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Comparative Performance of Newly Registered Crossbred Livestock Breeds and Their Role in Indian Animal Production Systems

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Introduction

Farm animal genetic resources form the foundation of India's agrarian economy by providing milk, meat, eggs, fibre, draught power, and organic manure. According to the FAO, Animal Genetic Resources (AnGR) include domesticated animal species and their populations that are used, or have the potential to be used, for food and agricultural production. India is a global hotspot of livestock biodiversity, possessing a rich diversity of indigenous breeds of cattle, buffalo, sheep, goats, camels, and other species that have evolved over generations under diverse agro-climatic conditions. In recent decades, scientific advances in animal breeding have further enhanced productivity through planned crossbreeding of indigenous and exotic germplasm, while maintaining adaptability to local environments.

The National Bureau of Animal Genetic Resources (NBAGR) is one of the six bureaus under the Indian Council of Agricultural Research (ICAR), established in 1984 to safeguard and sustainably utilize India's indigenous farm Animal Genetic Resources (AnGR). Its mandate includes the identification, characterization, conservation, and effective use of livestock and poultry genetic resources, along with capacity building and policy support in AnGR management. The Bureau undertakes nationwide surveys to explore and document new and potential animal populations, facilitates breed registration, and prioritizes conservation of indigenous breeds with unique traits. As the nodal national agency for AnGR, NBAGR also works closely with national and international organizations, including the Food and Agriculture Organization of the United Nations (FAO).

NBAGR launched the "Mission towards Zero Non-Descript Animal Genetic Resources (AnGR) of India" on 11 August 2021 with the objective of identifying and documenting unrecognized animal populations across the country. Under this mission, the

Bureau organized State Interface Meets involving key stakeholders such as State Animal Husbandry Departments, Agricultural and Veterinary Universities, Livestock Development Boards, Biodiversity Boards, and NGOs to create awareness about systematic documentation of AnGR. Interface Meets have been completed for almost all States and Union Territories. To support this effort, 18 institutional projects were initiated in collaboration with state agencies to survey and document AnGR, leading to the identification of new and homogeneous populations of livestock, poultry, and dogs.

Population dynamics

India's bovine population, as evidenced by the 20th Livestock Census conducted in 2019, stands as a formidable force in the country's dairy sector, with approximately 193.46 million cattle and 145.12 million buffalo. Among these, the diversity of breeds is apparent, with approximately 51.36 million categorized as Exotic/Crossbred and 142.11 million classified as Indigenous/Non-descript. Despite the Exotic/Crossbred cattle constituting only 26.54% of the total cattle population, their contribution to milk production is remarkable, accounting for 31.67% of the nation's total output. This underscores the significance of selective breeding and genetic improvement programs in enhancing productivity within the dairy industry.

From 209.96 million tonnes in 2020-21, the output surged to 221.06 million tonnes in 2021-22, registering an impressive annual growth rate of 5.29%. This growth is further buoyed by variations in productivity among different cattle breeds. Exotic cows lead the pack with a daily yield of 11.36 Kg/day, followed closely by Crossbred cows at 8.32 Kg/day, while Indigenous cows exhibit a more modest productivity of 4.07 Kg/day. Such distinctions highlight the role of breed selection and management practices in driving efficiency and optimizing milk production. Moreover, the rise in per capita milk availability to 444 grams per day in 2021-22 signals not only the sector's capacity to meet growing domestic demand but also its potential to contribute significantly to improved nutrition and food security for the Indian population.

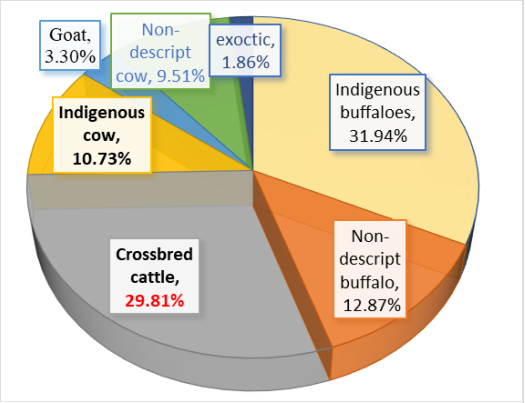


Figure :1 Population dynamic (BAHS 2022-23)

India's Milk Production according to BAHS 2024–25

Total milk production (2024–25)- 247.87 million tonnes and increased 3.6% from 2023–24. India remains the largest milk producer in the world and per-capita milk availability is 485 g/day.

