Breeding and conservation programs with local communities

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Abstract

Utilization strategies for genotypes that possess high levels of adaptive fitness should include breeding programs which maintain or enhance their merit and, in doing so, contribute to the economy of the communities depending on them. Issues facing such breeding programs where analyzed in five examples of breeding programs for sheep, goats and South American camelids in communities located in the Latin American Andes. Success of the breeding programs are largely related to the level of involvement of the community in the design, implementation and operation of the program. Traditional breeding procedures can be improved with the guidance of appropriately trained technical advisors. In general such advisors are very scarce but crucial to avoid repeating mistakes and to multiply positive experiences.

Keywords: breeding, sheep, goat, camelid, community

Introduction

Sustainable utilization of AnGR is the preferred avenue for safeguarding animal genetic diversity. Utilization strategies for genotypes that possess high levels of adaptive fitness to specific environments should include breeding programs which maintain or enhance their properties and, in doing so, contribute to the economy of the communities depending on them. If this is not the case then the risk for these genotypes of being lost will increase as communities will need to search for other sources of income. In many regions animals are the main and often the only source of income. For example along the Cordillera de los Andes, the mountainous backbone of the Americas, communities depend heavily on their small ruminants, if for any reason these animals are lost, farmers would be expelled with all the attached problems. In the Andes production is basically for self subsistence with some surplus products being marketed locally. An additional characteristic of these production systems is the low control farmers have of the animal production environment, hence the importance of adaptive fitness and productivity under changing environmental conditions. In order to understand the issues facing breeding programs in these conditions, examples of some breeding programs for sheep, goats and South American camelids will be analyzed.

Examples of Breeding Programs in communities

Sheep in Chiapas, Mexico

In the Chiapas area of southern Mexico, sheep production plays a substantial role in the economy of the Tzotzil population contributing also to their ethnic and cultural identity. For cultural reasons lambs are not used for consumption but wool is extensively used for local population clothing. In the past and for more than 20 years, crossbreeding with meat type breeds was proposed in the area. Meat production improved but wool production became worse, so that income for sheep producers did not change and traditional products, like wool-made costumes were put at risk. Further crossbreeding was resisted. Only when recognizing performance and culture-bound traits as breeding objectives, an effective breeding program based on the establishment of an open nucleus could be started in 1992 (lead by Dr Raúl Perezgrovas and his team from the Instituto de Estudios Indígenas, Universidad Autónoma de Chiapas). The characterization of the 3 different breeds (Chamula, Chiapas and Café) within the local sheep population, breeding objectives defined by farmers and selection based on fleece quality measurements, visual inspection and organization of a ram distribution program has been a successful strategy for sustainable utilization of the Chiapas local sheep resources (Zaragoza et al., 2005; García et al., 2003).

Sheep in the Sierra Central, Peru

In 1996 a survey conducted in the highlands of the Sierra Central (Dr Enrique Flores and his team from the Universidad Agraria La Molina) identified 3 types of sheep production systems: (1) individual family flocks, (2) communal flocks belonging to villages and (3) multi-communal flocks managed by cooperatives often involving several villages in a region. Only in the latter systems a “breeding plan”, often based on imported rams, may be operating, systems (2) and (1) do not have a planned breeding plan. In genetic terms there is no genetic structure. The survey identified two major requests of farmers related to breeding: the need of suitable rams and the need for training in breeding techniques. After extensive discussions, in 1995 an interesting breeding structure based on the open nucleus concept was established and made functional. The land and labor necessary to run the nucleus was provided by the communities based on a series of arrangements and technical support provided by the university. The nucleus was established by mating imported and locally produced top rams with 50 of “best” females of each of 9 communal and multi-communal flocks, half of the ewes returning pregnant to the suppliers and the other half starting a central nucleus providing improved rams to (2) and (3) which in turn also provided rams to (1). Incidentally the progeny of local rams proved to be better suited to the local market conditions than the progeny of imported rams. Farmer organization and farmer training is the backbone of this successful community based sheep breeding program still in operation (Mueller et al., 2002).

