Upscaling of community-based breeding programs in Ethiopia: process followed

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Background

In developed countries and in high input animal production systems, animal breeding has been traditionally supported by the state and implemented by well-organized national breeding programs. Data recording, provision of the recorded data to a data processing center, estimation of breeding values with complex statistical methods and central decisions about the use of male breeding animals are important elements of such breeding programs.

In developing countries, the required supportive infrastructure is largely unavailable, so attempts to replicate 'developed-country' approaches have met with little success (Kosgey *et al.,* 2006). The most common approach implemented in many developing countries, has been centralized breeding schemes, entirely managed and controlled by governments – with minimal, if any, participation by farmers (Haile *et al.,* 2018). These centralized schemes, usually a nucleus breeding unit, established at a central station were run by a governmental organization attempting to undertake all or part of the complex processes and breeding strategy roles including data recording, genetic evaluation, selection, delivery of genetic change, and feedback to farmers. Although well intended, these centralized schemes failed to sustainably provide the desired genetic improvements to smallholders (continuous provision of a sufficient number and quality of improved males) and also failed to engage the participation of the end-users in the process.

Another widely followed strategy has been importing improved commercial breeds in the form of live animals, semen, or embryos. These are usually crossbred with the local and 'less productive' breeds to upgrade them, but in most cases, it is done without sufficient pretesting of the suitability and adaptability of the exotic breeds and their resulting crosses to local production systems or conditions and without a clear strategy what the final genotype would be. Where indiscriminate crossbreeding with the local populations has been practiced, genetic erosion of these local populations and breeds has occurred.

An alternative approach is a community-based breeding program (CBBP). Programs that adopt this strategy consider 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 (Sölkner *et al.,* 1998; Wurzinger *et al.,* 2011; Mueller *et al.,* 2015; Haile *et al.,* 2018).

Community-based breeding programs

Breeding programs described as community-based cover a range of situations (e.g. Sölkner *et al.,* 1998; ICAR-FAO, 2000, Haile *et al.,* 2018) but typically target low input systems with farmers within limited geographical boundaries having a common interest to work together for improvement of their genetic resources (Mueller *et al.,* 2015). Community-based breeding programs focus on indigenous stock and consider farmers' needs, views, decisions and active participation, from inception

through to implementation, and therefore provide a participatory and bottom up approach. Ethiopian CBPP combines selection of breeding rams/bucks based on careful recording of important production parameters, such as body weight at 6 months and ewe/doe lambing/kidding interval, with expert local opinion as to what constitutes a good ram/buck and communal use of selected rams/bucks. Farmers who wish to participate are organized into sheep/goat breeding associations, many of which later evolve into formal cooperatives (Haile *et al.,* 2018). Local enumerators are recruited to help in data collection, which is then managed in a data base and analyzed by scientists from local research centers to help to inform selection decisions.

The whole community flock is treated as one and two stages of ram/buck selection are usually applied: initial screening when traditionally premature sales of young lambs/kids occur (at 4– 6 months of age) and final selection for admission to breeding. All young rams/bucks are collected at one central place in each community on an agreed screening date. Selection is then carried out based on the estimated breeding values and index is constructed where more than one trait is involved.

A breeding ram selection committee composed of about 3–5 members elected by the community are involved in the selection. If for example 15 rams/bucks were to be selected from 100 candidates, 20 would be preselected based on their breeding values and the committee ranks the selected rams/bucks culling the last five. The committee checks on the conformation, coat colour, presence or absence of horns, horn type, tail type and other criteria in decision making. The number of rams/bucks to be selected depends on the number of ewes/does available for mating with a male to female allocation ratio of 1 ram/buck to 30 ewes/does while accounting for the replacement rate required.

In Ethiopia the pilot CBBPs are designed and implemented since 2010 by a team of researchers from the International Center for Agricultural Research in the Dry Areas and International Livestock Research Institute, BOKU University, Austria and Ethiopian National Agricultural Research Centers. These programs were supported through various projects with financial support from different donors. The day to day follow-up of these programs was done by the research and extension departments of the Ethiopian government.

