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Popular Article

Bhadawari Buffalo: The Copper-Coloured Treasure of India's Ravines

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Abstract:

In the rugged ravines carved by the Yamuna and Chambal rivers lives one of India's most distinctive buffalo breeds. It may not produce milk in the enormous quantities associated with some specialised dairy breeds, but the Bhadawari buffalo offers something equally valuable: exceptionally rich milk, remarkable hardiness and the ability to survive under conditions where many high-producing animals' struggle.

Recognisable by its copper-coloured body and characteristic white markings around the neck, the Bhadawari represents generations of adaptation to the dry, undulating and resource-limited landscape of north-central India. It is not simply a dairy animal; it is a living reservoir of genes for heat tolerance, efficient feed utilisation and survival under low-input farming systems.

India currently has 22 buffalo breeds registered by the ICAR-National Bureau of Animal Genetic Resources. Bhadawari is among the oldest recognised breeds, with its official home tract extending across Uttar Pradesh and Madhya Pradesh.

Born In the Bhadawar Country:

The breed derives its name from the former Bhadawar estate. Its traditional breeding tract includes Agra and Etawah districts of Uttar Pradesh and Bhind and Morena districts of Madhya Pradesh. Important pockets are found around Bah in Agra, Chakarnagar and Barhpura in Etawah, Ambah and Porsa in Morena, and parts of Bhind. Bhadawari buffaloes have also been maintained in adjoining areas such as Auraiya, Jalaun, Jhansi and Mathura.

The landscape of this region is not easy. Deep ravines, uneven ground, thorny vegetation, recurrent droughts and summer temperatures approaching 48°C have shaped both the animal and the farming system. The compact body and comparatively short legs of the Bhadawari help it maintain balance while grazing on irregular ravine slopes. Farmers have traditionally valued the breed for its ability to travel, graze selectively and remain productive on coarse local feeds.

This intimate relationship with its environment explains why the Bhadawari cannot be evaluated only by comparing its milk volume with that of larger breeds. Its real value lies in the combination of production, milk quality, low maintenance requirements and environmental adaptation.

A Buffalo Unlike Any Other:

A true Bhadawari is a striking animal. Its coat ranges from blackish copper to light copper, while the lower portions of the legs may have a wheat-straw colour. The body is generally medium-sized and compact, with relatively sparse hair.

Its most recognisable feature is the pair of white lines present on the lower side of the neck. These chevron-shaped markings are locally known as the *kanthy*. The horns are black and usually extend slightly outward and downward, run backwards close to the neck and finally turn upwards at their tips.

The breed has historically been used for both milk and draught purposes. Bhadawari males have been considered suitable for agricultural work, including ploughing in wet fields. The females, however, are best known for producing some of the richest buffalo milk in India.

Less Milk, But More Value in Every Litre:

Bhadawari is a moderate-yielding breed. An organised-herd study at ICAR–Indian Grassland and Fodder Research Institute, Jhansi, reported an average lactation yield of approximately 1,250 kg, a 305-day yield of about 1,214 kg and a lactation length of nearly 291 days. Average milk production was about 4.3 kg per day of lactation, while peak daily yield approached 7 kg.

These figures may be lower than those of large dairy breeds such as Murrah or Nili-Ravi. Nevertheless, comparing only kilograms of milk overlooks the Bhadawari's principal advantage—its high concentration of milk solids.

Under organised management, average Bhadawari milk has been reported to contain approximately:

- **8.26% fat**
- **9.57% solids-not-fat**
- **4.05% protein**
- **5.23% lactose**

Individual animals may produce milk containing 13–14% fat, although such extreme values should not be treated as the herd average. The high fat and total-solid content make the milk particularly suitable for value-added products such as ghee, khoa, paneer and traditional milk sweets. In a pricing system that rewards fat and solids-not-fat rather than volume alone, Bhadawari milk can provide substantial economic value.

Studies involving different roughage diets recorded fat concentrations of approximately 6.95–7.61% without major changes in daily milk yield or composition, demonstrating that the breed can

maintain relatively rich milk under several forage-based feeding systems.

What Is Present in Bhadawari Milk Fat?

