



Community based livestock breeding programs in Bangladesh: Present status and challenges

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ABSTRACT

Community-based breeding (CBB) is a farmer-participatory approach having common interest to conserve and improve their genetic resources under low-input production system. In Bangladesh, the history of CBB for livestock species is quite recent and so far, several breeding programs have been implemented in a limited scale mostly initiated and supported by academic and research institutions but government is being moved. Some of these programs have shown promising results related to community herd's/flock's production performance and farmers' livelihood improvements, particularly with Red Chittagong cattle, Black Bengal goat and Indigenous chicken. Farmers' participations are encouraging in those breeding programs. However, like other developing countries, implementation of long-term and sustainable community-based breeding programs (CBBPs) is a major challenge due mainly to short-term funding commitment from national and international donor agencies, lack of government commitment and rapid urbanization. The experiences gained from the previous CBBPs indicate that self-sustained programs operation is almost impossible under smallholder production systems where continuous technical and financial support services are needed. Taken together, institutional and infrastructural arrangement for functional breed society formation and for technical supports from local and national government office, financial assurance at least for complementary services and farmers' participation as owners of the programs are essential for successful implementation and sustainability of a breeding program in a wider scale.

Keywords: Community-based breeding, smallholders, livestock, low-input system, Bangladesh

Introduction

Genetic improvement of livestock species is a high input oriented, labor intensive and long term program and remains a challenge for developing countries due to lack of resource personnel, supportive infrastructure and institutional arrangements. In developing countries, indigenous livestock populations are being reared predominantly by smallholders under traditional husbandry practices. Without or minimal involvement of farmers' participation in the design and implementation of the breeding schemes have been found unsuccessful in most cases under smallholder livestock production (Wurzinger et al., 2011). The centralized breeding programs operated by government intuitional farms and research stations have potential

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contribution for genetic improvement of indigenous breeds or varieties using open or closed nucleus breeding herds/flocks and has been shown potential impacts on station based performance. However, they don't couple up satisfactorily to the community level due to lack of animal's adaptation ability. The bridging gap between farmer's perception and researcher's interest is one of major hindrance for successful implementation of breeding programs. It is noteworthy to mention that the top-down manner breeding programs mostly collapse once withdrawal of financial and technological support or changes in government priorities (Nimbkar et al., 2008; Kristjanson et al., 2009). Within this context, the sustainability of any breeding program largely depend on farmer's interest and willingness to do work according to planned objectives. The community-based breeding program (CBBP) has revealed as more viable and sustainable for conservation and simultaneous genetic improvement of indigenous livestock under smallholders farming system (Philipsson et al., 2006; Wurzinger et al., 2011).

The concept of community-based breeding (CBB) is not new, formally used as a tool in agricultural research since 1970 (Omore et al., 2008). CBBPs are based on bottom-up participatory approaches and typically relate with the farmers of low-input production systems within the certain geographical areas those having a common interest to work together for the improvement of their genetic resources (ICAR-FAO, 2000; Mueller et al., 2015). CBB increases the productivity and profitability of indigenous breeds or varieties without compromising with their resilience and genetic integrity using easy to access interventions (Haile et al., 2010). Recently, genomic tools have also been used to determine the animal's breed composition, verify parentage and coat colors in community managed dairy cattle and sheep breeding (Mrode et al., 2016; Muniz et al., 2016). The essential steps for planning of CBBPs as proposed by FAO (2010) are presented in Figure 1. The CBBPs have been successfully implemented in small ruminants using indigenous genetic resources of smallholders in countries of Latin America with sheep, goat and llama (Mueller et al., 2002; Wurzinger et al., 2013), with sheep and goat in Africa (Ojango et al., 2010; Haile et al., 2014) and with goat and pigs in Asia (Roessler et al., 2012; Faruque et al., 2016). In contrast, the programs involved with cattle, chicken and pigs are rare due to widespread use of industrial breeding stocks, and availability of assisted breeding and reproductive technologies (Mueller et al., 2015). However, in Bangladesh, this farmer-participatory livestock breeding approach has been used recently and the species of interest are cattle, goat, chicken and sheep. As a pioneer, Department of Animal Breeding and Genetics (ABG), Bangladesh Agricultural University (BAU),

