

Article Information

Received date: Jan 30, 2019

Accepted date: Feb 15, 2019

Published date: Feb 20, 2019

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Review Article

Horro Sheep Breeds Improvement Breeding Program

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Abstract

Objectives: The main (General) objective of writing this breeding program is being familiar with preparing the breeding program by accomplishing the course Applied Animal Breeding.

And specifically practicing with-

- Suggesting the most appropriate breeding plan for indigenous Horro sheep breeds through:
- Improving growth and live weight of the population of pure horro sheep breeds.

Introduction

Sheep production is a major component of the livestock sector in Ethiopia owing to the large population of 25.5 million head [1] and with the diverse genetic resources [2]. At the smallholder level, sheep contribute a substantial amount to the farming household income, mutton and non-food products (manure, skin and wool). They are source of risk mitigation during crop failures, of property security and of monetary saving and investment in addition to many other socio economic and cultural functions [3]. Sheep are also important foreign currency earners accounting for 34% of the live animal exports [4].

In Ethiopia, in spite of the large population of sheep and its great role, the current level of on-farm productivity in the smallholder production systems is low due to the little attention received to the sheep sub-sector in the country for its improvement. Institutionalized and centralized sheep genetic improvement efforts were made for the last six decades in Ethiopia and have often failed to yield significant impacts at the farm level [5].

As alternatives, centralized breeding schemes which is entirely managed and controlled by governments were developed and implemented in many developing countries through a nucleus breeding unit limited to a central station. These centralized schemes are failed to sustainably provide the desired genetic improvements and also failed to engage the participation of the end users in the process.

Another alternative widely followed by many developing countries or individuals is importing improved commercial breeds in the form of live animals, semen, or embryos. Where indiscriminate crossbreeding with the local populations has been practiced, genetic erosion of the adapted indigenous populations and breeds has occurred [6].

To overcome the overall limitations a new approach is therefore required. An approach that has recently stimulated global interest is a community-based breeding strategy. Programs that adopt this strategy take into account the farmers' needs, views, decisions, and active participation, from inception through to implementation and their success is based upon proper consideration of farmers' breeding objectives, infrastructure, participation, and ownership [7].

Applying community-based breeding program is not only the matter of genetic theories and increased productivity. It is a matter of infrastructure, community development, and an opportunity for improved livelihood of livestock owners through productive and adapted animals and markets for their products.

To design a promising breeding scheme communal grazing and watering points are customary to consider the village population as one large flock or a breeding unit. In this case breeding animals are being selected based on phenotypes recorded within the village population. The primary aim of a breeding program for smallholder conditions should be to minimize the risk by developing cost and resource-saving production methods, while achieving acceptable genetic gain in important breeding traits [8].

Table 1: Characteristics of the area [9].

Habitat	Production System	Major Use the Breeds
Humid (1600-2800 m.a.s.l.)	Mixed crop–livestock	Meat

Selecting Target Breeds and Communities

Majorities of the farmers recognize the importance of selection and practice it with their own selection criteria. It is recognize that traits like body size, appearance and/or conformation, coat color, libido and tail formation were all considered important trait and given due emphasis in selecting breeding rams. Additionally, lambing interval, mothering ability, age at first lambing and twinning rate were considered to select breeding females [5].

In general, mating was performed in uncontrolled situation but farmers practice controlled breeding from cropping up to harvesting time as flocks are kept separately tethered on private lands and either ewes in heat are taken to the ram for mating or rams are brought to the flocks of households with no breeding ram. Commonly breeding rams are selected from the flock with their desired characteristics for breeding and sharing breeding rum is common in the area [9].

Some evidences shows that there was the shortage of breeding rum in the area because several households prefer to sell male lambs early for immediate cash income, fear of theft and predation, it results in early sold of fast growing lambs which results in negative selection. Mechanisms for retaining fast growing rams should be designed to avoid negative selection. In the area there where resources (particularly feed like crop residuals), availing breeding rams could result in more births and this could make significant contribution to improvement in livelihood of communities.