The Ethiopian Government has accepted CBBP as the strategy of choice for genetic improvement of small ruminants as explicitly indicated in the Ethiopian Livestock Master Plan (Shapiro *et al.,* 2015). Consequently, the second "Growth and Transformation Plan of the Ethiopian Government" and the new World Bank Livestock and Fisheries sector development projects are adopting CBBP. The strategy of up scaling by the Government focuses on using the existing CBBPs as nucleus stock where genetic improvement is generated and disseminated.

Results from CBBP

CBBPs have been established in a few countries around the globe but mainly as pilot projects. In Ethiopia there are around 40 CBBPs each having around 80 households. As CBBP is a relatively new strategy for genetic improvement of small ruminants, the last few years have been spent on testing the functionality of the

strategy and we have been refining and customizing the program to different agro-ecologies and production systems. We evaluated both biological and socio-economic performance of three CBBPs in Ethiopia and some of the results include the following (Gutu *et al.,* 2015; Haile *et al.,* 2019):

- Sheep/goat farming, once a side activity for these farmers, is now their main business activity and the linchpin of their livelihoods.
- The best rams/bucks are now retained in the community for breeding instead of being sold for slaughter.
- High demand for breeding rams from neighboring communities, other government programs and NGOs in all sites, provides the base for specific business models around production of breeding sires and semen for artificial insemination.
- 3200 households with more than 19,200 people in 40 villages directly benefiting from the scheme.
- Most of the participating households in Menz (one of the CBBP sites) graduated from the government-run safety net program that meets short-term food needs through emergency relief. They now use income from sheep sales to buy food.
- "Best of stock" growing breeding lambs/kids, previously sold and slaughtered ("negative selection"), are now kept improving the breeding stock.
- More than 35 functional cooperatives established.
- Increased income from sheep production (since CBBP inception in 2010, an average increase of 20 percent) and increased mutton consumption (now an average of 3 sheep slaughtered for home consumption per family per year compared to 1 sheep at the project start) directly linked to CBBP production in Bonga, Horro and Menz.
- Farmers' sheep/goats have shown an improvement in performance, such as lamb growth rate, lambing interval, reduced mortality and tend to attract higher prices in markets compared to sheep/goats from farmers who are not members of breeding groups.
- Most of the established cooperatives have been able to build capital (e.g. Boka-Shuta cooperative has capital of about USD 60,000).

Up scaling of CBBP: the framework

Several pilot CBBPs have been implemented in Ethiopia since 2010. Looking at the benefits and practical feasibility of CBBP (Gutu *et al.,* 2015; Haile *et al.,* 2019), the government of Ethiopia through its regional research and extension system (with ICARDA's support) is investing in establishment of additional CBBPs. Having now become a program of choice, the Government of Ethiopia has decided to adopt CBBP for small ruminant genetic improvement. In Ethiopia alone, the number of CBBPs have increased from the initial 6 to more than 40. However, to make impact at scale CBBPs need to cover a much larger population and area. Improved genetics produced in the CBBPs also need to be disseminated to a wider area through either natural mating or reproductive biotechnologies like artificial insemination.

Current CBBPs are primarily designed for improved rams/bucks to contribute genetic gain in the local community small ruminant populations. While some additional young breeding males are produced and sold externally, the total number is substantially

less than the number required to serve the whole target populations of each breed. Mueller *et al.* (2019) developed a methodological framework for up/out scaling options of CBBP. Following a detailed computation of the different population parameters, for example in Menz, one of our CBBP sites where ICARDA and partners have established 5 CBBPs, 40 young rams (5 CBBPs x 8 ram replacements per CBBP) are needed yearly to replace old ones and there are 5x40=200 young rams available. Yet, a total of 2841 young rams are needed for replacement in the whole Menz target population. Thus, only 7% of currently needed young rams are produced by the five Menz CBBPs (200/2841). The challenge of any population wide breeding program is to increase these proportions or otherwise consider a less ambitious program with smaller targeted core population sizes.

As indicated in Mueller *et al.* (2019), there are three strategies to increase the availability of improved rams/ bucks: increase the number of CBBPs, increase the supply of improved rams/bucks per CBBP and increase the use of improved rams/bucks.

