Community based breeding programs. Opportunity for smallholder goat genetic improvement and increased incomes

C. Nimbkar[1], PO. Ghalsasi[1], S. Parai[2], C. Singh Rao[3], H. Patel[4], V. Vaghani[4], A. Schurink[5], D. Bjelland[5] and P. Amer[5]

[1]Nimbkar Agricultural Research Institute, Phaltan, 415523, Maharashtra, India
[2]Tata Trusts, RK Khanna Stadium, 1 Africa Avenue, DLTA Complex, New Delhi, India
[3]Centre for Microfinance, N-102 (South), Adinath Nagar, J.L.N Marg, Jaipur, 302018, Rajasthan, India
[4]Collectives for Integrated Livelihood Initiatives, No:3 Sanidhya Bunglows, Opp Hotel Landmark, ISKON – Bopal Road, Near Ashok Vatika, Ahmedabad, 380058, Gujarat, India
[5]AbacusBio Dunedin, Level 5, Cargill House, 333 Princes Street, Dunedin 9016, New Zealand

Summary

The Garasiya Bhil ethnic community in the southern Aravali hill range in Rajasthan and Gujarat states in India, rely on livestock as a source of income, apart from agriculture on their meagre lands. Goats are one of the main livestock species for these economically marginalized communities. Local goats are adapted to grazing in the hilly terrain and are sold readily for meat mostly in other states and Sirohi breed bucks are much in demand as breeding stock. Sirohi is a recognized and popular goat breed from southern Rajasthan.

In the last decade, the Centre for MicroFinance and Collectives for Integrated Livelihood Initiatives have strengthened goat rearing by training village women to support goat health, nutrition and shelter management interventions. They also purchased phenotypically superior Sirohi bucks from other districts in Rajasthan and supplied them for use as breeding bucks.

To provide a more sustainable way of genetic improvement by selection within locally adapted goats, two community based breeding programs (CBBP) were established in 2024 in two blocks in each of the two states (3,000 goats belonging to 1200 households in 19 villages in Rajasthan and 1,500 goats belonging to 600 households in 6 villages in Gujarat). These CBBPs are using the Dtreo cloud-based database system for performance recording of goats. Breeding bucks will be selected according to goat keepers' preferences based on recorded data, placed in distant villages and does will be mated only to such selected bucks.

Data already recorded shows considerable variation in body weights and milk yields suggesting a good scope for selection. After a few rounds of breeding with selected bucks, it is planned to establish supply centres of surplus superior breeding animals through 'farmer producer companies' of women goat keepers.

Keywords: goats, community-based-breeding, selection.

Introduction

The Garasiya Bhil ethnic community reside in the southern Aravali range of hills in Rajasthan and Gujarat states in India. The Government of India Planning Commission estimated in 2013 that 14.8% of the population of Rajasthan lived below the poverty line and that most of the poor lived in the tribal southern part of the state (TRIOs, 2015). A baseline study of 1598 households in four blocks in south Rajasthan commissioned by the Centre for MicroFinance (CmF) in 2015 before launching the project 'Transformation Initiative' found that a large number of tribal households owned goats (on average 6 per household), mainly as a source of cash income and milk. Local goats, being hardy and climate-resilient, help these tribal families to tide over financial difficulties. The study also found that agriculture accounted for only 26.5% of household incomes and animal husbandry was one of the main livelihood strategies adopted by the poorest rural households (TRIOs, 2015). Similarly, a baseline study conducted in 2024 for a 'climate change mitigation' project to be implemented in two blocks of south Rajasthan and adjacent two blocks of north Gujarat, found that the range of number of goats owned per household was 1 to 65 with an average of about 5 in Gujarat and 8 in Rajasthan (Nagi and Kaur, 2025).

In the last decade, the Centre for MicroFinance (CmF) and Collectives for Integrated Livelihood Initiatives (CInI) have organized 57,000 households into community institutions in the proposed project areas in south Rajasthan and north Gujarat respectively. They have also strengthened goat rearing by training village women (*pashu sakhi*s) to support goat health, nutrition and shelter management interventions. The *pashu sakhi*s ensured adoption of improved livestock rearing practices at the household level. CmF and CInI also purchased phenotypically superior Sirohi bucks from other districts in Rajasthan and supplied them for use as breeding bucks. These interventions were found to have increased the income from goats four-fold between 2016 and 2021 (Rao and Patel, 2024). The need for systematic participatory approaches has been highlighted for pro-poor small ruminant breeding (SA PPLPP, 2012). In order to make available the benefits of an organized breeding program to target communities, to provide a more sustainable way of genetic improvement by selection within locally adapted goats through capacity building of women goat keepers and by introducing innovative strategies and to make available the benefits of an organized breeding program to target communities, two community based breeding programs (CBBP) were established in 2024 under a new project 'Climate Change Mitigation Managed and Led by Women Farmers' (CCMIM-LWF). The overarching objective of the CBBPs is to add value to the sustainable production, management and marketing of goats belonging to smallholder village communities using community focused interventions. The objective is also to use this as a proof of concept for adoption of women-led community based small ruminant breeding approaches by the Government of India and state animal husbandry departments and shall be showcased to them as best practice initiatives to influence policy. Two other papers in these proceedings, viz. those by Amer *et al* and Schurink *et al* have given details of the development of buck selection merit scores/ indexes in these CBBPs and the Dtreo database platform and allied phenotyping and recording strategies. This paper will describe how the community based breeding programs (CBBP) established in 2024 in south Rajasthan and north Gujarat have got under way and will present some of the recorded data.

