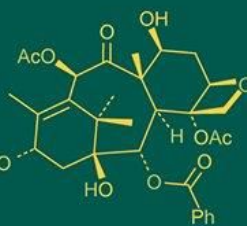
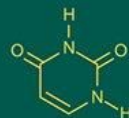


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693

ISSN Online: 2617-4707

NAAS Rating (2026): 5.29

IJABR 2026; 10(3): 739-745

www.biochemjournal.com

Received: 07-01-2026

Accepted: 10-02-2026

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Phenotypic characterisation and performance evaluation of indigenous cattle of Tripura: An unique germplasm

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i3i.7965>

Abstract

The indigenous cattle of Tripura is an unique animal genetic resources, well adapted to the humid subtropical climate. An Extensive study was conducted across all eight districts of Tripura to explore the morphology, reproductive, managerial, and productive traits, through field surveys, questionnaires, and interviews with farmers about housing management, breeding, feeding, disease, production etc. For the phenotypic characterisation and performance evaluation of this indigenous cattle, a total of 278 animals (23 males and 255 females) were studied. Study revealed that, this indigenous cattle of Tripura are small-sized, compact animals with a robust, cylindrical body and an average body weight of 154.49 ± 1.86 kg. Mean body length, height at withers, and heart girth were 99.42 ± 0.50 cm, 99.44 ± 0.50 cm, and 128.84 ± 0.57 cm, respectively. Prime qualitative traits included straight forehead (90.28%), medium hump (73.02%), a medium to small dewlap, and laterally elongated ears. Coat colour with considerable variation, with light red (50.7%) most common, followed by black, dark red, grey, white, and fawn. Muzzle and hoof were mostly black. Bowl-shaped udder with cylindrical teats. The average daily milk yield was 1.32 ± 0.03 kg with a lactation length of 153.24 ± 1.54 days, milk fat content of $4.98 \pm 0.04\%$ and SNF of $8.57 \pm 0.02\%$. The age at first calving was 43.56 ± 0.21 months, the calving interval of 454.81 ± 4.68 days, and the lifespan of 15-18 years with 5-9 calvings during the lifetime. These cattle are mainly reared under extensive grazing systems with natural breeding by local bulls. The study highlights that the indigenous cattle of Tripura are with valuable adaptive traits, superior milk quality, and are resilient to low-input farming systems. These unique characteristics and traits invite a need for systematic conservation, genetic improvement, and formal breed recognition.

Keywords: Indigenous cattle, characterisation, physical, phenotypic

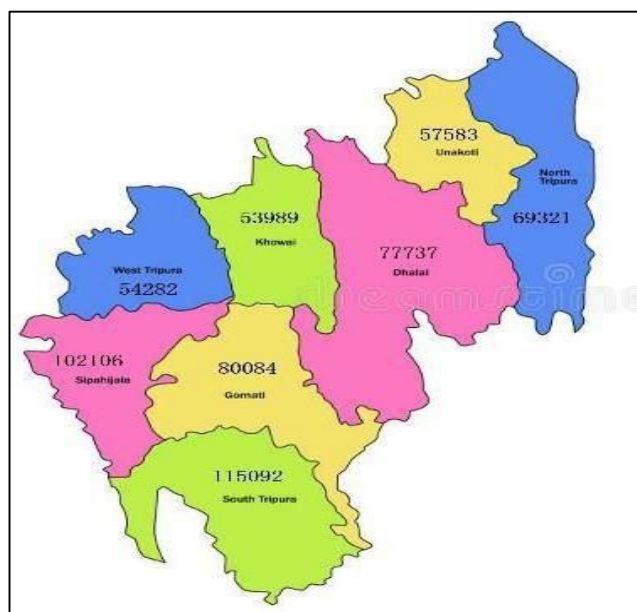
Introduction

Tripura, a small hilly state, with an area of 10491.63 sq. Km and about 4.06 million population, lies in $22^{\circ}56'-24^{\circ}32'$ N latitude and $91^{\circ}00'-92^{\circ}20'$ E longitude in the humid subtropical Eastern Himalayan agro-climatic zone of India. Availability of cultivable land of 27% and 65% being hills, tilla and hillocks. Agriculture and Animal Husbandry employ nearly 53% of the state's workforce, making livestock rearing a crucial venture of sustainable farming systems in the state.

