Review

Kerala's Goat Breeding Policy (2024): Implications for Indigenous Goat Genetic Resources

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ABSTRACT

The new goat breeding policy of Kerala aims to increase farmers' income by improving goat productivity through selective breeding. The policy proposes the use of selected Malabari and Attappady Black bucks for frozen semen production and natural mating to improve these breeds within their respective breeding tracts. It also proposes the use of exotic breeds such as Saanen and Alpine for milk production and Boer for meat production through controlled crossbreeding trials with non-descript goats. The use of superior Malabari and Attappady Black bucks for the genetic improvement of these breeds is a welcome step. However, the proposed use of exotic breeds for crossbreeding raises concerns about the possible genetic dilution of indigenous goat genetic resources. In this context, this article reviews some of the past experiences of crossbreeding native goats with exotic breeds. Improvements in milk production and growth performance was previously reported for crossbreeding Malabari goats with Saanen and Alpine. Similarly, Boer × Malabari crossbreds showed better growth performance under favourable management conditions. However, Malabari goats performed better than the crossbreds in several reproductive traits and showed greater adaptability to Kerala's hot and humid climate. The crossbreds also experienced higher mortality, greater susceptibility to respiratory diseases, and required better management. These limitations raise concerns about the long-term sustainability of crossbreeding under Kerala conditions. Experiences from crossbreeding programmes elsewhere also showed that the expected benefits were often not realized under low-input production systems, leading to the discontinuation of several such programmes. In view of these experiences, greater emphasis should be placed on the conservation and genetic improvement of indigenous goat breeds through systematic selective breeding. Such an approach may offer a more sustainable strategy for the long-term improvement of goat production in Kerala.

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INTRODUCTION

Goats are among the most preferred small ruminant species, particularly among resource-poor farmers. Goat farming is popular because it requires relatively low labour and capital investment and provides faster economic returns (Kumar *et al*., 2021). According to the 20th Livestock Census (2019), India has 148.88 million goats, accounting for 27.74% of the country's total livestock population, making it the largest goat-rearing country in the world (FAO, 2023). India also possesses rich goat genetic resources, with 43 recognised goat breeds adapted to diverse agro-climatic conditions across the country (ICAR-NBAGR, 2025).

Goats hold a unique place in Kerala and are vital to the livelihoods of marginal and smallholder farmers. According to the Twentieth Quinquennial Livestock Census (2019), Kerala has a goat population of 13.59 lakh, accounting for 0.91% of the total goat population of India. However, the majority of them do not fall into any specific category. The Malabari and Attappady Black are the two recognised indigenous goat breeds of Kerala (NBAGR, 2025). The Malabari breed, which is well known for its superior meat quality, low fat content, and high reproductive efficiency, is spread in their native breeding tract in the districts of Kannur, Kozhikode, and Malappuram in northern Kerala. The second registered breed, Attappady Black, is well adapted to extensive grazing systems and is mainly found in the remote hamlets of the Pudur, Agali, and Sholayur panchayats in the Palakkad district (Kerala State Biodiversity Board, 2023).

In 2024, the Government of Kerala announced a new goat breeding policy. The primary objective is to enhance the income of goat farmers in the statethrough measures such as selective breeding of the native Malabari and Attappady Black breeds within their respective breeding tracts and grading up of non-descript goats using selected Malabari bucks. In

addition to the above breeding programme for native breeds, the breeding policy proposes two separate goat improvement programmes in Kerala, one for milk and another for meat production using exotic breeds. The policy recommends the use of exotic breeds, Saanen and Alpine, to improve milk production and Boer goats to improve meat production.It is also proposed to establish a nucleus herd of exotic dairy and meat goat breeds for selective breeding and subsequent dissemination of germplasm.

The stated objective of these measures is to enhance productivity and improve farmers' income. However, a careful reading of the policy document reveals several areas of ambiguity and concern. In particular, the policy raises important questions regarding the conservation of native breeds, the potential genetic dilution of indigenous goat populations, and the long-term economic sustainability of the proposed breeding strategy. These issues merit careful examination to ensure that efforts to enhance productivity do not inadvertently undermine the conservation of valuable indigenous goat genetic resources. The present article examines these concerns in relation to the newly introduced goat breeding policy of Kerala.