Materials and methods

The CBBPs currently include recording of 3,000 goats belonging to 1200 households in 19 villages in Pindwara (Sirohi district) and Sayra (Udaipur district) blocks in Rajasthan and 1,500 goats belonging to 600 households in 6 villages in Poshina (Sabarkantha district) and Danta (Banaskantha district) blocks in Gujarat. The villages identified for carrying out goat recording were selected by CmF and CInI based on the availability

of reasonably high numbers of good quality goats and knowledgeable goat rearers wishing to participate in the breeding program.

A baseline survey was commissioned to assess the knowledge, attitudes and practices related to goat production and management among the women goat rearers who would participate in the project, to identify the existing facilities, infrastructure and resources available for goat rearing and to understand the goat production and breeding-related challenges faced by the communities. Questionnaires were specially prepared with open- and closed-ended questions to elicit the required information. The survey was carried out among 554 households in 26 villages of Rajasthan and 315 households in 10 villages in Gujarat (Nagi and Kaur, 2025). Forty-two in-depth interviews were held with various stakeholders such as goat keepers themselves, *pashu sakhi*s, board members of local farmer producer companies, local market traders who buy goats and state government animal husbandry department officers.

Goat production system

A substantial proportion of women goat rearers surveyed (84% and 75% in Rajasthan and Gujarat respectively) were found to take their goats for grazing and more than 95% to be providing concentrate mixture or grain to their goats. Almost all the rearers surveyed also reported facing a scarcity of grazing and tree leaves, especially in the summer (Nagi and Kaur, 2025).

Process of establishing CBBPs

The first step was awareness creation among goat keepers and promoting the understanding of project managers and advisers about the intricacies of the goat production system in the project villages. During the initial stages, the partners from the different collaborating institutions also developed a greater understanding of the work done and expertise of the respective institutions and developed rapport.

A 3-day training course was given by the Nimbkar Agricultural Research Institute (NARI), a technical partner organization in the project to 21 pashu sakhis, 6 community mobilizers and 9 other staff members from CmF and CInI. This was the first systematic introduction of these field teams to the objectives, principles, rationale, participatory nature, advantages and potential of CBBPs. They learnt how to carry out goat identification, goat performance recording and enter recorded data into the cloud-based Dtreo database provided by the technical partner organization AbacusBio Ltd. They also learnt the proper technique of castration of bucks not desired for breeding.

Goat ear tags with pre-printed unique numbers were sourced as the primary animal identification. Tablet computers were purchased and provided to the *pashu sakhi*s to enter data.

Breeding preferences

Data on preferred characteristics of breeding bucks as expressed by women goat keepers was collected in the baseline survey. Breed, colour and typical breed characteristics were considered important by about 70% of the goat keepers in Rajasthan. About 50% of surveyed goat keepers from both Rajasthan and Gujarat gave importance to the physical features of breeding bucks such as age, height and weight. We also found in the dialogues conducted with goat keepers that in Rajasthan, they preferred breeding bucks of the Sirohi breed with typical Sirohi breed colour

pattern (brown spotted) and other characteristics. In Gujarat, white and black were the preferred colours of breeding bucks depending on the village. It is thus evident that goat keepers do have marked preferences but over the years, breeding has not been done systematically in accordance with these preferences. This is exactly the situation which the CBBPs have set out to address.

Success of Bihar CBBP

The CBBP established under Project Mesha in Muzaffarpur district of Bihar, where goat performance recording is done in 18 villages in 4 blocks (Nimbkar *et al.,* 2024), has now placed 175 selected breeding bucks in 7 blocks of the district (pers. comm. Kumar Navneet). Project Mesha aims to make Muzaffarpur a breeding buck cluster. Women buck keepers called breeding service entrepreneurs have started to purchase the bucks, paying over 75% of the cost of their own accord.

Results and discussion

Identification ear tags have been put on about 5,000 female goats and 800 male goats in the CCMIM-LWF project and their data has been entered into Dtreo. Some preliminary analyses of these data were conducted by fitting fixed linear models using the Echidna software.

Weights of kids in the age group 60 to 100 days were analysed and the results are given in Table 1 below. The range of weights between 60 to 100 days was 2.0 to 15.0 kg in Rajasthan and it was 3.8 to 12.8 kg in Gujarat.