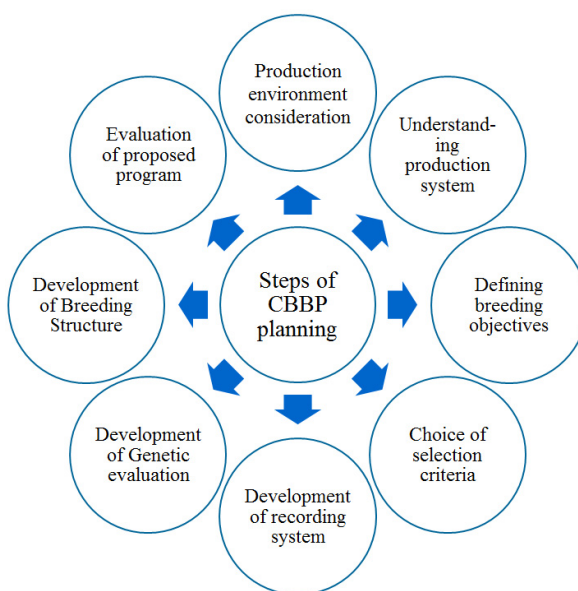


Figure 1. Basic elements and principles for planning community-based breeding program (CBBP) given by FAO (2010).

Mymensingh-2202, Bangladesh has started CBBPs with smallholders for genetic improvement and conservation of aforementioned first three indigenous species. Later on, Bangladesh Livestock Research Institute (BLRI) and Department of Livestock Services (DLS), Ministry of Fisheries and Livestock (MOFL) as well as few non-government organizations (NGOs) have joined in this journey and several programs are ongoing. The aims of this study were to review the status of existing CBBPs, their prospects and limitations in execution as well as recommendations for further research in Bangladesh.

Livestock population of Bangladesh

Livestock is an integral component of agricultural farming system in Bangladesh with shares of 1.60% of the total gross domestic product (GDP) and 14.31% of agricultural GDP in the FY 2016-17, and has been coming up with an average 3.31% annual growth rate (BBS, 2017). The livestock species includes cattle, buffalo, goat, sheep, horse and pig. The total heads of major livestock species are shown in Figure 2 which depicted steady increasing trends in population size over the past 8 years (DLS, 2016). Most of the aforesaid species are indigenous type except that only about 20% cattle are exotic cross (Bhuiyan, 2014). Majority of animals are being reared by small-holders having 1-2 heads of cattle, 2-4 heads of goat/ sheep along with few poultry under subsistence mixed farming system. Livestock, being an asset of the rural poor (up to 70% of animals are kept by non-farm and smallholders), in addition to meeting the daily animal protein requirements, contributes to rural income growth, employment generation, women empowerment and livelihood improvements. Therefore, smallholders low-input production system are still the key component of livestock farming in Bangladesh.

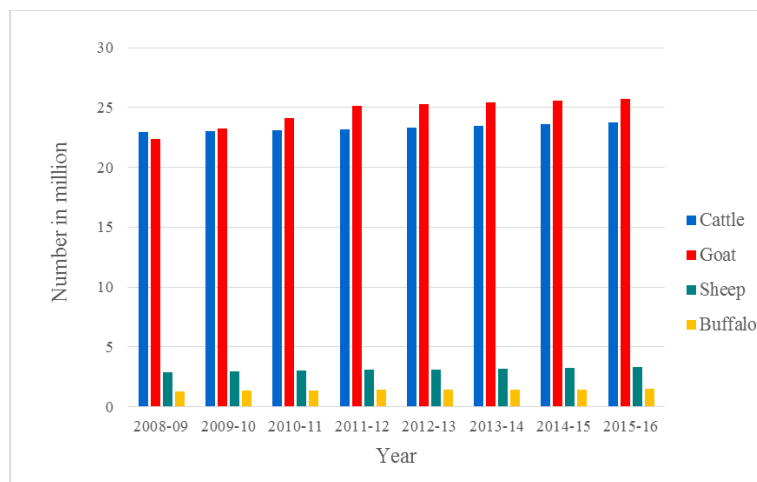


Figure 2. Major livestock population of Bangladesh over the past 8 years (source: DLS, 2016).

National livestock breeding policy and practices in Bangladesh

The first national breeding policy was adopted in 1982 with given emphasis on both selective and crossbreeding/up-grading program particularly in cattle to meet up country's growing demand for milk and meat. Later on, this policy was revised in 2007 with clear animal breeding guidelines and directions known as "National Livestock Breeding Policy 2007" (NLDP, 2007) and is presented in Table 1. This breeding policy categorized three distinct breeding goals (short, medium and long term) for cattle coherent with existing production systems in the country. For commercial cattle production (dairy as well as beef), use of crossbreds derived from specialized (temperate and tropical) breeds have clearly been envisaged. On the other

hand, the policy clearly recommended for selective breeding in potential indigenous cattle (Red Chittagong, Pabna, Munshiganj), buffalo, sheep, goat and chicken breeds/varieties in the subsistence or low input production system.

