

Livestock Breeding: Strategies and Concerns



Breeding strategies contribute significantly to improving livestock production efficiency, by enhancing the productive and reproductive performance of livestock. Several national breeding programs are still focusing solely on production outputs (e.g., milk yield) but do not consider its relationship with other important traits (e.g., reproductive performance or health). The utilization of livestock by small holder or communal farmers requires that the correlation among different traits be established before breeding schemes are adopted. The decision criteria, concepts and implementation of strategies, for the conservation of locally available farm animal genetic resources, are presented.

Major Constraints to Livestock Breeding

The small number of stud breeders makes the implementation of an effective national breeding policy virtually impossible. Another major threat to indigenous farm animals is the uncontrolled mating of disseminated crossbred stock. A characterization and performance evaluation of

available indigenous populations is still missing or incomplete for all important livestock species including local strains of poultry. Other major constraints for a sustainable genetic improvement of livestock, *in-situ*, are detailed in the box.

Major Constraints for Genetic Improvement of Farm Animal Genetic Resources

Sector policy and breeding program

1. Lack of national breeding policies
2. Insufficient *in-situ* conservation plan for genetic resources
3. Lack of well-defined breeding strategies
4. Unsustainable or lack of continuity of breeding program
5. Insufficient support of relevant research and training activities
6. Insufficient number of qualified animal breeders available
7. Livestock improvement program unsustainable due to dependency on external funding or subsidies and distorted markets

Infrastructure

1. Lack of performance recording schemes in several countries, especially in the smallholder sector and for indigenous breeds
2. Organization of animal breeders in many countries insufficient or non-existent
3. Communication, transport and computation facilities insufficient or not available

Breeding programs

1. Breeding objectives often non-existent or vague
2. Ineffective sire exchange and artificial insemination program
3. Small population sizes, small herd sizes and unreliable animal identification
4. Characterized by indigenous populations
5. Genotype environment interactions often neglected

Selection and genetic gain

1. Long generation intervals through extended and late maturing animals
2. Low selection intensity through high mortality rates and limited performance testing, if any
3. Low accuracy of estimated breeding values due to small active breeding population
4. Inbreeding effects may cause depression of performance
5. Antagonistic relationship between genetic merit for production and adaptation



Livestock Breeding Strategies

Focus on Indigenous Populations

Selection within population or breeding for traits of medium to high heritability, such as daily gain or lean meat percentage, is a potential and sustainable strategy in developing countries. Development of local populations through adequate selection sustains local breeds and, therefore, secures conservation of genetic resources. With this scheme, breeding costs are kept low by not importing exotic livestock.

However, it is argued that this strategy progresses slowly over a given time period due to low level of output (e.g., milk, meat) of some of the indigenous livestock. Also, insufficient characterization of local populations prevents the set-up of a viable long-term selection program.

A group breeding scheme is also an efficient system to improve livestock. In the smallholder sector and where no progeny testing and artificial insemination (A.I.) scheme exists, breeders may adopt cooperative breeding schemes. A number of interested farmers record their flock, select the best females and send them to one unit forming a nucleus. The so called nucleus could be managed by a farmers' committee and is kept open for highly productive females. Selected males are used as replacement sires in the cooperating farms. The maximum rate of gain is achieved, when 5% to 10% of the total number of breeding animals is kept in the nucleus.

Efficiency, in its broad sense, is defined as the product output per unit of input involving a complex relationship between factors such as feed input, maintenance feed requirements, level of reproductive and productive performance, infrastructure and breeding costs and income per unit of sold product.



Design a Sustainable Breeding Program

The general strategy for sustainable *in situ* conservation programs should focus on the optimization of the genetic potential according to environmental factors (e.g., the needs of the market, the ecological environment and future development).

Livestock farmers should develop and identify their own breeding objectives, testing schemes and breeding stock based on their own conditions, which are determined by the production environment. Characterization of indigenous populations and comparative performance trials require sufficient and accurate data sources as the choice of the foundation stock for any breeding program is very important.



Steps in designing sustainable breeding programs for *in situ* conservation

Principal thrust:

To improve overall biological and economic efficiency of livestock production, through the provision of an optimized genetic potential, to fulfill the needs of the market or the subsistence of the farming system.