Particularly, cattle play a key role in supporting rural livelihoods through milk, manure, fuel, and draught power. Traditional cattle rearing has been practised for generations since the princely state period. As per the Livestock Census, 2019, the total cattle accounted for nearly 57% of the total livestock (about 13.18 lakh). Out of the 7.39 lakhs total cattle, indigenous cattle account for 83.3% (6.16 lakh). These cattle are typically reared on a small-scale farming system with minimal investment for milk, draught work, manure and household livelihood support etc. The indigenous cattle of Tripura represent a unique and valuable germplasm with strong adaptability, disease resistance, and the ability to thrive under harsh climatic and low-input management conditions, in the region's specific eco-geographical conditions.

The breedable indigenous cattle population is estimated at 3,35,973, with higher concentrations in Dhalai, Sepahijala, and South Tripura. During 2022-23, the state produced approximately 230.12 thousand tonnes of milk, with a per capita availability of 163 gm/day, (Basic Animal Husbandry Statistics, MoFAHD, DAHD, GoI, 2023-24), highlighting the growing importance of indigenous cattle in meeting the rising demand for milk and dairy products in Tripura.

Considering the contribution of cattle husbandry, excellent traits, disease resistance, and adaptability capacity of the indigenous cattle of Tripura, it is pertinent to shed light on the unique physical, productive, and Reproductive characteristics of these cattle.



Materials and Methods

The study is carried out across all eight districts of Tripura—North Tripura, South Tripura, West Tripura, Dhalai, Unakoti, Khowai, Sepahijala, and Gomati. Farmers interviewed and surveyed to know the habitat, management and performance of the cattle. Performance traits like birth weight, age at first estrous, age at first mating, age at first calving, calving interval, daily milk yield, peak milk yield, milk quality, lactation length, lactation yield, milk vein pattern, dry period, manure production, draft performance, life span, life time production, etc. Other related information was also collected, like breed preference and utility patterns, feeding, disease prevalence and veterinary access, etc. Different body measurements and physical characteristics were recorded on 278 (23 male and 255 female) Indigenous Cattle. The body measurements recorded were body length, heart girth, punch girth, height at withers, height at croup, head length, head width, neck length, muzzle circumference, ear length, horn length and tail length without switch, switch length, rump length, rump width, chest height, bicoastal diameter, canon bone circumference etc by standard tape and Vernier Calipers. Some other qualitative traits viz. coat color, muzzle color, eyelid color, hoof color, forehead pattern, ear shape and orientation, horn orientation, hump size, dewlap and naval flap size, udder and teat size, shape & pattern and biometry etc. Body weight (kg) was estimated by using the formula heart girth (cm) × heart girth (cm) × body length (cm)/300 X 0.454. All this information were collected by preparing a standard questionnaire. The statistical analysis were performed by standard statistical methods (Snedecor & Cochran, 1982) [14]

Results and Discussion

Physical and Morphometric Characteristics (Body Size and Conformation)

Indigenous cattle of Tripura are, small-sized compact, with sturdy cylindrical body. The average body weight of adult animals is 154.49 ± 1.86 kg, which closely aligns with Pundir *et al.* (2014) [9], 110 kg for cows and 142 kg for bullocks and Majumder *et al.* (2025).