The new breeding policy proposes the use of selected Malabari and Attappady Black bucks for frozen semen production and natural mating to improve these breeds within their respective breeding tracts. In other parts of the state, selected Malabari bucks will be used. This is clearly a positive step from the perspective of sustainable conservation and therefore deserves full support.

However, the recommendation to import Saanen, Alpine, and Boer parent stock for goat improvement programmes raises serious concerns. The policy states that these breeds will be used only for crossbreeding trialsconducted in institutional goat farms and NGO-managed units. Even so, this assurance does not fully allay concerns that the use of imported breeds may eventually lead to the genetic dilution of valuable indigenous goat breeds.

It is also important to note that such trials are largely repetitive. Similar crossbreeding experiments have already been carried out in Kerala and elsewhere in our country. The results and conclusions of these studies are well documented. This article discusses the findings of earlier studies to stimulate informed discussion among stakeholders.

Crossbreeding experiments involving Malabari and exotic dairy goat breeds

One of the comprehensive crossbreeding experiments involving Malabari goats and the exotic dairy breeds, Saanen and Alpine, was conducted by the Kerala Agricultural University (KAU) under the ICAR-All India Coordinated Research Project (AICRP) on Goats. This project was initiated in 1971 during the Fourth Five-Year Plan (1969-74). The primary objective of this initiative was to improve milk production by crossing with exotic germplasm. It was initially introduced in three centres (i) National Dairy Research Institute (NDRI), Karnal, (ii) KAU, Mannuthy, and (iii) Mahatma Phule Krishi Vidyapeeth, Rahuri (GoatGyan, 2022). In this programme, under the KAU centre, Malabari × Saanen and Malabari × Alpine crossbreds were produced by mating Malabari does with Saanen and Alpine bucks, respectively.

The results of these experiments showed a marked improvement in milk production in the crossbreds. The Alpine × Malabari crossbreds produced 97 kg of milk in 152.1 lactation days, while the Saanen × Malabari crossbreds produced 147.7 kg in 230.9 days, compared to 42.5 kg in 125.3 days in purebred Malabari goats (Sahni, 1990). The average daily milk yield was 395.5 g in Malabari goats and 460.3 g in Saanen × Malabari crossbreds (KVASU, 2018). Jain *et al.* (1998) also reported that milk production showed a 60.2% increase in milk yield in Saanen × Malabari crossbreds and a 34.9% increase in Alpine × Malabari crossbreds when compared to native Malabari goats. Similarly, Stephen *et al*. (1996) reported that Saanen × Malabari crossbreds consistently produced higher lactation yields than Alpine × Malabari crossbreds and pure Malabari goats across four lactations. The crossbreds also had longer lactation periods (Nair, 1979; Stephen *et al*., 1996). Overall, milk production increased by nearly 200% in crossbreds when exotic breeds were used (Siddiky, 2017). These findings clearly show that the crossbreds produced more milk than the native Malabari goats.

Improvement in milk production was also observed when native Beetal goats were crossed with Saanen and Alpine at NDRI, Karnal (Goat Gyan, 2022). Here, lactation yield increased by 97.3% in Saanen × Beetal crosses and 63.8% in Alpine × Beetal crosses over native Beetal goats (Jain *et al.,* 1998). Among these, the Saanen × Beetal crosses with 75% exotic inheritance showed the best performance, with an average milk yield of 399.1 ± 34.0 kg (Siddiky, 2017).

In terms of growth performance, Saanen × Malabari and Alpine × Malabari crossbred goats showed better growth rates than the native goats. Hybrid vigour contributed to higher body weights, with crossbred offspring outperforming their dams (Acharya *et al*., 1982; Raghavan *et al*., 1988; Shrestha and Fahmy, 2007). However, the scenario was different when reproductive traits were compared. Malabari goats performed better than the crossbreds in most reproductive parameters.