1. Identify production system(s), potential markets or market niches and economic merits of the animal population and its traits.
2. Define breeding goal and objective through a participatory approach.
3. Evaluate available populations for breeding purposes and select the best stock. Ensure identification of potential breeding animals and herds. Estimate critical effective population sizes and their 'cut-off' points, which are both species and population-specific.
4. Promote and develop adequate structures enabling the conduct of breeding systems (e.g., characterization, multiplication and selection) by the livestock owners. Ensure knowledge at farmer and professional level through applied training.
5. Develop improvement schemes based on testing and selection against the formulated breeding goal.
6. Ensure gene flow through dissemination of breeding animals using traditional stock sharing system or formal markets to all livestock production herds.

Within an agro-ecological zone, for example, the risk of extinction of a population, the presence of unique traits such as adaptive behaviour, disease tolerance or good mothering ability, and cultural and historical values of a population, the critical role of the population in crop-livestock systems, could be assessed by a representative group of stakeholders. The application of a simple scoring model for each criteria, e.g., ranging from 'very high' to 'non-existent', and its weight can be used to establish an aggregate score.



Create a Multi-Sectoral Team of Appraisers

In the absence of objective data derived from long-term recording or in-depth studies, an assessment by a representative group of stakeholders might be helpful. The information gathered from the assessment would present the relative importance of populations within and between species. The exercise would allow direct farmer participation and ownership of a future breeding program.

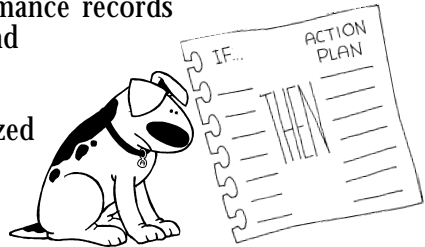
However, the outcome of such an exercise could be distorted with the prevailing biases (e.g., donor dependencies, previous extension messages). This requires a critical review of the assumptions made and further independent analysis.



Develop Action Plans for Policy Development

If the livestock production can no longer cope with the increasing demand, effective and efficient breeding policies should be implemented immediately. Listed below are some action plans recommended to achieve a measurable impact:

- Analyze production systems and economic merit in existing and future national, regional and overseas markets for livestock products. Assess needs of the subsistence sector to improve income generation in rural areas.
- Develop breeding policies and implement measures to avoid further uncontrolled developments resulting in extinction of indigenous populations and inefficient crossbreeding programs.
- Analyze existing performance records of indigenous, exotic and crossbred populations. Conduct comparative studies under standardized typical environmental conditions involving sufficient numbers of animals. Analyze assumed antagonistic relationships between productive and adaptive traits. Develop cost efficient and effective field performance testing schemes.
- Define and record secondary traits of importance for multipurpose livestock, such as disease resistance or utilization of locally available feed resources.
- Conserve valuable genetic resources. Establish a regional network on conservation issues as a venue to exchange ideas, experiences and problem solving strategies. Screen existing populations.
- Evaluate the genetic and economic merit of planned breeding strategies before exotic stock or advance technology is imported.
- Disseminate improved livestock to producers by applying a participatory approach, i.e., farmers must be integrated to achieve ownership of the program. Develop group breeding and open decentralized nucleus schemes.



- Review the impact of state owned and managed nucleus herds, breeding station and extension organizations. Market development and orientation as well as cost recovery should become a high priority.
- Pool national efforts and utilize existing facilities, know-how and technologies region wide, such as estimation of breeding values or testing of innovative technologies and promote professional training.
- Stakeholders, including professional animal breeders, should start a concerted action to implement *in-situ* conservation programs through appropriate breeding strategies.



Conclusion

Decentralized, community-based group breeding activities, applying standardized data recording schemes, could be the best compromise in the less developed countries to improve livestock and to conserve genetic resources. The indigenous genetic resources of livestock offer an enormous potential, which is not yet explored. The conservation of such valuable germplasm should be regarded as mandatory for securing food for present and future generations.

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Contributed by:
Clemens B. A. Wollny
(Email: clemenswollny@gmx.net)
(Email: cwollny@gwdg.de)

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