Milk fat is not a single compound but a complex mixture of fatty acids. Analysis of Bhadawari milk identified 22 *fatty acids*, including 13 saturated and nine unsaturated fatty acids. Approximately 77.3% of the detected fatty acids were saturated, 21.54% were monounsaturated and 1.1% were polyunsaturated.

Palmitic, myristic, stearic and lauric acids were among the major saturated fatty acids, while oleic acid was an important unsaturated component. The exact fatty-acid profile can vary with diet, stage of lactation, season, management and individual genetics.

The high fat content should therefore be presented primarily as a processing and economic advantage rather than as an unrestricted health claim. Milk composition, serving size and the consumer's complete diet must all be considered when discussing nutritional effects (Figure 1).

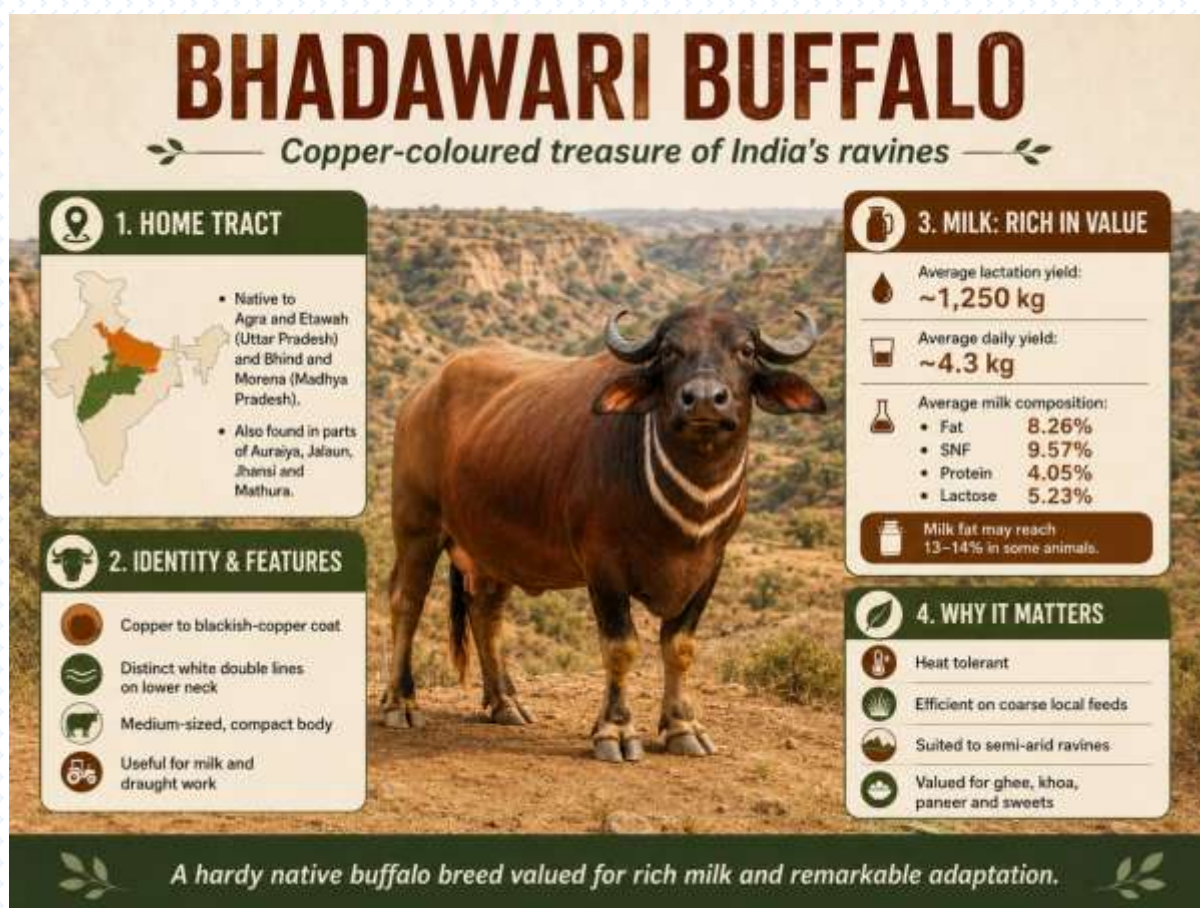


Figure 1. Key characteristics, native tract, milk quality and adaptive traits of the Bhadawari buffalo.