The average body length of Tripura cattle was 99.42 ± 0.50 cm, which is comparable to Manipur local cattle (Meetei San) at 97.67 ± 0.96 cm (Pundir *et al.*, 2015b) [11, 12] and slightly higher than earlier reports on Tripura cattle at 98.09 ± 0.54 cm for cows (Pundir *et al.*, 2014) [9], comparable with Thuto cattle with 103.14 ± 1.03 cm (Pundir *et al.*, 2018) [10] and also similar to the Balang cattle of Arunachal Pradesh with bulls and cow averaging 101.06 ± 0.38 cm and 97.67 ± 0.96 cm (Kadirvel *et al.*, 2022) [4] respectively. However, the indigenous cattle body length is considerably larger than that of Assam local cattle, with an average body length of 83.668 ± 0.590 cm (Kayastha *et al.*, 2011) [7], suggesting regional and eco-geographical variation in body size even within the North-Eastern zone. This data denotes that Tripura cattle represent an intermediate size category among indigenous breeds of the region.

Height at Withers

The height at withers for Tripura cattle is recorded as 99.44 ± 0.50 cm, which is similar to Manipur local cattle at 99.73 ± 0.32 cm for cows (Pundir *et al.*, 2015b) [11, 12] and 87.86 ± 1.71 cm by Majumder *et al.*, (2022). Balang cattle of Arunachal Pradesh have an average height of 104.01 ± 0.46 cm for bulls and 99.73 ± 0.32 cm for cows (Kadirvel *et al.*,

2022) [4]. Assam local cattle have an average height of 91.942 ± 0.55 cm (Kayastha *et al.*, 2011) [7]. These variations in height at the withers may be attributed to nutrition and management practices over time, or to variation in sampling populations. The Thutho cattle of Nagaland were recorded with greater height at 106.23 ± 0.680 cm for cows and 107.59 ± 1.02 cm for bullocks (Pundir *et al.*, 2018) [10].

Heart Girth and Punch Girth

The heart girth of Indigenous cattle of Tripura cattle measures 128.84 ± 0.57 cm, which is substantially higher than the earlier report of 122.05 ± 1.09 cm for cows by Pundir *et al.*, (2014) [9] and 112.80 ± 2.86 cm by Majumder *et al.*, (2025) but consistent with Manipur local cattle at 128.64 ± 0.68 cm for cows (Pundir *et al.*, 2015b) [11, 12]. Relatively, Assam local cattle showed lower heart girth at 113.146 ± 0.738 cm (Kayastha *et al.*, 2011) [7], while Thutho cattle of Nagaland were recorded with higher values at 142.45 ± 1.40 cm for cows and 148.02 ± 2.28 cm for bullocks (Pundir *et al.*, 2018) [10]. Balang cattle of Arunachal Pradesh recorded heart girth of 135.29 ± 0.44 cm for bulls and 128.64 ± 0.68 cm for cows (Kadirvel *et al.*, 2022) [4].

The punch girth of Indigenous Cattle of Tripura is 135.14 ± 0.63 cm, compared to 125.14 ± 1.08 cm as reported earlier by Pundir *et al.*, (2014) [9] and 112.02 ± 2.91 cm by Majumder *et al.*, (2025). However, Thutho cattle were measured 144.01 ± 1.42 cm for cows (Pundir *et al.*, 2018) [10], Balang cattle at 142.12 ± 0.98 cm for bulls (Kadirvel *et al.*, 2022) [4], which are almost in alignment with the Indigenous cattle of Tripura with slight difference with Assam cattle with 121.181 ± 0.761 cm (Kayastha *et al.*, 2011) [7].

Head and Facial Characteristics

The forehead of indigenous cattle of Tripura is mostly straight (90.28%) with a few concave (9.7%) with an average length of 35.54 ± 0.28 cm and width of 15.74 ± 0.14 cm, which is consistent with the earlier report of 35.30 ± 0.20 cm for cows by Pundir *et al.* (2014) [9]. These measurements are also comparable to Balang cattle with 38.34 ± 0.17 cm for bulls and 37.99 ± 0.15 cm for cows (Kadirvel *et al.*, 2022) [4], and Assam cattle at 35.035 ± 0.195 cm (Kayastha *et al.*, 2011) [7]. Manipur local cattle showed slightly higher face length at 38.00 ± 0.70 cm for cows (Pundir *et al.*, 2015b) [11, 12], while Thutho cattle of Nagaland with 38.31 ± 0.31 cm (Pundir *et al.*, 2018) [10], indicating quite uniform facial proportions in indigenous cattle in the North-Eastern region.