Accordingly, upgradation of indigenous cattle varieties has been practiced for the last few decades through introduction of high yielding tropical and temperate dairy breeds (Sahiwal, Sindhi, Holstein-Friesian). For this purpose, artificial insemination (AI) program has been operated by DLS, MOFL as a pioneer since the inception of upgrading scheme. Later on, one dairy cooperative society (Bangladesh Milk Producers Cooperative Society, brand name Milk Vita) and few NGOs like Bangladesh Rural Advancement Committee (BRAC), American Dairy limited (ADL) and Lal Teer Livestock (LTL) have started their AI activities using imported pure breeds as well as locally produced superior Local-Friesian and Local-Sahiwal crossbred breeding bulls. Therefore, a considerable number of crossbred cattle are discernible nowadays throughout the country. However, this increasing proportion of crossbred population may increase milk and meat production exponentially at the expense of genetic dilution of indigenous cattle genetic resources. In reality, for selection of breeding bulls, all breeding service providers just have been used performance (with poor reliability) and andrological data rather than breeding worth of animals due to mainly absence of functional animal registration and herd book based animal recording system (Bhuiyan, 2014). As a result, the indiscriminate upgrading and crossbreeding programs led to the production of large number quasi individuals. A substantial proportion of upgraded genotypes could not achieve the target milk production as well as to develop a synthetic dairy cattle line suitable for hot-humid tropical environment of Bangladesh (Siddiquee et al., 2013). It is notable to mention that these AI programs only covers 36% of the total breedable cows (DLS, 2016) and remaining depends on natural service by locally available bulls. However, DLS since 2002 has initiated program for the production of breeding bulls of known merit through field based progeny testing (Bhuiyan, et al., 2015) but its fruit is only becoming tangible recently. The upgrading program of indigenous buffalo has been continued with a limited scale for the last few years by DLS and Milk Vita in some buffalo potential zones of the country. At present, only Murrah bulls/semen has been used for upgrading purpose.

Table 1. Current livestock breeding policy of Bangladesh¹

Species	Purpose	Production system	Breeding Strategy	Mating plan
Cattle	Milk	High-input/ Intensive	Up-grading	Top most up-graded HF ♀ x pure (100%) HF ♂
		Medium-input/ Semi-intensive	Up-grading/ pure-breeding	50% IC ♀ x 50% HF ♂, IC ♀ x 50% HF ♂, SL ♀ x SL ♂ and IC ♀ x SL ♂
		Low-input/ Subsistence	Selective breeding	SL, PC, RCC, MUC and other improved IC
Cattle	Meat	Medium-input	Up-grading	50% IC ♀ x 50% BR ♂ or up-graded males of HF and SL
Buffalo	Milk	High/Medium-input	Up-grading	IB (R/S) ♀ x 50% MU ♂, IB (R/S) ♀ x 50% NR ♂
		Low-input	Selective breeding	IB (R) ♀ x IB (R) ♂, IB (S) ♀ x IB (S) ♂
Goat	Meat	Medium/low-input	Selective breeding	BB ♀ x superior BB ♂
Sheep	Meat	Medium/low-input	Up-grading	50% IS ♀ x 50% LH ♂, 50% IS ♀ x 50% RM ♂
		Medium/low-input	Selective breeding	IS ♀ x superior IS ♂

¹source: NLDP, 2007 and Bhuiyan, 2014; HF = Holstein-Friesian; BR = Brahman cattle; SL = Sahiwal; PC = Pabna cattle; RCC = Red Chittagong cattle; MUC = Munshiganj cattle; IC = Indigenous cattle; IB (R/S) = Indigenous buffalo (river/swamp type); MU = Murrah buffalo; NR = Nili-Ravi buffalo; BB = Black Bengal goat; IS = Indigenous sheep; LH = Lohi sheep; RM = Romney Marsh sheep.

Alongside, small ruminants (goat and sheep) breeding have been performed mainly by the inferior quality bucks and rams primarily kept by scheduled caste or by smallholders own rams or bucks (Islam et al., 2016). So, there has been continuous negative selection in the population which might have led to decreased performance. To overcome this limitations, DLS

and BLRI have established goat and sheep farms to disseminate superior quality bucks and rams to the community farms (DLS, 2016; BLRI, 2017.) Despite, their contribution is insignificant against the country's total requirements. In addition, the up-grading/crossbreeding programs in goat and sheep are only in research station based for testifying their performance and adaptation under tropical environment conditions and therefore, gene pools of these two species are still intact or undiluted (BLRI, 2017).