During implementing community-based breeding programs it is important to pick the right breeds, populations, and locations to work with. There are a number of criteria to follow in selecting target breeds and communities. Those considerable criteria’s for Horro breeds are:

- The most populous in Ethiopia with a wide area coverage and
- A good potential for genetic improvement of the breeds

Those factors included in selecting the communities are:

1. Willingness/interest of the community to participate in this program
2. Willingness/interest of the community to keep records
3. Willingness/interest of the community to accept castration of unselected males
4. Availability of sufficiently large (combined) sheep flock

Table 2: Geographic distribution and physical features of Horro Breeds [4].

Ecology	Geographic distribution	Important physical features
<ul style="list-style-type: none"> ➤ Cool, wet highlands (2991m) to ➤ Humid mid-highlands (1600m) 	East Welega, West Welega, Illubabor, Jimma and West Shoa zones of Oromia, and some bordering Gambella and Benishangul Districts	<ul style="list-style-type: none"> ➤ Long fat tail extending below hock, either straight (51.4%) or coiled/twisted (48.6%) at ➤ The tapering end; prominent fat tail in males; Large, leggy and prolific; ➤ Dominant colors are brown and fawn, belly is lighter especially in adult ewes, less frequent are black, white, brown with white patches; ➤ Both sexes are polled.

- Existence of communal/shared resources like common grazing land or watering points, and or common use of breeding rams, herding or marketing facilities.

Characterization of Target Sites and Breeds

Description of the production system

In brief, a mixed crop–livestock is the major production systems in the area. Where there is availability of sheep populations, presence of communal grazing land, accessibility, and willingness of the community to participate in the sheep improvement program (Table 1).

Breed characterization

Populations of livestock species in developing regions are traditionally recognized as distinct types by ethnic group or geographical locations (e.g. the Horro), from where they often derive their names [10] (Tables 2 & 3). Preliminary identification of breeds or populations involves phenotypic characterization of distinct populations and identifying the representative samples of animals from the targeted populations (Figure 1).

Definition of Breeding Objectives

Breeding goal definition is the first step to be made in designing of breeding program. A clear understanding of production objective and breeding goal of the farmers is an important component of planning of breeding programs. The breeding goal identifies the animal traits that farmers would like to be improved. Breeding objectives must to be set at national (macro), regional or local level by stakeholders (and not by outsiders) to truly reflect the real needs of the area; farmers must support the direction of change [11,12]. The ultimate goals of a breed at the micro level the definition of breeding objectives means that for the given production environment the relative importance of improvement of different traits of the breed must be identified [13].

Thus the breeding goal definition in subsistence system needs to take account the diversity of traits [14]. Therefore, the breeding objective and the selection criteria (traits), on which the livestock keepers wish to improve and base their selection should be identified through the full participation of smallholder farmers. It assumes that the farmers have made a premeditated choice to genetically improve the next generation of animals in terms of their performance in relation to their parent generations [15]. The breeding objective in any livestock species is to increase profit by improving production efficiency [16]. Breeding structures provide systems for gathering information about the assessment of animals in the production system and conditions that allow selection of parents of the future progeny [17].

A participatory approach has recently been adopted and used to define breeding objectives for various sheep breeds [18]. By

Table 3: Reproductive performances of Horro sheep breeds and other production characters.

Characters	Parameter			Source
	Minimum	Maximum	Mean ± SD	
Age at first service of male (month)	4	18	7.1 ± 3	Zewdu, 2008 [28]
Age at service of female (month)	3.5	19	7.8 ± 2.4	Zewdu 2008 [28]
Age at first lambing (month)	11	19	13.3 ± 1.7	Zewdu 2008 [28]
Reproductive life span of female (yrs)	2.0	15	7.9 ± 3.1	Zewdu 2008 [28]
Lifespan lamb crop (number)	7	25	15.3 ± 4.3	Zewdu 2008 [28]
Lambing interval (month)	5.0	15	7.8 ± 2.4	Mengiste,2008
Twining rate (percent)	3	100	39.8 ± 19	Zewdu 2008 [28]
Litter size			1.34	Solomon & Gemedda, 2000
Body weight (Ewe 1 Yr)(kg)			15.5 ± 1.30	Tibbo <i>et al.</i> (2004) [3]
Body weight (Ram 1 Yr)(kg)			16.8 ± 1.27	Tibbo <i>et al.</i> (2004) [3]

considering those realities, this participatory approach program (community-based breeding) is identified:

To increase meat production by improving productivity, growth and live weight of the population of the indigenous Horro breed as primary breeding objective.