Species	% of Total Milk Production
Crossbred cattle (high-yielding cows)	30.80%
Buffalo – Indigenous	31.18%
Buffalo – non-descript	11.97%
Indigenous cattle	11.20%
Cattle – non-descript	9.64%
Exotic cattle (pure foreign breeds)	1.89%
Goat	3.32%

(Data from BAHS 2025 survey based estimates) (Animal Husbandry & Dairying Dept.)

Although crossbred cattle constitute a smaller proportion of the total cattle population compared to indigenous and non-descript animals, they contribute nearly one-third of the country's total milk output. This higher contribution is mainly due to their superior milk yield per animal, which allows a relatively smaller population of crossbred cattle to produce a disproportionately large volume of milk when compared with the much larger indigenous cattle population.

Newly register breeds_2025_January

ICAR-National Bureau of Animal Genetic Resources, Karnal, in its 12thmeeting held on January 06, 2025, registered TEN NEW INDIGENOUS BREEDS. After registration of these breeds, indigenous animal breeds are now 53 for cattle, 21 for buffalo, 41 for goat, 46 for sheep, 8 for horses & ponies, 9 for camel, 15 for pig, 4 for donkey, 5 for dog, 2 for yak, 20 for chicken, 4 for duck, and 1 for geese.

No.	Species	Name of breed	Accession Number	Native tract
1	Buffalo	Manah	India_ Buffalo _0200 Manah_ 01021	Assam
2	Dog	Gaddi	India_Dog _0600_ Gaddi _19004	Himachal Pradesh
3	Dog	Changkhi	India_ Dog_ 3800_ Changkhi_19 005	Ladakh
4	Donkey	Ladakhi	India_Donkey_3800_ Ladakhi_05 004	Ladakh
5	Duck	Tripureswari	India_ Duck_ 1900_ Tripureswari _11004	Tripura

6	Goat	Chaugarkha	India_Goat_2400_Chaugarkha_06040	Uttarakhand
7	Goat	Bundelkhandi	India_Goat__ 2010__ Bundelkhandi _06041	UP &MP
8	Pig	Karkambi	India__ Pig__ 1100__ Karkambi_09015	Maharashtra
9	Sheep	Kheri	India__ Sheep_1700 Kheri_14046	Rajasthan
10	Yak	Ladakhi	India_ Yak_ 3800_ Ladakhi_16002	Ladakh