Ear Dimensions

Ear length in Indigenous Cattle of Tripura is measured 19.00 ± 0.21 cm, which closely matches the earlier reports of 19.47 ± 0.24 cm for cows reported by Pundir *et al.* (2014) [9]. However, in Balang cattle lower values of 18.90 ± 0.11 cm for bulls and 18.46 ± 0.17 cm for cows (Kadirvel *et al.*, 2022) [4] were noted, which is comparable to Assam local cattle at 18.131 ± 0.111 cm (Kayastha *et al.*, 2011) [7]. Both Manipur local cattle (20.32 ± 0.37 cm) (Pundir *et al.*, 2015b) [11, 12], Thutho cattle of Nagaland (20.15 ± 0.25 cm) (Pundir *et al.*, 2018) [10] recorded higher values for ear length. The ears are mostly elongated (83.45%), of indigenous cattle and oriented laterally (74.10%), & Erect outward (25.89%). The ear measurements show that Indigenous Cattle Tripura possess small to medium-sized ears, being a characteristic of indigenous cattle breeds adapted to tropical climates.

Horn Characteristics

All indigenous cattle of Tripura are horned, with an average length of 12.82 ± 0.28 cm, which is slightly lower than the earlier estimate of 14.37 ± 1.48 cm (Pundir *et al.*, 2014) [9]. The horns are predominantly black (87.76%) in color, oriented upward (47.12%), pointed (32.37%), downward (14.74%), and forward/backwards (5.75%), and with different patterns, viz. Curved (50.35%), Straight (45.68%) and Lyre-shaped (3.95%). This horn length is comparable to Balang cattle of Arunachal Pradesh at 12.11 ± 0.20 cm for bulls and 9.96 ± 0.17 cm for cows (Kadirvel *et al.*, 2022) [4], and slightly higher than that of Assam cattle at 11.85 ± 0.38 cm for bullocks and 11.71 ± 1.01 cm for cows (Kayastha *et al.*, 2011) [7]. Thutho cattle of Nagaland showed lower horn length at 9.90 ± 0.46 cm for cows and 11.00 ± 0.98 cm for bullocks (Pundir *et al.*, 2018) [10], while Manipur cattle exhibited a horn length of 15.55 ± 0.55 cm for cows (Pundir *et al.*, 2015b) [11, 12]. The horn orientation pattern in Tripura cattle differs from that of other indigenous populations. While Tripura cattle show predominantly upward orientation (47.1%), Thutho cattle horns are described as stumpy or outward, forward and then upward (Pundir *et al.*, 2018) [10]. Pundir *et al.* (2014) [9] described Tripura cattle horns as small, black or gray in color, with outward and upward orientation.

Tail Dimensions

The tail length of Tripura cattle is 65.00 ± 0.68 cm with switch length of 26.6 ± 0.57 cm, compared to the earlier report of 47.33 ± 1.34 and switch length of 17.16 ± 1.00 cm for cows by Pundir *et al.* (2014) [9]. These measurements are almost comparable to Balang cattle at 90.39 ± 0.32 cm for bulls and 86.69 ± 0.18 cm for cows (Kadirvel *et al.*, 2022) [4], and higher than Assam cattle at 54.196 ± 0.527 cm (Kayastha *et al.*, 2011) [7]. Thutho cattle of Nagaland showed tail length of 73.86 ± 1.11 cm for cows (Pundir *et al.*, 2018) [10], while Manipur cattle recorded 74.60 ± 1.28 cm for cows (Pundir *et al.*, 2015b) [11, 12], higher than Tripura cattle, indicating intermediate tail length compared to other indigenous breeds in the region.

