

Enhancing breeding programs in harsh environments: insights and innovations

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The 75th EAAP Annual Meeting, Session 12: effectiveness of breeding programs for local breeds in the Mediterranean region and other harsh environments.

“Designing a breeding programme is much more than genetic theories and increased productivity.

It is a matter of **infrastructure**, **community development** and an opportunity for improved livelihood of livestock owners through **better animals** and **markets** for their products.”

J. Philipsson et al., 2011.

Outline

- The role of small ruminants in harsh environments
- Breeding programs in harsh environments:
 - challenges
 - pitfalls
 - success factors
- Future directions



Small ruminants in harsh environments

Livelihood, Sustainability, and Economic Empowerment

- Sheep and goats are crucial in difficult environments.
- Areas characterised by poor forage quality, limited feed options, and climate-related risks.
- Farmers depend on these animals for income, and socio-economic stability.
- Successful breeding programs can boost animal productivity, health and provide reliable income to farmer.



Breeding programs in harsh environments: challenges, pitfalls and success factors

Key challenges



Animal productivity is challenged by environmental stressors

(climate, nutrition, health, and management limitations, especially under extensive pastoral systems)



Environmental factors can overshadow the benefits genetic improvements, complicating investment justification



The production context is highly fragmented, no economies of scale

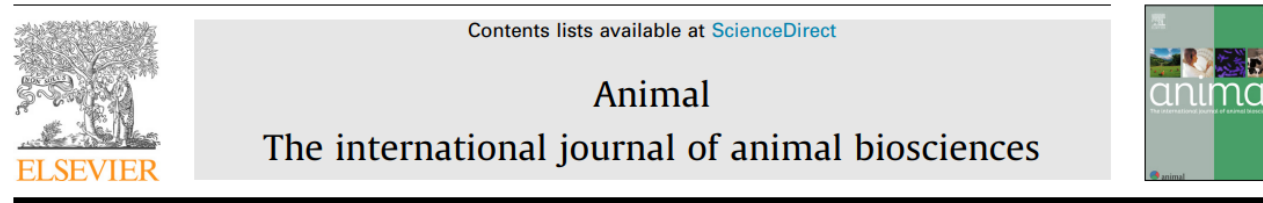
Key challenges



Breeding program “infrastructure” can be missing or inadequate

- lack of systematic animal identification,
- inadequate animal performance recording, storage and management
- organizational and institutional shortcomings
- inadequate policies, because of governments’ needs for immediate results
- low level of literacy and training

Key challenges



Identifying selection strategies based on the practices and preferences of small ruminant farmers to improve the sustainability of their breeding systems



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Among 272 interviewed farmers (France, Spain, Italy, Greece, and Uruguay)
30% not know meaning of EBV and not using tools linked to genetic progress

Pitfalls

- Overlooking the **socio-economic context** and the cultural roles of livestock
- Indiscriminate crossing, disregarding of **local native breeds**
- Designing **breeding programs too complex** (logistics, technology), or without distribution strategy
- Ignoring **environment-specific breeding needs**, leading to erroneous breeding goals



Photo: AAP via EPA/Orestis Panagiouto

Full Length Research Paper

Response to absorption of the crossbreeding of the local goat with exotic breeds in the oases of Southern Tunisia

Amor Gaddour, Sghaier Najari and Mabrouk Ouni

“Crosses of Damasco with Alpine and Murciano–Granadina goats improved milk production and kid growth, but negative effects in reproductive traits were also detected”



Dissemination of genetic progress: a key aspect of genetic improvement of local breeds

Published online by Cambridge University Press: 11 April 2013

Julie Labatut, Nathalie Girard, Jean-Miche Astruc and Bernard Bibé

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Article Metrics

“The breeding centre does not find enough buyers for its rams, while there is a shortage of rams in the region of Western Pyrenees”



Italian Journal of Animal Science

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/tjas20

Diversity of breeding practices is linked to the use of collective tools for the genetic management of the Corsican sheep breed

Lola Perucho, Jean-Christophe Paoli, Christina Ligda, Charles-Henri Moulin, Ioannis Hadjigeorgiou & Anne Lauvie

“Farmers (commercial flocks) concerned about unsatisfactory characteristics of the animals coming from the breeding scheme (Corsican sheep breed)”

Success factors

- 1) Culturally and contextually appropriate
- 2) Simple “begin with the foundation”, with early-wins for participants
- 3) Focused on long-term environmental sustainability and resilience



1) Culturally and contextually appropriate

- Involve **locals** (communities, farmers and stakeholders) in the **design and implementation** of breeding programs
- Consider **environmental constraints** and the **available** (genetic) **resources**
- Market-oriented: **demand-driven**, yet considering the multi-purpose use of the animals and **diversity of production** types and farmers' expectations

France



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“Farmers (commercial flocks) concerned about **unsatisfactory characteristics** of the animals coming from the **breeding scheme** (Corsican sheep breed)”