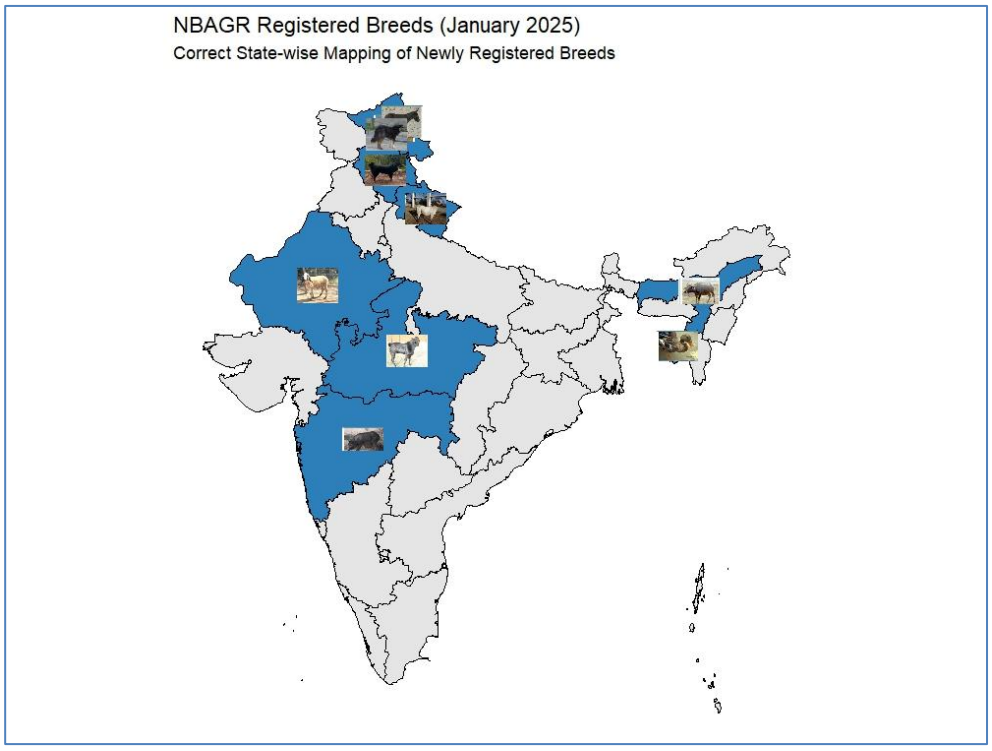


Figure :2 Different breeds with corresponding state (according January_2025).

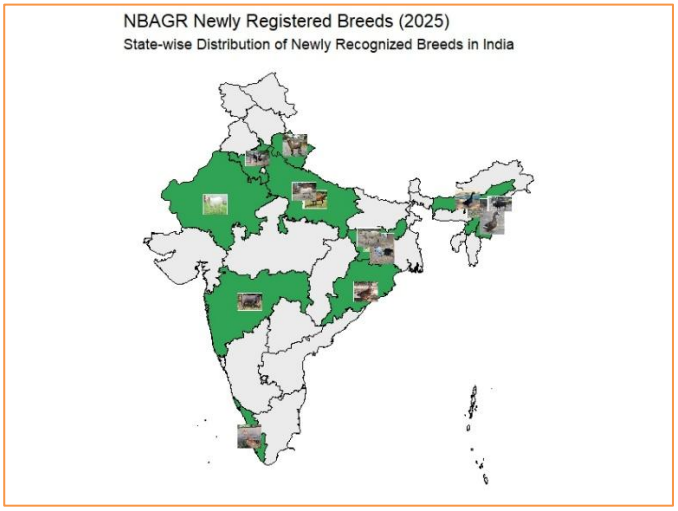


Figure 3: Different breeds with corresponding state (according December_2025)

Newly register breeds_2025-December

ICAR–NBAGR has registered 13 indigenous and 3 synthetic breeds across cattle, buffalo, goat, sheep, poultry and ducks—strengthening conservation, diversity and farmer livelihoods. A proud step for India's animal genetic heritage. Meeting: 13th Breed Registration Committee

NO.	SPECIES	NAME OF BREED	NATIVE TRACT
1	Cattle	Rohilkhandi	Uttar Pradesh
2	Cattle	Medini	Jharkhand
3	Buffalo	Melghati	Maharashtra
4	Goat	Palamu	Jharkhand
5	Goat	Udaipuri	Uttarakhand
6	Mithun	Nagami	Nagaland
7	Chicken	Mala	Jharkhand
8	Duck	Kodo	Jharkhand
9	Duck	Kudu	Odisha
10	Duck	Kuttanad	Kerala
11	Duck	Manipuri	Manipur
12	Duck	Nagi	Assam
13	Geese	Rajdigheli	Assam
14	Cattle	Karan Fries	Haryana
15	Cattle	Vrindavani	Uttar Pradesh
16	Sheep	Avishan	Rajasthan

Comparison of newly register breeds from January and December 2025

NO.	SPECIES	January_2025	December_2025
1	Cattle	53	55
2	Buffalo	21	22
3	Goat	41	43
4	Sheep	46	46
5	Horse & Ponies	8	8
6	Camel	9	9
7	Pig	15	15
8	Donkey	4	4
9	Dog	5	5