Developing Adequate Breeding Structures

Genetic improvement strategies

Genetic improvement aimed to exploit the present within and between breed variations (ILCA, 1994). Any genetic improvement programs falls under the three major genetic improvement pathways:

- i. Within breed selection;
- ii. Selection between breeds (breed substitution) and
- iii. Cross breeding.

To be successful in genetic improvement of livestock, appropriate breeding programs need to be planned, implemented and maintained. Breeding program is defined as the organized structure that is set up

in order to realize the desired genetic improvement of the population [20,21].

In tropics, the small flock size, single sire mating, lack of performance and pedigree recording, low level of literacy, and lack of organizational structure hinders within breed selection. To solve these problems, nucleus (open and closed) breeding schemes are the most used and recommended tools for small ruminant genetic improvement programs in tropical countries [14,22,23]. Community based breeding program is a recently advocated option for tropical traditional low input livestock production systems [7,8,24]

Community (village) based breeding schemes

Community based breeding programs are a new approach of genetic improvement program proposed for the low input traditional smallholder farming system. The community-based breeding strategies also consider the production system holistically and involve the local community at every stage, from planning to operation of the breeding program [26]. The breeding structure of such a program is commonly single-tiered with no distinction between the breeding and production units, i.e., the farmers are both breeders and producers [4].



Figure 1: Horro Sheep herded by young boys and Horro ram.

The breeding program

The simplest and most straight forward design is one in which the best males and females are selected as replacements (i.e. future parents of the next generation) from the whole population. This means that all the herds/flocks would be monitored and be involved in screening for the best individual animals [9].

An alternative design would be to have some farmers with ‘best’ animals and often ‘best or average practices’ to breed males for use by the whole population. Such designs with structured populations are called ‘nucleus systems’. Nucleus farmers concentrate on maximizing genetic gains while the remaining ‘base’ farmers can concentrate on production. In this case best males and females are mated in the nucleus, in order to produce the ‘best’ next generation of young animals, thus increasing the probability of having better gene combinations in the progeny at the nucleus compared to the rest of the population.

For the above designs to convey, the nucleus must be functional, that is nucleus farmers not only have to make genetic progress but also have to consistently produce and disseminate appropriate number of genetically superior males to nucleus and base populations. The nucleus can be either closed or open. A closed nucleus means no upward (from base to nucleus) gene flow is allowed, while an open nucleus allows the best sheep to enter the nucleus from the base population (Figure 2).

Animal identification

Animal identification is crucial in genetic improvement programs. Animals should be uniquely identified, so as to accurately trace their respective pedigrees and link the performance of individual animals to her/his progeny and relatives through known genetic relationships. The identification method we use could be Ear tags because it is relatively cheap, easy to apply, and are less stressful to animals.

The identification of the base population was done thereafter; identification of newly born lambs was undertaken by village enumerators. Eventually, community members should be trained to handle animal identification by themselves.

Participatory identification of breeding objectives traits

Identification of the breeding objectives traits in participatory approach are a recommended approach for the sustainable breed improvement programs in tropics. In the present program, participatory own flock ranking and group ranking methods will be adapted from were applied.

Data recording and management

Development and use of a simple, flexible, and cost-effective performance recording and evaluation system is essential for the breeding program. The recording formats should be kept as simple and as practical as possible for easy use and adoption [27,28].

In accordance with the agreed selection traits, different recording formats will developed for identifying sheep: which is for ewes and lambs. The ewe format contained information such as lambing date, parity, and litter size and also data formats will have detailed information about the ewe (Annex 1). The lamb data format will accumulates information about lamb identity and performance.

Major traits considered for breeds would be weight (at birth, weaning, six months, and yearling), number of lambs weaned and number of lambs born (twinning). Simple index based on the set selection criteria for each breed should be developed and the overall merit values computed and shared with the communities and farmers as part of the feedback and for use to effect selection.