Prospects and limitations of community based livestock breeding in Bangladesh

It has come to realization and broad consensus by the scientific community from the lessons learned through reviewing of existing breeding practices of Bangladesh that farmers' participatory breeding program might be worthy alternative for conservation and improvement of indigenous livestock genetic resources. The concept of CBBPs is relatively new for Bangladesh perspective. So far, a number of programs have been implemented mostly with the help of foreign funding source and the outputs of some of these projects are promising. In 2004, first CBBP was initiated in a small-scale with Black Bengal goat aiming to produce superior Black Bengal bucks and to increase family income among poor farmers, under the technical supervision of the Department of ABG, BAU, Mymensingh (Haque et al., 2005). In 2009, a community driven farmer-participatory indigenous (Red Chittagong) cattle conservation and pure breeding program was launched through USDA funding and is still in operation with the technical support from the Department of ABG, BAU, Mymensingh and with the financial assistance of USDA and an international organization, World Vision Bangladesh (Nahar et al., 2016 and Islam, 2017). Since 2009, International Livestock Research Institute (ILRI) in partnership with ABG, BAU has been implementing a global environment facility (GEF) funded UNEP-GEF-ILRI FAnGR Asia project in two locations (Bhaloka and Jhinaigati Upazila) of Bangladesh where research on in-situ indigenous goat and chicken conservation and improvement. Meanwhile, remarkable awareness and interest through the said researches have been built among the smallholders of project sites and at national level. Notable improvement in production and reproduction has been made through science led breeding intervention in the farmers' flocks (Choudhury et al., 2012; Islam et al., 2015). "Indigenous Goat Rearing Women Cooperative Society Ltd. (Govt. Registered) and model "Buck Park" have been developed through implementation of the project which over time showed significant improvement of Black Bengal goat's performance (Sarker et al., 2014; Sarker et al., 2015). At present, this goat breeding program is ongoing with the technical support of ABG, BAU and financial support of BLRI, Bangladesh. Importantly, the "Buck Parks" are now self-sustaining due to gained capacity of the farmers to select, recruit and replace quality breeding bucks for rendering Black Bengal conservation and breeding program. In addition, several others community based breeding projects have already implemented on goat and cattle under the leadership of BAU. Apart from this, BLRI and DLS have taken CBBPs in a wider scale for indigenous sheep and chickens conservation and improvement since 2014.

Until to date, the CBBPs so far implemented or on going are based on national and international donor support. None of the programs is in operation as self-sufficient or only limited technical supported approach. Remarkably, in most cases, the breeding programs discontinue their activities once withdraw of financial and technical support (personal communication). Sustainability is a big question for these programs and it's a high time to explore the associated reasons for failure. The possible limiting factors behind mainly are the absence of formal breed society for a particular breed or population, lack of awareness on value of indigenous genetic resources and farmers' participation goal, insufficient/unavailable of necessary support service from the relevant local or national institutions and limited market opportunity of their products with premium price. Above all, the researcher-driven and top-down fashion breeding programs make them vulnerable for long-term continuation with specific goal.

Recommendations for successful community based livestock breeding

The nature of community based livestock breeding is not similar with other conventional breeding practices and therefore, need to set-up plans according to production environments and farmers' need as bottom-top manner. Based on the facts, figures and suggestions from the previous authors (Haile et al., 2014 and 2016; Gutu et al., 2015, Mueller et al., 2015), the following points need to be taken into consideration for successful implementation and sustainability of CBBP.

1. Ensure farmer's participation in the stages of breeding program planning, proposal formulation and evaluation process, and include their opinions accordingly in the plan.
2. Formation of registered breeding cooperative (well-functioned) by the members of smallholders has found effective for successful implementation and sustainability of CBBP.
3. Proper assessment of needs to the community and those reflect by the objectives of the project.
4. Set up breeding objectives in line with the national breeding policy.
5. Development of simple, cost-effective and objective oriented record keeping scheme.
6. Regular communication with farmers by arranging consultation meeting and group discussion, and incorporation of farmer's feedback in the research design.
7. Ensure continuous technical and institutional support to the community flocks/herds from local or national research and extension services.
8. Availability of complementary services like affordable health service and access to adequate and quality feed resources.
9. Establishment of better market link to ensure returns on investment and strengthening the financial capacity of cooperatives.
10. Periodic evaluation of on-going programs for drawbacks identification and adopt program activities as per evaluated information.

Conclusion

A limited number of CBBPs have been implemented so far in Bangladesh. Some programs showed promising results and have been more successful with small ruminant species and chicken. However, the capacities in terms of social, technical and economical have not yet been developed for implementation of self-sufficient breeding programs in Bangladesh. The long-term commitment of farmers' participation, formation of farmers' organization and supporting services from the research institutes, government livestock development office, cooperatives and agribusiness agents are essential for the sustainability of breeding programs.

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