Built For Local Feeds:

Bhadawari buffaloes are frequently described as animals that “eat less and produce more”. Although the phrase is an oversimplification, feeding experiments support their capacity to utilise fibrous feeds and crop residues efficiently.

When Bhadawari and Murrah buffaloes were maintained on a barley-straw-based ration, Bhadawari animals consumed less total dry matter because of their smaller body size. However, intake

relative to body weight and the efficiency with which protein and energy were used for milk production were comparable between the breeds. Milk yield was lower in the Bhadawari group, but milk composition remained comparable and Bhadawari milk showed a tendency towards higher fat.

Under grazing conditions, Bhadawari calves obtained a greater proportion of their total feed intake from pasture than Murrah calves. Their dry-matter, organic-matter and protein digestibility was comparable, and fibre digestibility showed a favourable tendency. Murrah calves grew faster, but the Bhadawari demonstrated its ability to derive nutrients from semi-arid pasture resources.

Research with sorghum, natural-grass and *Stylosanthes* has showed that all three could support lactating Bhadawari buffaloes. *Stylosanthes* has provided better protein and fibre digestibility and resulted in a higher positive nitrogen balance.

Similarly, a combination containing *approximately 60% green Bundel Guar-2 forage and 40% wheat straw* provided favourable feed intake, digestibility and nitrogen balance in growing heifers. When the proportion of low-protein wheat straw became too high, nutrient intake declined and animals receiving wheat straw alone entered negative nitrogen balance.

These findings carry an important message: hardiness does not mean that the breed can be neglected. Bhadawari buffaloes can use local roughages efficiently, but crop residues still need to be balanced with legumes, green fodder, minerals and appropriate concentrate supplementation.

More Protein Is Not Always Better:

Several studies have tested whether Bhadawari calves and heifers require expensive high-protein diets. In growing calves, a diet containing 20% less protein than the reference recommendation supported a daily growth rate of around 400 g without reducing feed intake or fibre digestion.

In older heifers, providing 20% more dietary protein did not improve growth, puberty or conception. Instead, excess protein increased nitrogen loss through urine.

These observations do not mean that protein can always be reduced by a fixed percentage. Requirements depend on age, body weight, growth target, pregnancy and milk production. They do show, however, that indiscriminate use of costly protein supplements may waste money and increase nitrogen excretion without improving performance.

A recent study offered another practical alternative. Replacing 60% of the nitrogen supplied by mustard cake with berseem hay meal did not adversely affect feed intake, nutrient digestibility, milk yield or milk composition. Average milk yield remained close to 5 kg per day. The modified diet reduced daily feeding cost by 14.49%, reduced the cost of producing one kilogram of 4% fat-corrected milk by 16.80%, and increased net daily income by approximately ₹24.82 per buffalo.

For smallholders who grow berseem locally, such feeding strategies could lower dependence on purchased oilseed cakes while maintaining milk production.

The Farming System Is Changing:

Traditionally, Bhadawari buffaloes grazed extensively in the Yamuna–Chambal ravines. Over time, natural grasslands and common grazing resources have shrunk. The spread of thorny babul vegetation, conversion of common land and commercialisation of dairying have contributed to a gradual shift from extensive grazing towards semi-intensive and stall-fed systems.

A survey covering farmers associated with the Bhadawari conservation programme found that approximately half followed a semi-intensive system combining grazing and stall feeding, while the remainder largely depended on stall-fed sorghum stover, wheat straw and locally available concentrates. Calves were generally allowed to suckle their dams, and weaning was uncommon. More than 80% of the surveyed farmers used artificial insemination, reflecting the shortage of quality breeding bulls in villages. Approximately 95% reported cleaning teats and utensils before milking.

Around 60% sold whole milk, 25% retained milk for household consumption and approximately 15%, particularly in remote villages, converted milk into ghee. Most milk was sold through middlemen rather than directly in organised markets.

These observations reveal both a challenge and an opportunity. The breed produces premium-quality milk, but farmers may not receive a premium price unless milk is tested for fat and solids and marketed under a distinct Bhadawari identity.