- Increasing the number of CBBPs requires additional project staff for recording and extension work, additional identification and weighing supplies, larger coordination and supervision efforts.
- Increasing the number of rams/bucks supplied per CBBP requires participating farmers to enhance reproduction, recording and maintaining a higher proportion of male progeny till final selection. The supply can also be increased reducing the requirements for a ram/buck to qualify for breeding. In the latter case this is achieved at the cost of a reduced selection differential.
- Increasing the use of improved rams/bucks through higher dissemination or through extending their use in time. Higher dissemination is possible through artificial insemination (AI). Increasing the age of ram/buck disposal also leads to higher dissemination, although at the cost of an increased generation interval.

These avenues to reach a larger sheep/goat population with improved rams/bucks are not exclusive and should be considered jointly when planning different programs.

CBBP has attracted global interests and is also being scaled out in many places in Africa (e.g. Malawi, Uganda, Sudan, Tanzania, South Africa) and elsewhere (Brazil, Iran, Mongolia). This was made possible because of the following reasons:

- The technology is easy to implement in local communities.
- Requires little funding compared to centralized nucleus schemes.
- The technology develops confidence in local communities as it is based on existing management and breeding practices and there is not much change that comes with it.
- Because of failure of earlier centralized schemes, people are desperate for a new approach.

Implementation progress

In Ethiopia, with support from Livestock and fisheries sector development project and CRP livestock we have started upscale of small ruminants in 4 regions (Amhara, Oromia, South and Tigray) of Ethiopia. Progress made so far is described below.

Consultative meeting and planning with partners

With a plan to upscale CBBPs in Ethiopia in the four major regions (Amhara, Oromia, South and Tigray), a consultative meeting was organized with partners, including NARs, extension staff, LFSDP and ICARDA staff, for each region. This was done in Sekota for Amhara, Adama for Oromia, Hawassa for South and Mekelle for Tigray. During the consultation/ planning meetings, detailed work plan and budget as well as the role of partners and schedule of activities was discussed and agreed up on. The priority small ruminant populations to be targeted were also identified for each region (Table 1). A technical committee to follow on routine activities as well as steering committee tasked with the overall coordination was established.

Table 1. Small ruminant population identified for CBBP upscale

SR species	SR population targeted	Amhara	Oromia	South	Tigray
Sheep	Menz	X			
	Washara	X			
	Bonga			X	
	Doyogena			X	
	Abera			X	
	Horro		X		
	Arsi-bale		X		
	Begait				X
	Atsbi				X
Goat	Abergelle	X			
	Central highland	X			
	Konso			X	
	Central highland (Ambo)		X		
	Harerge highland		X		
	Abergelle				X

Some of the major activities in each region is described below:

Tigray:

Workshop
A workshop was held at region level in Mekele on 3 April 2019. World bank representative of the region, TARI livestock research director, Regional livestock officers, LFSDP staff, ICARDA, researchers from different research centers were in attendance. As indicated earlier, priority small ruminant populations to be targets in the upscale operation were identified. A team was also established to work on proposal detailing activities to be undertaken in the upscale with the three populations.

Humera sheep CBBP
In October 2019, discussions and awareness creation workshop were held in Humera with 40 participants from ICARDA, Humera Research Center, TARI, Abrgelle Research Center, extension experts and community selected for the breeding program. The purpose was to initiative CBBP for Begayit sheep. following the workshop, a team of researchers and extension staff engaged in recruitment of

enumerator, identification of participant households, collection of baseline data, animal identification and start of CBBP. Eleven breeding rams were purchased by ICARDA and transfer to the community to kick of the breeding program. Routine animal data recording is going on.

Figure 1. Discussion (up) and purchased Abergelle rams (bottom)

Oromia:

Workshop

Workshop was held in Adama on March 16, 2019. OARI Director General and Director of Livestock Research, Livestock Agency Head, LFSDP staff, researchers, extension staff and ICARDA staff participated in the workshop. As indicated earlier, priority small ruminant populations to be targets in the upscale operation were identified. A team was also established to work on proposal detailing activities to be undertaken in the upscale with the three populations. Filed upscale implementation is planned for 2010.

Figure 2. Workshop at Adama

Amhara:

Workshop

Regional planning workshop on scaling out of small ruminant CBBP in Amhara region was help during 11 to 12 December 2018. Forty-one people including ARARI Livestock director, regional head of livestock agency, LFSDP coordinator of the region, researchers from different research centers and Universities, farmers, Wereda and zone level extension and ICARDA staff participated in the workshop. A team was also established to work on proposal detailing activities to be undertaken in the upscale with the four populations identified during the workshop. The team prepared a working document which is being used in upscale operation.