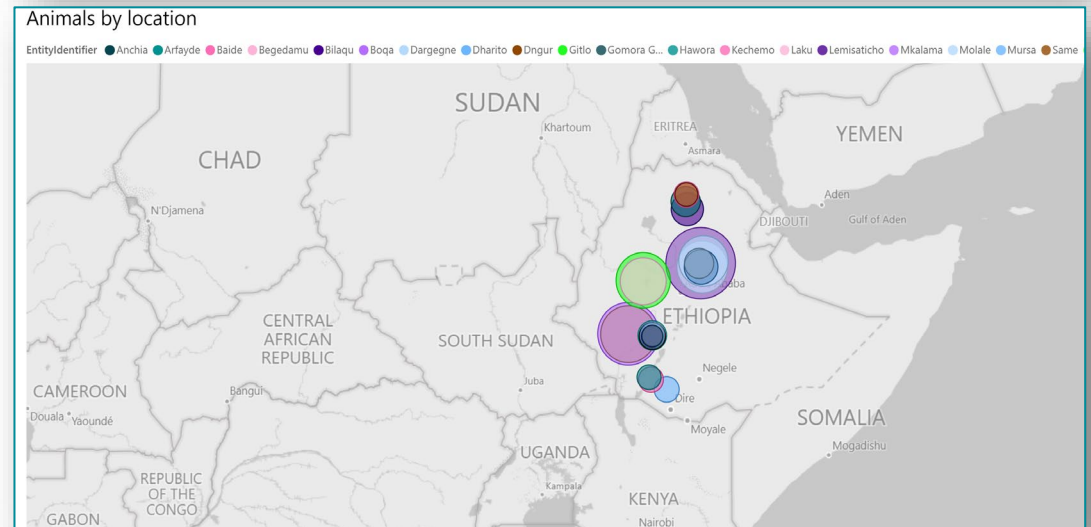
Inclusion of **functional traits** important for traditional framers into the breeding program together with milk quantity:

- Morphological qualities
- Hardiness
- Udder

Increase in sales of breeding rams from the program.

Ethiopia

- CBBP to support communities of goat and sheep breeders
- Focus on improving flock performance by selection methods, and addressing market demand without undermining indigenous breeds' resilience and genetic integrity
- Positive impact on animal performance, market participation, and income livelihoods.



India

- **Project Mesha**, community-led program implemented by AKF since 2016
- Aimed at **improving the quality of life** of farming households, by improving local **Black Bengal** breed
- Enable women goat farmers to advance further up the **value chain**



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2) Begin with the foundation “Fundamental principles first”

- Animal **identification** and **reproduction control** (castration, presence and timing of selected breeding males)
- **Data recording**: farmer-friendly decision support reports and tools.
- Early wins: this gives farmers an **immediate return** on their investment and effort to record the data

Ethiopia



- Since 2019, ICARDA has **trained 65 local enumerators** to collect data (Dtreo platform)
- 100,000 animals, 125,500+ live weight records, and 23,000+ milk records
- Data collection ongoing in 24 CBBP sites across Ethiopia.
- Demand from breeding programs in other ICARDA program countries: **Jordan, Tunisia** and **Mali**



India

- Project Mesha Trained over 350 women paravets for data collection and veterinary services to 70,000 female goat owners
- Keeping pedigree and weight records
- Using this to select breeding bucks

3) Long-term focus: environmental sustainability and resilience

- Promote practices that enhance both animals' productivity, health and sustainability
- Conserve the desired genes, not the genotype (composite breeds and crossbreeds that can offer improved productivity and resilience)

The NARI Suwarna

Composite sheep breed based on the Lonand strain of Deccani, by crossbreeding with:

- Garole sheep, carrier **FecB** mutation:
+ ovulation rate
+ 60 % chance twin lambs
- Bannur (meat breed)
- Madgyal (large size breed)
- Awassi (dairy breed from Israel)



Breeding Program

- A **nucleus flock** maintained at NARI under a **traditional grazing system**
- Selection at 4 months based on **DNA test for FecB carrier** status, body weight and the reproductive performance
- NARI has so far **supplied 900 FecBBB breeding rams** and 1400 FecB carrier breeding ewes.