They showed better litter size, shorter service periods, shorter kidding intervals, and higher kidding efficiency with better kid survivability (Acharya *et al*., 1982; Shrestha and Fahmy, 2007).

Although several studies reported superior reproductive performance in Malabari goats, some reports indicated better reproductive performance in crossbreds. For example, the age at first kidding was higher in Malabari goats (700 days) than in Alpine × Malabari (685 days) and Saanen × Malabari (585 days) crossbreds (Acharya *et al*., 1982; Shrestha and Fahmy, 2007).However, Malabari goats showed better adaptability to the climatic conditions of Kerala, whereas the crossbreds recorded higher mortality rates (Siddiky, 2017). Respiratory infections and pre-weaning mortality were high in Alpine × Malabari crosses. The decline in reproductive performance, along with higher mortality in crossbreds, reduced the overall advantages gained from increased milk production. This further showed that crossbreds were less suited to the environmental conditions of Kerala (Jain *et al.,* 1998; Siddiky, 2017). Due to their poor adaptability to the hot and humid climate of the state, the Malabari crossbreeding project was discontinued in 1989 (Arora, 1992). Later, the policy emphasis shifted towards improving native goat breeds through selective breeding, as they are well adapted to the local environment and management systems (GoatGyan, 2022).

Crossbreeding experiments involving Malabari and exotic Boer goats

Under the ICAR–AICRP on goats, in the Fifth Five-Year Plan (1974–1979), the "goat for meat" programme was introduced. The initiative focussed to improve the production of Indian goat breeds through crossbreeding with exotic breeds (Goat Gyan, 2022). Later, Boer goat, a South African meat breed well known for their rapid growth and muscling, was introduced to Kerala to improve the meat production (KLDB, 2017). The performance of Boer × Malabari crossbreds provided useful insights when compared with that of purebred Malabari goats. Crossbreds showed hybrid vigour, and their average daily weight gain was 115 g, 105 g, and 105 g at 3, 6, and 9 months of age, respectively, in females. However, Raghavan and Raja (2004) reported that similar daily weight gains of 116 g, 107 g, and 107 g at the same ages were also recorded in the best-performing purebred Malabari goats from different field areas under the AICRP on goats. The results of Raghavan and Raja (2004) showed substantial variation in daily weight gain within the Malabari goat population. This variation could be effectively exploited to improve growth performance through systematic selection within the breed. Better growth performance was also observed in Boer crossbreds with other Indian breeds, such as Barbari. The 50% Boer × Barbari (F1) males reached 30.73 kg, while the 75% Boer × Barbari (F2) males reached 37.69 kg at 12 months, compared to only 21.08 kg in pure Barbari males under intensive management conditions (Anand *et al*., 2025).

Crossbreeding experiments involving Boer goats and local breeds in other countries also showed that the crossbreds exhibited superior growth performance. In Sri Lanka, the introduction of 25% Boer blood into local goats increased the 12-month live weight of male goats from 23.2 kg to 33.7 kg (Rajaguru, 1988). In Nepal, 50% Boer × Khari crossbred kids reached 34.10 kg at 12 months compared to 19.24 kg in native Khari goats (Bhattarai *et al.*, 2018). Further studies in Nepal showed that Boer × Khari male crossbreds with 50% and 75% Boer inheritance attained body weights of 41.08 kg and 43.69 kg at 12 months of age, respectively. However, very high exotic inheritance (87.5%) reduced conception rates in Boer crosses (Parajuli *et al.,* 2020). In Ethiopia, Boer crossbred goats exhibited superior feedlot performance under supplementary feeding, with higher carcass weights and faster growth rates than indigenous goat breeds. However, under low-management conditions, the performance of Boer crossbred goats was not superior to that of indigenous Ethiopian goat breeds (Tesema *et al*., 2022). It is important to note that the higher growth observed in first-generation crossbreds is mainly due to hybrid vigour, which arises from non-additive gene action. However, this advantage cannot be maintained without continuous crossing with purebred Boer goats (Bablu, 2002). Despite these advantages, certain limitations have been observed in Boer crossbreeding programmes. Boer goats require higher input costs for feed and healthcare. Raghavan and Raja (2004) reported that the rapid weight gain and heavy muscling in Boer goats were achieved only under feedlot conditions. The animals should be provided with high-quality feed so that their full genetic potential can be expressed. In contrast, Malabari goats showed comparable performance even with lower feed requirements. Moreover, Boer goats had a lower average number of kids per kidding than Malabari goats. The corresponding values for Boer and Malabari goats were 1.63 and 1.76-1.97, respectively (Raghavan and Raja, 2004).