10	Yak	2	2
11	Chicken	20	21
12	Duck	4	9
13	Geese	1	2
14	Synthetic Cattle	1	3
15	Synthetic Sheep	0	1
16	Mithun	0	1
17	Total	230	246

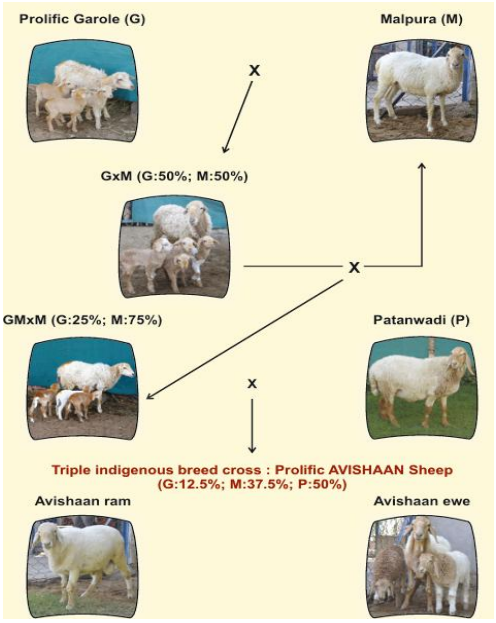
Vrindavani cattle

Vrindavani cattle are a recently developed synthetic crossbred strain of (IVRI), Izatnagar, Bareilly, India, carrying exotic inheritance from Holstein-Friesian, Brown Swiss, and Jersey breeds, along with indigenous inheritance from Hariana cattle. Vrindavani cattle predominantly exhibited brown coat colour, although black, white, and beige colours were also observed. They possessed a well-proportioned head with a prominent poll and concave forehead, medium-sized laterally oriented ears with rounded edges, and a generally trough-shaped udder, with docile to moderate temperament. A study by Singh et al. (2011) reported that the mean birth weight of Vrindavani calves was 22.13 ± 0.12 kg. The same study recorded an average lactation milk yield of 3219.75 ± 41.09 kg, a 305-day milk yield of 3047.42 ± 33.80 kg, and a peak milk yield of 16.58 ± 0.16 kg. Additionally, the mean age at first successful service and age at first calving were 746.28 ± 8.94 days and 1012.14 ± 9.32 days, respectively, while the service period and dry period averaged 149.54 ± 4.55 days and 99.65 ± 5.75 days.

Vrindavani

Breeding plan for Avishan sheep breed

Avishaan is a high-performing prolific sheep strain developed by ICAR–Central Sheep and Wool Research Institute (CSWRI), Avikanagar, with a focus on improving mutton production under Indian conditions. The breed was evolved through a structured breeding programme incorporating the prolificacy gene (FecB) to enhance multiple lambing. Avishaan sheep exhibit high twinning and multiple birth rates, resulting in increased litter weight and better overall productivity. The strain also shows improved milk yield in dams, which supports faster growth of lambs. Avishaan sheep are large in size with long legs, making them suitable for semi-arid and harsh climatic environments. They typically possess a Roman nose and long tubular ears, with face colour ranging from light to dark brown and an off-white body coat. Both rams and ewes are polled and produce coarse wool. The Avishaan strain was officially released in 2016 for field evaluation and is considered a promising genetic resource for sustainable sheep farming. Birth weight (2.65±0.04 Kg), 3-month weight (14.66±0.30 Kg), 6-month weight (22.03±0.50 Kg), 12-month weight (31.37±0.37 Kg), respectively.



Source: Sharma et al., 2020

Karan Fries

The Karan Fries crossbred of dairy cattle, developed through a meticulous crossbreeding program initiated in 1971 at ICAR-NDRI, Karnal, represents a harmonious blend of Holstein Friesian (HF), Brown Swiss (BS), and Jersey (J) genetics with Tharparkar

cows. This strategic breeding aimed not only to boost milk production but also to retain the heat tolerance and disease resistance characteristics inherent in indigenous cattle breeds. By 1982, the Karan Fries strain was officially recognized, signifying a milestone in the quest for a high-yielding breed with enduring health and productivity traits. Through successive crosses and evaluations, the breed's genetic makeup evolved, with an emphasis on enhancing additive genetic variance to achieve optimal performance.