Hump and Dewlap Characteristics

Indigenous cattle of Tripura were with short (18.3%) to medium-sized (73.02%) humps with mostly having little plain hairs (84.5%) and medium (58.9%) to small-sized (37.4%) dewlaps. This is in consistent with the observations recorded by Pundir *et al.* (2014) [9]. Tuft of hair on hump forehead and ears were also reported in Balang cattle by Kadirvel *et al.*, (2022) [4], while Mizoram cattle and Thutho cattle also showed small dewlap and hump (Pundir *et al.*, 2015a; Pundir *et al.*, 2018) [11, 12].

Naval Flap

Naval flaps in indigenous cattle of Tripura are mostly small (73.02%) to Medium-25.89%, however, cattle with large (1.07%), naval flaps were also not uncommon. Penis sheaths are mostly of a small size in male (56.52%).

Coat colour patterns

The coat color distribution in Indigenous cattle of Tripura shows appreciable variation, with predominantly light red (50.7%), followed by dark red (14.02%), black (17.6%), fawn (2.5%), grey (7.19%), and white (7.91%). This coat color distribution pattern differs moderately from the earlier

report by Pundir *et al.* (2014) ^[9], who reported brown (46.15%), red (21.16%), black (16.76%), and grey/white (15.93%). This color variation is markedly differ from other indigenous cattle populations in the region. Mizoram cattle show brown as the predominant color (85%), followed by black (11%) and grey (4%) (Pundir *et al.*, 2015a) ^[11, 12]. Thutho cattle of Nagaland are predominantly black (82%), with brown (16%) and grey (2%) (Pundir *et al.*, 2018) ^[10], showing an even more uniform color pattern. Balang cattle of Arunachal Pradesh show black (62%), brown (23.8%), and light brown (14.2%) coat colors (Kadirvel *et al.*, 2022) ^[4], while Manipur local cattle have varied coat colors (Pundir *et al.*, 2015b) ^[11, 12]. The greater color diversity in Tripura cattle suggests a more heterogeneous genetic background which might be evolved through continuous natural selection within the population.

Muzzle and Hoof Colors

The muzzle color in Indigenous cattle of Tripura is mostly black (92.8%), with non-pigmented (3.59%) and grey (3.59%) variations; however earlier reports stated black (79%) and brown muzzle by Pundir *et al.* (2014) ^[9]. Hoof color is predominantly black (90.28%), with non-pigmented (3.23%) and grey (6.47%) variations, compared to the earlier report of black (87%) and brown (13%) hoofs (Pundir *et al.*, 2014) ^[9]. Mizoram cattle showed black (87%) and brown (13%) hooves, and black (79%) and brown muzzles (Pundir *et al.*, 2015a) ^[11, 12], while Thutho cattle exhibited black (88%) and brown muzzles (Pundir *et al.*, 2018) ^[10]. The predominance of black color of muzzles and hooves appears to be a common characteristic across indigenous cattle populations of the North-Eastern region.

Udder Characteristics

Medium (40.78%), large (11.76%), and small (47.45%) sized udders with bowl-shaped (72.1%), round (24.3%), and trough (3.52%) configurations udders were noted in Indigenous cattle of Tripura. Milk veins are prominent in 39.60% and not prominent in 60.4% of cows, with teats are either cylindrical (74.5%) or funnel (25.4%) shaped, with pointed-51.76% and tip-48.23% type teat. This description are well comparable to earlier report in Tripura cattle (Pundir *et al.*, 2014) ^[9], Balang cattle (Kadirvel *et al.*, 2022) ^[4], and Manipur cattle having small udders (Pundir *et al.*, 2015b) ^[11, 12].