Alpacas in Puno, Peru

In the high-plateau of southern Peru, alpacas are the main livelihood of farmers providing fiber, meat, hides and cultural identity. In developed countries alpacas have become fancy pet animals also used as pack animals for trekking and fiber production. A few local alpaca breeders benefit from this exportation but the external demand for alpacas has disrupted local market and puzzled breeding objectives. Outstanding males particularly in terms of coat color are exported but the textile industry demands white fine alpaca fiber. Indeed the alpaca population in Peru is increasingly white, other colors now demanded as natural colors are
scarce. In Macusani, Puno a breeding program (led by Mr Zenon Choquehuanca and his team of SPAR Macusani) was started recently by visually classing males for fiber and providing mating opportunities to females from the community. This isolated and elementary breeding program contrasts with the importance of alpacas for farmers in Peru. R&D organizations responsible for orientating farmers are weak and under-funded, trained breeders are scarce. This situation has resulted in sporadic and sometimes flawed breeding program proposals. For example marker assisted selection and pedigree information based selection programs were proposed to farmers instead of more realistic breeding programs based on standard quantitative genetic procedures. This example highlights the importance of training in breeding and also the need of strategic services for farmers like wool sample testing in some countries.

Llamas in Turco, Bolivia

The highland of Eastern Bolivia (4,000 masl) is a llama breeding area. In the village of Turco llamas are vital in providing meat but also fiber, hides, manure and transport. Threats to the species and its breeds are rural exodus, climatic disasters and over consumption of llama meat. To avoid inbreeding and to access better animals many farmers of Turco participate in a community breeding structure. Llama males are selected by the group of farmers amongst young males born in member flocks and then taken to “Centros de Machaje” were they are run together, separated from females. Members of the program shepherd these males in proportion to their contribution of males. Males are taken to the farms in turns of about 15 days each and mated to females detected in heat.

The interesting point is that farmers discuss breeding traits and exchange males thus, agree on breeding objective and control rate of inbreeding (Rodriguez & Quispe, 2003). The program could be improved if weighing equipment were available in the village and if objective measurements of fleece traits could be implemented. As in Peru, wool testing services are not available.

Goats in Patagonia, Argentina

In NW Patagonia, farming of fiber producing goats is a traditional activity. Formerly goat fiber was offered individually and sold at very low and uniform prices. Impoverished farmers increased goat numbers as much as possible and severe desertification processes commenced, turning animal survival very fragile. Authorities failed to recognize the causes of the problem and in 1967 issued a Provincial Law prohibiting goat production (!), a legislation which never could be effectively implemented. In the 1970s Mohair producing goats (Angora breed) were differentiated from goats producing ordinary fibers. Farmers of Angora goats in the scarcely populated areas of Patagonia improved their income given the much better prices of Mohair as compared to ordinary goat fiber.

Angora goats were subjected to a comprehensive and successful improvement program. The program started with the screening of “best” Angora females and males to a nucleus which in turn provided bucks to multipliers. Fifty-four communities participated in the program, each with a multiplier. In the development of the program it became clear that multipliers need to be designated by the communities rather than by the scientists involved in the design of the program. Based on the success of the breeding plan, bureaucrats launched a large scale upgrading program for the remaining criollo goats. It proved a disastrous idea in areas where a market for goat meat was important (Angoras have a low reproduction rate), and where vegetation was more shrubby, and the very long Mohair fibers get entangled with the vegetation. Disappointed farmers started to cross their criollos with exotic breeds (largely
Anglo Nubian) to improve meat productivity. However short haired goats did not resist the frequent low temperatures in the mountains and required extra feeding and additional health treatments. The risk of loosing adapted stock only increased.