Figure 3. Workshop at Sekota Research Center

Awareness creation trainings
- Training on overview and implementation guidelines of small ruminant community-based breeding program was given for Eastern Amhara extension

workers at Kombolcha on 4 January 2019. A total of **280** staff from Wag Hemra, North Wollo, South Wollo and Oromia Zones were in attendance.

- Another training was organized at Wereta specifically for decision makers/officials from all participating zone and werdas of the Amhara region. About **65** staff were trained and the focused was on overview of CBBP, major impact and achievements of CBBP in Ethiopia, scaling out options, CBBP project awareness and implementation guideline of CBBP.

Figure 4. Training for extension workers at Kombolcha

Field implementation and trainings

Three parallel trainings (at Menz, Gondar and Sekota) on implementation and scaling out of Community-Based Breeding Program were organized in three different locations of the Amhara region. The training was for three days and had covered both theoretical and practical session.

- Theoretical sessions focused on the overview of breeding program, implementation procedures of CBBP, scaling out options and implementation procedures.

- Practical training covered:

  - Visit to one of the CBBP sites in each area

  - Practical training on participatory sire selection, ranking and price setting

  - Visit to one of scaling out village

  - How to approach and discuss with the new community

  - Training on animal identification and base line data collection

Menz implementation/training - 31 March to 2 April 2019
- Experience sharing at one of the old CBBP sites - Molale

- Participatory selection and animal ranking practices were held in the old CBBP

- Awareness creation on sire transfer and base line data collection in production unit

- A total of 141 improved Menz breeding rams were disseminated to about 341 households in Menz area.
    - 25 breeding rams transferred to the production site in 3 villages around the Molale CBBP site (a total of 60 HHs participated).
    - 58 breeding sires purchased by Regional LS agency and disseminated in 2 kebeles (approximately 200 hhs involved) around Mehal Meda CBBP.
    - Another 58 rams disseminated around Molale CBBP for 81 hhs.

Figure 5. Theoretical and practical training in Menz.

Sekota implementation/training: 7 to 9 April 2019
- Theoretical training at Sekota research center
- Experience sharing in one of the old sites – Abergelle- Sazba Village

- 11 breeding bucks purchased from Abergelle-Bilaque CBBP site and were transferred to a production site (Sikalla) – Additional 28 bucks disseminated by the livestock agency in the same village. A total of 54 hhs were covered.

- 14 breeding bucks purchased from Zequala goat CBBP site and transferred to selected production site (Tsynakola) involving 18 HHs.

- 24 breeding bucks disseminated in Gosque village by the extension. A total of 65 hhs have been participated.

Figure 6. Implementation/ training in Abergelle area

Figure 7. Selected Abergelle Bucks

Maksegnit goat CBBP - Gondar

- Theoretical training at Maksegnit - Gondar

- Experience sharing in one of the old goat CBBP site

- Six breeding bucks were transferred to the production site.

Figure 8. Training - Maksegnit

South Ethiopia

Workshop

A workshop was held at region level in Shashemene on 3 April 2019. SARI livestock research director, Regional livestock officers, LFSDP staff, ICARDA, researchers from different research centers were in attendance. Priority small ruminant populations to be targeted in the upscale operation (Table 1) were identified. A team was also established to work on proposal detailing activities to be undertaken in the upscale with the four populations. No field implementation and training has so far started in South abut this is planned for 2020.

Plans for 2020

- Start training and implementation of upscale in Oromia and South Ethiopia; cover the remaining populations in Tigray and Amhara

- Strengthen existing CBBPs and upscale operations

- Link the breeding programs with fattening of unselected male animals

- Link the CBBPs with markets

- Guidelines for setting up CBBPs available but will be translated to local language and easy to use format

- Experience sharing visits will be organized for farmers to different sites

- Routine data recording will be implemented

Conclusion

Generally, inception workshops were held in the four regions. However, trainings and field implementation of the upscale operation has not started in Oromia and South Ethiopia. This is planned for 2020. In Tigray, upscale of Begait sheep and trainings of partners were conducted. In 2020, this will be strengthened and CBBP upscale and trainings will be conducted in the remaining sites. The Amhara work is relatively advanced as we have covered three population out of the four identified. Several on the job trainings were also carried out.

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