Selection of candidate rams

Young rams should be selected based on recorded data (own and maternal performance) for the set of agreed selection traits. Selections involve culling of animals with undesirable phenotypic characteristics (e.g. tail type, coat color, horns, conformation, and general appearance). But selection decision can be made in line with the traditional practice due to the probability of acceptance by the community.

For good reasons, it is important to cull undesirable males before they reach puberty (i.e. before they can serve). Depending on the breeds, this may be as early as 6-8 months of age. Where communal grazing is practiced, synchrony and agreement on when to cull is important as flocks can meet in common pastureland, when the undesired entire males can breed, and hence reduce the selection impact. When the breeding program is fully functional the best rams should be identified by their breeding value computed from recorded data and based on their pedigree.

The community has to be actively involved in the selection process so that the ram ranking closely match their (own valuations) goals and desires. This helps to build trust and confidence, buy-in, and a sense of belonging among the beneficiary community that increases both their confidence in the selected rams and ownership of the process.

Management and use of breeding rams

Repeated consultations should be made with the community to arrive at an agreed modality as there is no single arrangement that applies to all situations. The modalities for ram exchange with the communities included:

- ⊖ Sharing rams based on friendship and trust among members of the breeding pool
- ⊖ Exchanging rams based on purchase between different breeding pools (if possibly present) when rams complete the defined service period in a given flock

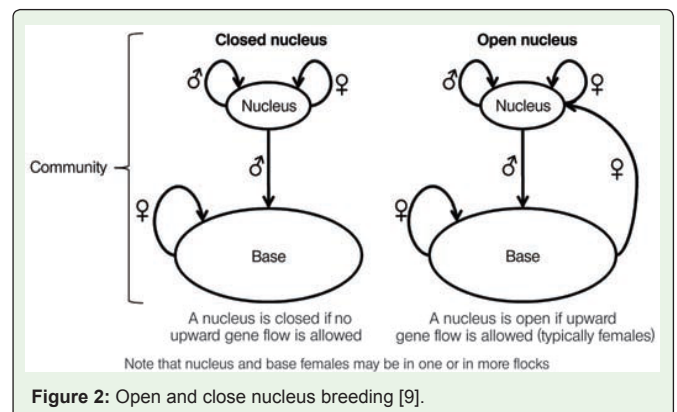


Figure 2: Open and close nucleus breeding [9].