More recently a different approach was taken (Dr María Rosa Lanari and her team of INTA Bariloche). The non-Angora criollo goat population (about 1,500 farmers with 340,000 goats) was studied considering more carefully production system and communities. The implications of transhumance with summer and winter ranges and the role of buck keeping farmers were analyzed. Three types of criollo genotypes were identified on geographic, phenotypic and genetic differences. These genotypes were named for their coat characteristics: red, long hair and short hair (Lanari et al., 2005 and Bedotti, 2002). Open nucleus flocks in communities of each genotype were established. These flocks provide bucks to members of the community. Recently a cashmere combing business started amongst some of the long hair genotype producers. Characterization and labeling re-valorated goat genetic resources. Producers are now proud of their stock and eager to protect it from further introduction of exotic breeds. Interestingly, local Municipalities now issued a promotion and protection ruling of these recently named goat populations. The recent history of goat breeding in Patagonia is a compendium of failures and achievements of farmers, technical advisors and public authorities alike.

Lessons from community based breeding programs

1. **Breeding plan and breed choice.** Often a breeding program is understood as the introduction of males from elsewhere or the crossing with males of exotic breeds. In systems were communities and farmers have a low control of the environment this “genetic improvement” approach often leads to new or additional problems. In addition to housing, feeding and health issues there is the additional dependence on the supply of expensive exotic males in an absorption plan, or, there is the usually underestimated complexity of planned crossbreeding (controlled mating, etc.). Less spectacular but more sensible is to start a sound breeding plan with the already adapted local genotype. The introduction of new breeds or crossbreeding with breeds that require higher inputs should occur only after a comprehensive life-cycle evaluation of the performance of these breeds and crosses in the particular environment (Mueller, 1993). Such evaluations need careful experimental design and are usually very costly and time-consuming but more costly and more time-consuming is the misguidance of whole communities as the previous examples show.

2. **Breeding objective.** In subsistence production systems livestock contribute a variety of goods and services, therefore breeding objectives need to take into account a diversity of traits. This is different to completely market oriented and specialized production systems where breeding objectives can be readily identified and environment adjusted to meet high performing animals. Participative definition of breeding objectives is crucial but support of farmers regarding market trends and relative economic importance of traits is also important. Some of the previous examples illustrate these points.

3. **Breeding value estimation.** Many important traits are not easily measured and sometimes no measurements are possible at all. It is important to apply appropriate technologies without insisting on extensive measurements and pedigree recording or unnecessary complicated selection programs. Experience shows that demanding data collection may lead to the abandonment of the program. Breeding program advisors need to balance selection accuracy with dissemination of the selection candidates. In the systems described above, dissemination is basically by natural mating therefore selection accuracy
does not need to be very high. Basic performance records and informed visual appraisal are often enough to start a sound breeding program for meat and fiber traits.

4. Breeding structure. Open nucleus breeding systems proved to be suitable starting breeding structures. They stimulate discussion on breeding objectives and selection procedures involving all stakeholders. Open nucleus structures easily evolve towards sire reference schemes or towards functional pyramidal structures. The key for a successful structure is the involvement of the community in its design and operation, this needing community organization and technical support.

Final remarks

These lessons from community based breeding programs are not really new and probably not restricted to community breeding programs of small ruminants, the general problems were described by Hoffman & Scherf (2005) and recommendations were also adequately summarized in the Montpellier Symposium (2002) for each level of production system. In addition comprehensive guidelines for developing breeding strategies and suitable case studies with low input systems were presented in a previous workshop (Galal et al., 2000). What is discouraging is that very few community-based formal breeding programs are in operation with small ruminants in the Latin-American Andes despite their importance for the communities depending on them. Informal breeding programs based on local knowledge are often effective and practical but can also benefit from knowledge of other communities and from science. Indeed some programs need validation and approval of trained advisors in order to increase community confidence in its breeding program and its own genetic resources and in order to serve as an acceptable model for other communities. This confidence is crucial in avoiding indiscriminate and unplanned crossbreeding with usually highly promoted exotic breeds. Traditional breeding procedures can be improved with the guidance of appropriately trained technical advisors. In general such advisors are very scarce but crucial to avoid repeating mistakes and to multiply positive experiences.

References