The biggest challenge for Boer × Malabari crossbred kids was their high susceptibility to respiratory infections and mortality. The high humidity in Kerala, especially during the rainy season and winter, was considered the main reason for this problem (Bablu, 2002). However, Malabari goats performed well under low-input management conditions. These

findings clearly highlight the superior adaptability of Malabari goats, which makes them well-suited to the environmental conditions of Kerala.

Similar constraints have been observed in Boer goat crossbreeding programmes in other countries. Ethiopian farmers perceived higher susceptibility to disease and drought as drawbacks of Boer crossbred kids (Habtegiorgis *et al*., 2024). A higher prevalence of major health problems (42.2%) and a higher mortality rate (47.6%) were reported in pure Boer goats in Ethiopia (Hunduma *et al*., 2010; Molla, 2016). Tesema and Kebede (2022) reviewed Boer goat crossbreeding programmes in Ethiopia and found that Boer crossbreds did not perform as expected under the prevailing low-input production systems. Although Boer inheritance has the potential to improve growth, the crossbred goats generally showed no clear advantage over indigenous goats under smallholder conditions. They also exhibited lower survival rates, higher mortality and health problems, and poorer adaptation to the local production environment.

Based on these observations, the authors concluded that most Boer-based crossbreeding programmes in Ethiopia were discontinued because the anticipated benefits could not be realized under the existing management conditions and because the exotic genotype was not well suited to the prevailing low-input production systems. Another major concern in crossbreeding with exotic breeds is the difficulty of controlling crossbreeding once the crossbreds reach farmers' flocks. Good-quality crossbreds were obtained only when purebred Boer semen was used. However, when these crossbreds were further bred among themselves, their performance declined in later generations (Bablu, 2002).

Implications

From the above, it is clear that Saanen and Alpine crossbreds generally showed better performance in milk production and growth than purebred Malabari goats. However, Malabari goats performed better in several reproductive traits and demonstrated greater adaptability to the climatic conditions of Kerala. In contrast, the crossbreds were associated with higher mortality rates. These findings suggest that although crossbreeding can improve certain production traits, the adaptive and reproductive strengths of the Malabari breed should not be overlooked.

In light of these, the focus shifts to identifying suitable breeding strategies for the future. As recommended in the breeding policy, greater emphasis should be placed on systematic selection within indigenous breeds. Malabari bucks may be selected based on economically important traits such as weight gain, prolificacy, and twinning rate. The selected bucks can then be used for frozen semen production as well as natural mating to accelerate genetic improvement within the breeding tract of the breed. Similarly, superior Attappady Black bucks may be identified and utilized for frozen semen production and natural mating within their breeding tract. Such a strategy would help improve the productivity of these breeds while retaining their valuable adaptive characteristics. However, the new breeding policy also recommends crossbreeding with Saanen and Alpine to improve milk production. Although this is restricted to non-descript goats, implementing it effectively under field conditions may be challenging. In many cases, farmers may find it difficult to clearly distinguish non-descript goats from indigenous breeds such as Malabari, increasing the possibility of unintended crossbreeding. In such a situation, the risk of dilution of valuable native genetic resources cannot be ignored. Therefore, a more practical approach may be to improve the non-descript goat population through the use of selected Malabari bucks.