Reproduction Follows the Seasons:

Bhadawari reproduction is strongly influenced by season. Herd records from Jhansi showed that approximately 41.87% of calvings occurred during the rainy season and another 28.5% during autumn. Only about 4.88% occurred during summer. August and October were among the most important calving months.

An organised-herd analysis reported an average service period of approximately 172 days, calving interval of 522 days and dry period of about 242 days. Buffaloes calving during the rainy season generally had shorter reproductive intervals than those calving during summer or winter.

Season also affects males. A study of Bhadawari bulls found significant changes in seminal-plasma enzymes and metabolites as temperature and the temperature–humidity index increased. These biochemical shifts indicate that even a heat-adapted breed benefits from shade, cooling, sufficient water and season-sensitive semen collection and breeding management.

Decline, Recovery and The Unfinished Conservation Task:

Older field studies repeatedly warned that pure Bhadawari numbers were declining. The introduction of Murrah buffaloes and indiscriminate crossbreeding were major causes. Farmers understandably preferred animals producing larger volumes of milk, particularly where payment systems ignored fat concentration and adaptation.

Recognising the threat, the Indian Council of Agricultural Research initiated a conservation and improvement programme at ICAR–IGFRI, Jhansi, in 2001. The programme established an organised herd, introduced artificial insemination in the breeding tract and generated valuable information on production, reproduction, nutrition and milk quality. Historical surveys estimated that the population had fallen sharply and that animals fully conforming to the traditional breed type were becoming less common.

There is, however, encouraging recent evidence. The ICAR–NBAGR Breed Watch List 2022 places Bhadawari in the “**not at risk**” category based on breed-wise data from the 20th Livestock Census.

This classification is welcome, but it should not produce complacency. A breed can have an adequate numerical population while still experiencing dilution of its characteristic appearance, milk quality and locally adapted gene combinations. Conservation must therefore protect not only animal numbers but also breed purity and functional traits.

Turning Conservation into A Profitable Enterprise:

Bhadawari conservation will become sustainable only when keeping a pure animal is economically attractive to farmers. Several actions can support this goal:

1. **Pay farmers for milk quality.** Milk purchasing should reward fat, protein and total solids instead of volume alone.
2. **Develop a Bhadawari milk identity.** Ghee, khoa, paneer and traditional sweets made from verified Bhadawari milk could be marketed as premium regional products.
3. **Expand purebred artificial insemination.** Adequate semen from evaluated Bhadawari bulls is essential to prevent indiscriminate upgrading with other breeds.
4. **Record animals in farmers' herds.** Digital identification, pedigree recording and repeated measurement of milk yield and composition would allow superior animals to be selected accurately.
5. **Conserve the breed both on farms and in gene banks.** Living herds should be supported in the native tract while semen, embryos, DNA and somatic cells are preserved as long-term genetic security.
6. **Restore local fodder resources.** Community pasture development, leguminous fodders, fodder banks and balanced use of crop residues can reduce feeding costs.
7. **Select for the complete Bhadawari package.** Milk fat, fertility, heat tolerance, feed efficiency, disease resilience and survival must be valued alongside milk yield.

A Breed for The Future, Not Merely The Past:

The Bhadawari buffalo is often introduced as a rare copper-coloured animal that produces high-fat milk. That description is correct, but incomplete.

It is also a model of biological adaptation. It converts local roughages into nutrient-dense milk, tolerates a harsh semi-arid environment and fits the resource base of small and marginal farmers. Its value

is becoming even more relevant as climate variability, water scarcity and rising feed prices challenge input-intensive dairy systems.

The future of Indian dairying cannot depend on one breed or one production model. High-yielding breeds will remain important, but so will animals capable of maintaining production when fodder, water and climatic conditions are less than ideal.

The Bhadawari teaches an important lesson: livestock productivity should not be measured only by the amount of milk in the bucket. The richness of that milk, the resources required to produce it and the animal's ability to withstand its environment are equally important.

Protecting the Bhadawari is therefore not an act of nostalgia. It is an investment in milk quality, rural livelihoods, climate resilience and India's irreplaceable animal genetic diversity.

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