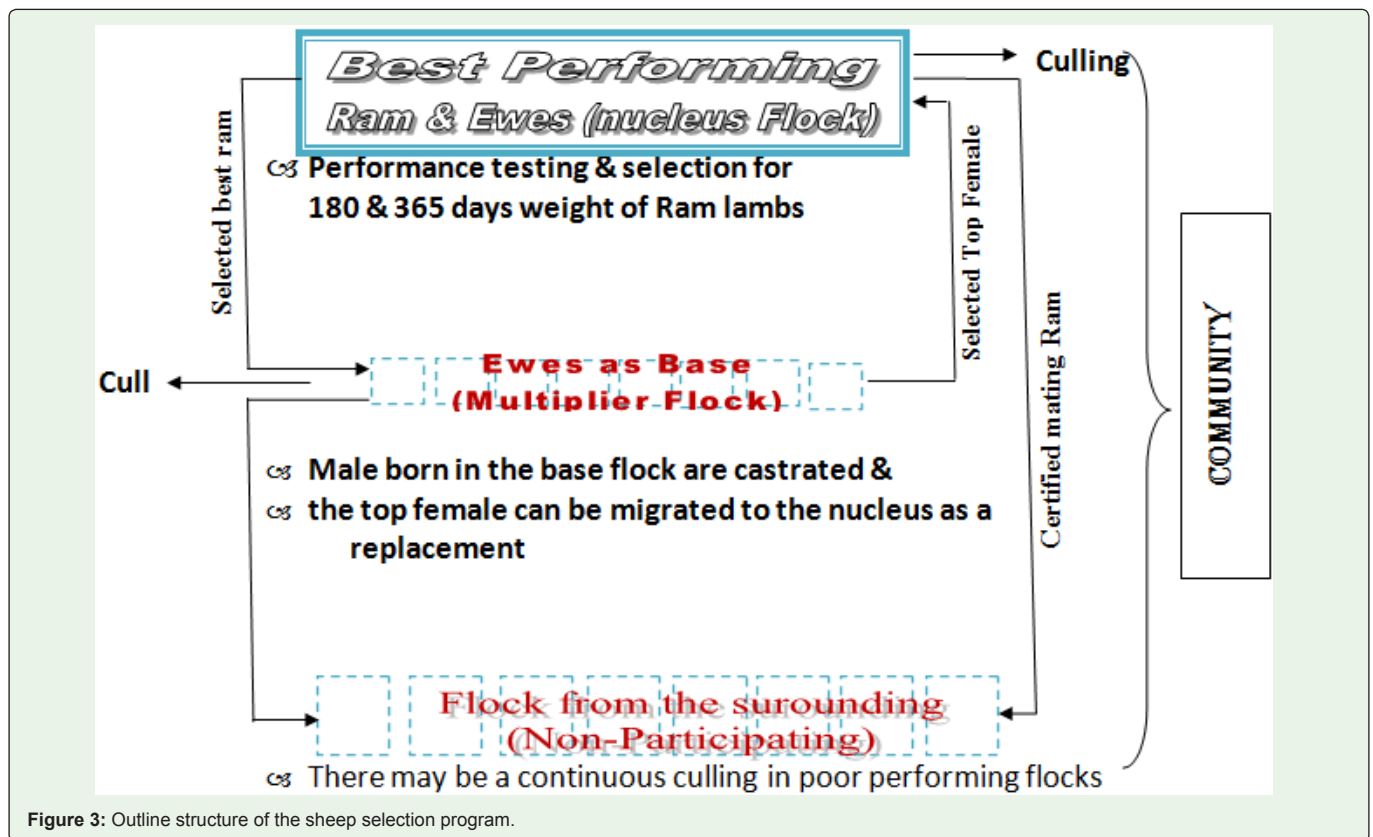


Figure 3: Outline structure of the sheep selection program.

The management of selected breeding rams to be used by the community should be based on prior-agreed modalities. Some of the options include:

- Manage the ram in rotation
- Keep the ram in one agreed household and other community members contribute in kind (e.g. feed and veterinary drugs) to keeping the ram.

A critical issue that needs to be known is how to manage the unselected rams. Therefore, mechanisms should be designed to sell these rams. Value addition in terms of fattening could be organized for the unselected rams and linked to markets (Figure 3).

Monitoring & Evaluation

An integral component of a functional community-based breeding program is monitoring technical and management issues related to the implementation of the breeding program; whether outputs, outcomes and impacts are achievable; and whether mechanisms to ensure sustainability of the breeding program are in place.

Finally, a breeding program should be evaluated by the genetic improvements obtained in all important traits and the effects on total output of products and outputs per unit of measurement. As stated by A Haile et al., [9] effective monitoring and evaluation, the defined key indicators to measure the progress in achieving the main outputs of the breeding program, as well as indicators to assess whether or not the program outputs are contributing or will eventually contribute to the desired outcomes and impacts at individual flock, household, and community levels.

Conclusions

Community based breeding programs are proposed as an option for genetic improvement of livestock in developing countries. This new approach has been tested with promising results in few places.

For Horro sheep breeds, we design a community-based breeding program which represents mixed farming production systems. Although it will take more time until changes in genetic gains can be fully evaluated, the breeding programs will achieve a promising result in near future.

Assumed Genetic Changes to be Expected

Genetic changes will be estimated using recorded data. Lamb breeding values will be averaged over year of birth. Phenotypic values will be obtained by deviation of year mean from overall mean. Phenotypic and genetic trends will be obtained by regression of annual phenotypic and breeding values on year.

Assumptions to be show that lamb weights at all ages will be the lowest at starting time and subsequent years. There may be an average decline in phenotypic trend of the weights at 180 and 365.

Through applying the breeding program there may be an increase in breeding values at rates of 13 ± 5.8 and 16 ± 3.2 g/year for 180 and 365 day weight, respectively. The average generation interval for the program identified will be expected to be 2.68 year. Performing these genetic analyses may show that, there may be genetic value maintained or slightly increased during the period of selection.

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