The weights of kids from Gujarat and Rajasthan in the above table are not strictly comparable as the average age of kids from Gujarat is six days higher. The wide range of weights probably reflects variability of genetics as well as management conditions.

The body weights of 1 to 1.5 year old goats were also analyzed. The predicted mean weight of goats from Gujarat (n=258) was 21.4 ± 0.5 kg while that of goats from Rajasthan (n=447) was 23.5 ± 0.5 kg. The range of weights in both states was from 10 to 57 kg. The predicted mean weight of 604 does in the 1 to 1.5 years old age group was 21.0 ± 0.3 kg and that of 101 bucks was 23.9 ± 0.8 kg. This is the first time that the performance of goats maintained by tribal families in south Rajasthan and north Gujarat is being documented systematically. The confidence of the pashu sakhis who are doing the data recording has increased tremendously. Once the selection merit

Table 1. Predicted mean weights of kids aged 60 to 100 days.

State Factor fitted	Number of kids		Mean and standard deviation (s.d.) of age of kids (days)				Predicted mean weight ± standard error	
	Rajasthan	Gujarat	Rajasthan		Gujarat		Rajasthan	Gujarat
			Mean	S.D.	Mean	S.D.		
Sex of kid								
• Male	131	42	76	12.2	82	12.6	6.6 ± 0.3	8.0 ± 0.4
• Female	140	93					5.7 ± 0.3	7.0 ± 0.4
Type of birth								
• Single	229	127					7.1 ± 0.2	8.5 ± 0.2
• Twin	42	8					5.2 ± 0.5	6.5 ± 0.7

score is established and systematic breeding only with selected bucks is started, reasonable genetic gain can be expected.

It is the ground reality in almost all states of India and in all indigenous goat breeds reared that there is an acute scarcity of 'good quality' breeding bucks and does. The establishment of CBBPs will go a long way towards ameliorating this situation.

An example given by Flint and Woolliams (2008) illustrates the significant value added by selective breeding if it is done systematically and scientifically. They estimated the annual value of livestock production in Europe to be about €123 billion. Annual genetic gain in the livestock industry at the producer level was estimated to be 1.5% or €1.8 billion. The annual research and development cost of breeding organizations, including collecting data for estimating breeding values and carrying out breeding programmes but not product marketing, was approximately €150 million. This yielded a benefit to cost ratio of 10:1. Genetic gains are permanent and cumulative so that the gain made in one year would give benefits over all subsequent years without further intervention. The livestock sector in Europe was at that time, the largest sector in agriculture in terms of both employment and output value. Genetic progress is therefore central to the success of this major industry. This example illustrates the value and utility of investing in systematic livestock genetic improvement.

Conclusions

The establishment of CBBPs in tribal villages of south Rajasthan and north Gujarat is the start of a quiet revolution. Substantial progress has been made in awareness creation, training and capacity building of local goat rearers and *pashu sakhi*s. Opportunities of mutual learning have also been exploited by gaining insights from the comprehensive knowledge of goats possessed by the goat keepers and bringing a systematic and scientific perspective to the goat rearing activity. These have the potential to elevate the profession to a new level and turn the goat keepers into goat entrepreneurs. The CBBP will also produce genetically superior but climate-resilient goats and contribute to risk mitigation for goat keeper families in the face of the increasing climate variability and unpredictability.

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List of references

Flint A.P.F. and Woolliams J.A. 2008. Precision animal breeding. Philosophical Transactions of the Royal Society B. 363:573590.

Nagi, M. K. and Kaur, G. 2025. Baseline assessment report for Project Climate Change Mitigation Initiative Managed and Led by Women Farmers(CCMIM-LWF) in Gujarat and Rajasthan. Commissioned by Nimbkar Agricultural Research Institute (NARI). Assessment by ImpactDash, India. pp. 100.

Nimbkar C., Abeykoon, S., Amer, P., Kumar, N. and Sawhney, T. 2024. Benefits of synergies between improvement in genetic and other aspects of goat rearing in a women's economic empowerment program (Project Mesha) in Muzaffarpur district of Bihar. Compendium of the International Conference on Small Holders' Goat Production in Tropical Countries – Opportunities and Constraints. Held at PGRIAS, Tamil Nadu on 8-9 August 2024. Tamil Nadu Veterinary and Animal Sciences University. pp. 580-582.

Rao C.S. and Patel H. 2024. Goat: a risk mitigating asset for the tribal in Aravali range: Rajasthan and Gujarat. Compendium of the international conference on small holders' goat production in tropical countries – opportunities and constraints. Held at PGRIAS, Tamil Nadu. August 2024. Tamil Nadu Veterinary and Animal Sciences University. pp. 76-78.

SA PPLPP 2012. Small ruminants – breed conservation and genetic improvement. pp. 68.

TRIOs. 2015. Baseline study for the project 'Transformation initiative in south Rajasthan'. 2015. TRIOs Development Support (P) Ltd. pp. 108.