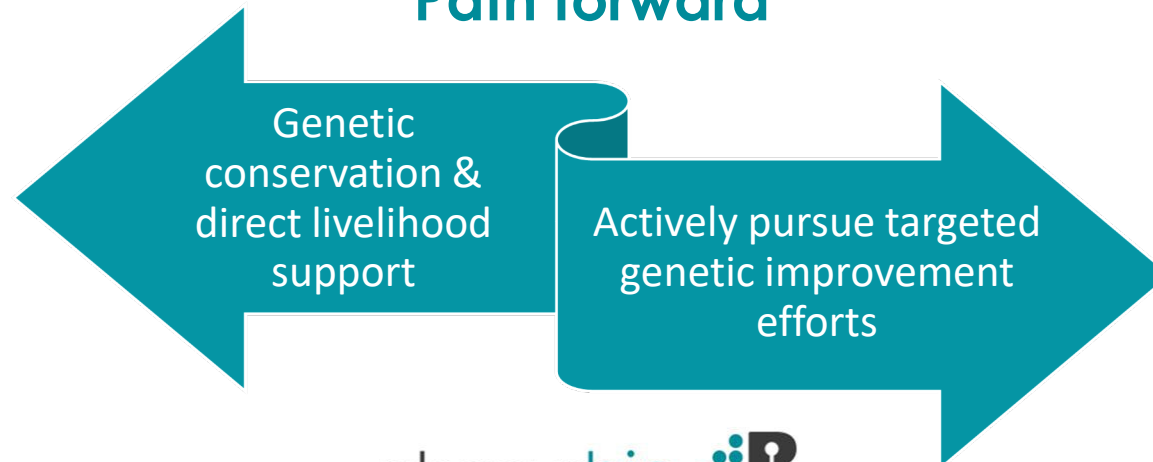
Future directions

Which scenario?

- Private sources of investment (dairy, pigs and poultry) are missing in harsh environments.
- Industry bodies linked to breed societies (sheep and beef) are also falling short in supporting genetic improvements in challenging conditions.

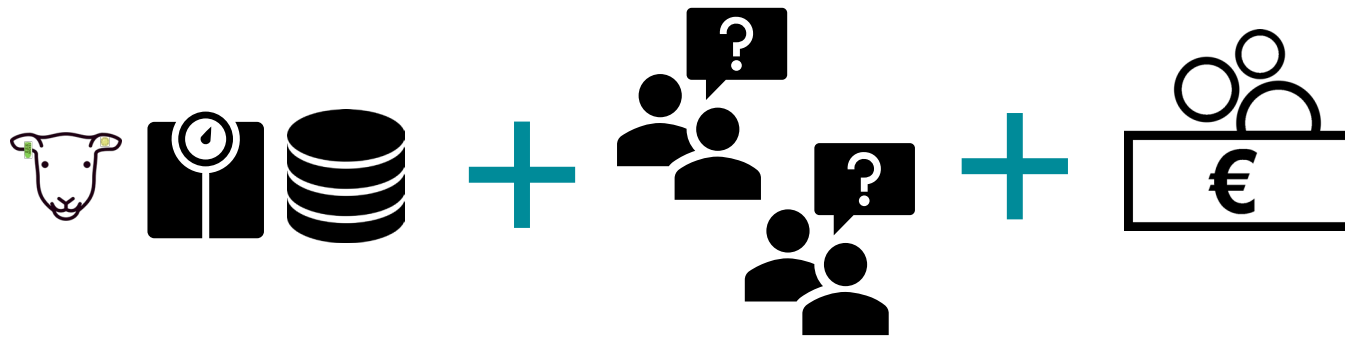


Path forward



Building sustainable breeding programs

- Getting the **foundation in place**: core infrastructure in place and capability development
- Consider the **diversity of production types** and farmers' expectations
- **Policy Support** from governmental and non-governmental organizations



Thank you!



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References

- **Gaddour**, A., Najari, S., and Ouni, M. 2010. Response to absorption of the crossbreeding of the local goat with exotic breeds in the oases of southern Tunisia. *Afr. J. Agric. Res.*, 5, 363–371.
- **Haile** A., S. Gizaw, T. Getachew, J.P. Mueller, P. Amer, M. Rekik, & B. Rischkowsky. 2019. Community-based breeding programmes are a viable solution for Ethiopian small ruminant genetic improvement but require public and private investments. *J. Anim. Breed. Genet.*, 136:5, pp 319-328.
- **Labatut** J, Girard N, Astruc JM, Bibe B. 2013. Dissemination of genetic progress: a key aspect of genetic improvement of local breeds. *Anim Genet Resour.* 53:117–127.
- **Nimbkar**, C., P. Amer, A. Schurink, T. Sawhney & R. Azam. 2021. Genetic improvement of goats owned by smallholder goat keeper women in Bihar, India, with the help of a database tool. *Proc. Assoc. Advmt. Anim. Breed. Genet.*, 24, pp 272-275.
- **Perucho**. L., Paoli, J.C., Ligda, C., Moulin, C.H., Hadjigeorgiou, I. & Lauvie, A. 2020 Diversity of breeding practices is linked to the use of collective tools for the genetic management of the Corsican sheep breed, *Italian Journal of Animal Science*, 19:1, 158-172.
- **Philipsson** J., Rege, J.E.O., Zonabend E. and Okeyo A.M. 2011. Sustainable breeding programmes for tropical farming systems In: *Animal Genetics Training Resource*, version 3, 2011. Ojango, J.M., Malmfors, B. and Okeyo, A.M. (Eds). ILRI, Nairobi, Kenya, and Swedish University of Agricultural Sciences, Uppsala, Sweden
- **Thénard**, V., Quénon, J., Arsenos, G., Bailo, G., Baptista, T.R., Byrne, T., De Barbieri, I., Bruni, G., Freire, F., Theodoridis, A. Vouraki, S. 2024. Identifying selection strategies based on the practices and preferences of small ruminant farmers to improve the sustainability of their breeding systems, *animal*, 18:7