The same principle may also be applied to meat production. Although the breeding policy recommends the use of exotic Boer goats for crossbreeding, it is important to recognize that the daily weight gain of the top 10% of Malabari goats was comparable to that of exotic Boer goats (Raghavan and Raja, 2004). This indicates that considerable genetic potential for growth already exists within the Malabari population. Therefore, rather than relying on exotic Boer goats for improving meat production, it may be more practical to identify and utilize superior Malabari animals through systematic selection and breeding under field conditions.

The economic implications of crossbreeding also deserve careful consideration. The increasing presence of Boer × Malabari crossbreds in the market may create commercial pressure in favour of crossbred animals. Farmers may be attracted to these animals because of their apparent production advantages, particularly in growth performance. Over time, this could reduce interest in maintaining purebred Malabari goats and may adversely affect efforts aimed at conserving the breed.

The practical challenges associated with rearing exotic breeds under Kerala conditions also need to be considered. Although exotic breeds such as Boer may exhibit superior production performance under favourable management conditions, this advantage is often associated with higher requirements for feed, healthcare, and management. In addition, their lower adaptability to Kerala's hot and humid climate raises

concerns about the long-term sustainability of such crossbreeding programmes under field conditions.

These concerns further emphasize the inherent strengths of indigenous breeds. Malabari goats have evolved over centuries under the agro-climatic conditions of Kerala through a long process of selection (Bablu, 2002). Consequently, they are well adapted to the local environment and production systems. Traits such as adaptability, reproductive efficiency, resilience and the ability to perform under low-input management conditions make the breed particularly valuable for sustainable goat farming in the state. Any breeding strategy should therefore give due importance to preserving these unique attributes. For these reasons, the conservation and genetic improvement of Malabari goats through systematic selective breeding should remain a priority for ensuring long-term sustainability. In this context, the evidence generated from earlier crossbreeding experiments raises an important question: Is the use of exotic goat breeds for crossbreeding really necessary in Kerala?

This question is not merely theoretical but is also supported by past policy experience. The lessons learned from goat development programmes implemented during the Fourth, Fifth, and subsequent Five-Year Plans highlighted the importance of improving indigenous breeds rather than relying on exotic germplasm. Reflecting this shift in thinking, the AICRP on Goats was restructured as a network project in 1990, with greater emphasis on the characterization and genetic improvement of indigenous goat breeds through selective breeding based on progeny performance in farmers' flocks (Goat Gyan, 2022). The views expressed in a recent policy paper by Naveena *et al*. (2023) are also consistent with many of the issues discussed above. The authors identified several issues affecting small ruminant production in India, including inbreeding, the shortage of genetically superior breeding males, the declining availability of pure breeds, and the low productivity of many native breeds. They also highlighted the poor availability of suitable exotic breeds for crossbreeding and noted that crossbreeding programmes have achieved only limited success in improving carcass yield.

To address these constraints, it is recommended that the periodic replacement of breeding rams and bucks, the supply of superior breeding males on a community basis, village-based selection schemes using local breeds, and the *in-situ* conservation and genetic improvement of indigenous germplasm may be followed. Open nucleus breeding schemes and participatory breeding programmes for the improvement of non-descript sheep and goat populations may also be adapted. The exotic breeds with high meat-producing ability may have a role in commercial production systems, but the authors did not explicitly recommend crossbreeding with exotic breeds as a general strategy for genetic improvement. The experiences gained from more than five decades of crossbreeding programmes indicate that the expected benefits are often difficult to realize under field conditions. Under the hot and humid conditions of Kerala, the long-term suitability and sustainability of crossbreeding with exotic breeds therefore remain open to question.

CONCLUSION

The introduction of exotic breeds, even for controlled crossbreeding trials, should be approached with caution. The findings from earlier crossbreeding studies provide valuable lessons for planning future breeding strategies in Kerala. It is therefore important that these experiences are carefully considered while implementing the new breeding policy. Such an approach would help achieve a balance between improving productivity and safeguarding valuable native goat genetic resources. Ultimately, strengthening and improving indigenous breeds while maintaining their unique adaptive traits is likely to offer a more sustainable pathway for the long-term development of goat production in Kerala.

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