Experiences of Pilot Community-Based Sheep Breeding Program in Ethiopia

The current research was conducted on different community-based sheep and goat breeding programs that were implemented in Ethiopia. The national agricultural research centers such as Bako, Bonga, Debre Berhan, and Werer, in collaboration with

the international research institutions (ICARDA-ILRI-BOKU) (Gutu *et al.*, 2015) in four sites (Afar, Bonga Horro and Menz). The earlier research studies conducted in detail by (Gizaw *et al.*, 2011, 2011; Haile *et al.*, 2011; Mirkena *et al.*, 2011) on community-based sheep breeding programs were studied in Ethiopia. CBBPs were implemented in four regional states of Ethiopia (Bonga, Horro, Menz, and Afar). Expanded to two new sheep sites, Doyogana and Atsbi, and one goat site, Abergelle. Bonga sheep CBBP continued with the regional government's financial support and the strong technical back-up from Bonga agricultural research Centre (BARC) attracted by its performance, institutions like ICARDA also lend supporting hands. Comprehensive characterization of the production system and market analysis was initially conducted and results were communicated.

According to the report by Gutu *et al.*, (2015) the community-based breeding programs in Bonga, Horro and Menz were evaluated and realized several achievements and some of the major achievements are Bonga, Horro, and Menz: body weights at birth, 3 and 6 months of age and the number of births were increased and thus the market outlet was improved. Lambs with bigger size and attractive colors were obtained and fetched a better market price. The mortality rates were reduced due to the combination of breeding with improved health care and feeding. Better awareness about inbreeding and the need for breeding rams was created and well-functioning cooperatives were formed. Additionally, the negative selection, exercised by the local community, has been reverted as fast-growing lambs are being retained for breeding purposes instead of ending up in markets.

Experiences of pilot community-based goat breeding program

According to the earlier research studies conducted in detail by (Solomon, 2014; Temesgen *et al.*, 2019; Getachew *et al.*, 2020; Amare *et al.*, 2020) on community-based Goat breeding programs were studied in Ethiopia. The local goat breeds were the CBBP research conducted in Ethiopia in Abergelle and Western lowland goat breeds (Solomon, 2014) and Abergelle, Central Highland, and Woyto-Guji goat breeds (Temesgen *et al.*, 2019). The current information is available on CBBP activities undertaken by the National small ruminant research projects (Sheep and Goat commodity) and small ruminant breeds and their implementing areas of the community-based breeding programs are initiating in the country (Abebe, 2018).

Challenges of the Community-Based Small Ruminant Breeding Program in Ethiopia

There are different challenges are faced by small ruminant community-based small ruminant breeding programs (CBBP) in Ethiopia. Also, several authors are raised and

reported the challenges faced in the development and implementation of Small ruminant CBBP in Ethiopia (Mirkena *et al.*, 2011; Gizaw *et al.*, 2013; Gutu *et al.*, 2015; Abebe, 2018; Bruh and Gebretnsae, 2020). Challenges faced by the community-based small ruminant breeding program include:-

- Disease and poor animal health services.
- Shortage of feed. Poor market access.
- Selling selected breeding rams.
- Uncontrolled mating system.
- Difficulty of pedigree and performance recording.
- Year-round lambing/kidding pattern.
- Unwillingness of farmers to keep all young rams/bucks until the time of selection
- Incompatible cooperative society proclamation.
- Shortage of incentives for participant farmers is identified as the main challenge of the program.
- Extreme delay in legalizing the cooperatives- licensing. Poor linkage between the different stakeholders and national database system is at its infant stage (we need to work to standardize, formation of national database system).

CONCLUSION AND RECOMMENDATION

Crossbreeding, nucleus-based selection, and community-based breeding programs were the different options implemented in Ethiopia to improve the productive performance of local breeds. In conclusion, the current and past research studies have been reviewed and discussed from the available literature such as the small ruminant production system, breeding program, methods of the small ruminant breeding program, and current community-based sheep and goat breeding program in the country. More research studies were undertaken in sheep breeding programs than goat breeding programs based on crossbreeding and distribution of crossbreed rams/bucks from stations/ ranches, selective breeding involving central nucleus schemes, and the recent community-based breeding programs. Moreover, genetic improvement through such selection programs was too slow and yielded unsatisfactory results. To twist the situation, a community-based breeding program (CBBP) was introduced and implemented in Afar, Horro, Menz, Atsbi, Bonga, Doyogana, and areas on sheep and Abergelle goats.

Therefore, supporting the above conclusion the following recommendations were advanced for the success of a community-based breeding program (CBBP) in Ethiopia.

- Organizational capacity of cooperatives and the monitoring system of the national agricultural research system (NARS) need to be enhanced.
- Support in market linkage and value-addition practices. Development of a simple, cost-effective, and objective-oriented record-keeping scheme.
- Regular communication with farmers by arranging consultation meetings and group discussions and incorporation of farmers' feedback in the research design should be encouraged.
- Ensure continuous technical and institutional support to the community flocks/herds from local or national research and extension services.
- Availability of complementary services like affordable health service and access to adequate and quality feed resources.
- Establishment of a better market link to ensure returns on investment and strengthen the financial capacity of cooperatives.
- Periodic evaluation of ongoing programs for drawbacks identification and adoption of program activities as per evaluated information.

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AUTHOR'S CONTRIBUTION

All authors equally contributed to the data collection, reviewed information, and write up the manuscript. The authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare that no conflict of interest concerning the research, authorship, or publications of this article.

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