Despite initial successes in improving milk production, subsequent breeding strategies focused on selective breeding to maintain and enhance the breed's genetic potential. The breeding committee of the institute, recognizing the value of selectively breeding individuals with over 50% Holstein inheritance, recommended a shift towards this approach. Presently, the level of Holstein inheritance in Karan Fries is around 62.5%, reflecting a strategic balance between exotic genetics and indigenous adaptability. Sire evaluation programs based on pedigree, performance of half-siblings, fitness, and semen quality have been pivotal in selecting superior breeding stock. However, challenges such as declining fertility traits have emerged, leading to increased culling rates due to reproductive problems, highlighting the ongoing need for balanced genetic improvement in the breed.

Production performance

Production performance of Karan Fries cattle indicated that the overall least squares mean for first-lactation Total Milk Yield (TMY), 305-day Milk Yield (305DMY), Lactation Length (LL), and Peak Yield (PY) were 3657.45 ± 42.19 kg, 3053.65 ± 25.47 kg, 352.96 ± 3.07 days, and 15.77 ± 0.09 kg, respectively. The corresponding least squares means for first-lactation Service Period (SP), Dry Period (DP), and Age at First Calving (AFC) were 160.12

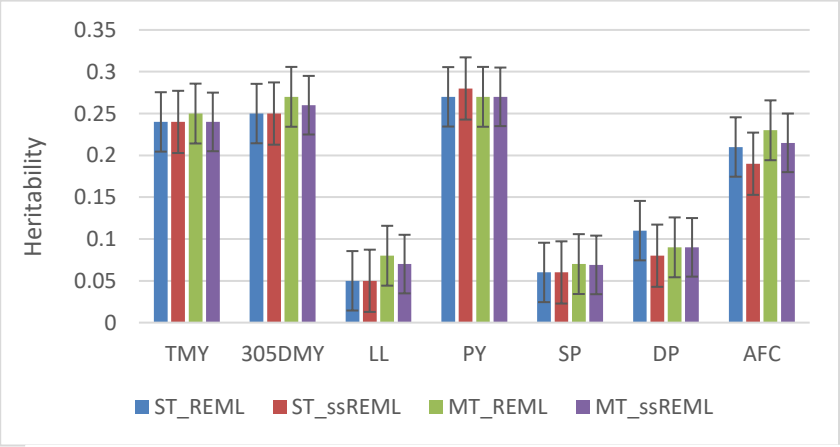


Figure 4: Heritability of Production and reproduction traits from single, multi trait REML and ssREML

± 2.86 days, 90.35 ± 1.00 days, and 1031.65 ± 3.81 days, respectively. Heritability estimates for production traits (TMY, 305DMY, LL, and PY) were found to be moderate, whereas reproduction traits (SP, DP, and AFC) exhibited low heritability, as illustrated in the

accompanying figure. Ilayaraja et al. (2025) estimated genetic parameters, including heritability of production and reproduction traits in Karan Fries cattle, using single-trait and multi-trait models through REML and single-step GREML (ssGREML) methods, and the results are presented in Figure 4.

Conclusion

The findings clearly highlight the crucial role of crossbreeding in enhancing livestock productivity in India, as crossbred animals produce disproportionately higher outputs despite their smaller population size. Systematic identification, documentation, and registration of breeds by NBAGR are essential for conserving valuable indigenous genetic resources while ensuring their sustainable utilization. Successful crossbred strains such as Karan Fries and Vrindavani cattle demonstrate significant improvements in milk yield, reproductive efficiency, and adaptability under Indian production systems. Similarly, the Avishaan sheep strain exemplifies how targeted genetic interventions can improve prolificacy, growth, and resilience in harsh environments.

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