Productive Performance (Milk Production)

The average daily milk yield of Indigenous Cattle of Tripura is 1.32 ± 0.03 kg with a peak yield of 2.02 ± 0.04 kg and lactation milk yield 216.01 ± 5.83 kg, which is consistent with the earlier report of 1.36 ± 0.06 kg daily milk yield by

Pundir *et al.* (2014) ^[9]. The average lactation length is 153.24 ± 1.54 days, which is slightly higher than the earlier estimate of 145 days reported by Pundir *et al.*, (2014) ^[9]. Mizoram cattle showed an average daily milk yield of 1.54 ± 0.11 kg with lactation length of 178 days (150-210 days) (Pundir *et al.*, 2015a) ^[11, 12], while Balang cattle of Arunachal Pradesh demonstrated 1.10 ± 0.67 kg average daily yield, peak yield of 1.31 ± 0.51 kg, and lactation length of 170.24 ± 9.32 days (Kadirvel *et al.*, 2022) ^[4]. However, Manipur local cattle (Meetei San) exhibited a higher average daily milk yield of 2.86 ± 0.03 kg, total milk production of 363.34 ± 5.86 kg, and lactation length of 407.23 ± 1.83 days (Singh *et al.*, 2025) ^[13]. This considerable difference may be due to intensive selection or a better plane of nutrition and management. Kakki *et al.*, 2021 ^[5] reported a wide variation in daily milk yield (2.65 ± 0.18 kg) in indigenous cattle of Arunachal, which is considerably higher than that of the indigenous cattle of Tripura.

Milk Quality

Despite lower milk production, a significant strength of the Indigenous cattle of Tripura lies in their superior milk quality. The milk fat percentage is estimated $4.98 \pm 0.04\%$ with SNF of $8.57 \pm 0.02\%$, indicating nutritious milk that fetches premium values in local markets. The milk fat and SNF values are higher than those in Balang cattle at $4.52 \pm 0.48\%$ fat and $8.27 \pm 0.54\%$ SNF (Kadirvel *et al.*, 2022) ^[4]. Indigenous cattle of Arunachal Pradesh demonstrated even higher milk fat and SNF of $5.895 \pm 0.032\%$ and SNF of $8.582 \pm 0.027\%$ (Kakki *et al.*, 2021) ^[5]. Kayastha *et al.*, (2008) ^[6] reported fat ($5.34 \pm 0.06\%$) and SNF ($8.54 \pm 0.03\%$) in Assam native cattle, indicating that high milk quality is a characteristic feature of indigenous cattle across the North-Eastern region. The superior milk quality with high-fat milk is preferred for traditional dairy products and fetches better prices.

Birth Weight

Birth weight is an important indicator of calf vigour and survivability. Indigenous cattle of Tripura show birth weight of 10.08 ± 0.24 kg for female calves and 12.33 ± 0.23 kg for male calves, which is lower than the earlier estimate of 10-15 kg range reported by Pundir *et al.*, (2014) ^[9]. The Balang cattle of Arunachal Pradesh reported an average birth weight of 14.28 ± 0.52 kg (Kadirvel *et al.*, 2022) ^[4], while Assam local cattle showed a mean birth weight of 14.667 ± 0.150 kg (Kayastha *et al.*, 2008) ^[6]. The lower birth weight in the Indigenous Cattle of Tripura may reflect adaptation to the extensive management system and limited nutritional inputs during pregnancy.

Table 1: Qualitative Morphological Characteristics of Indigenous Cattle of Tripura

Trait	Characteristics features
Body Type	Small-sized, compact, sturdy cylindrical body
Forehead Shape	Straight (90.28%) and Concave (9.7%)
Hump Size	Short (18.3%) and Medium (73.02%)
Hair type	Little/Plain hairs (84.5%)
Dewlap Size	Medium (58.9%) and Small (37.4%)
Horns (Presence)	All animals horned
Horn Orientation	Upward (47.12%), Pointed (32.37%), Downward (14.74%), and Forward/Backward (5.75%)
Horn Colour	Black (87.76%), Brown (9.76%) and Grey/Whitish (2.51%)
Horn Shape	Curved (50.35%), Straight (45.64%) and Lyre-shaped (3.95%)
Horn Attachment	Fixed (76.6%) and Loose (23.4%)
Hoof Color	Black predominant (90.28%), non pigmented (3.23%) and grey (6.47%)
Muzzle Color	Black (92.8%), non pigmented (3.59 %) and grey (3.59 %)
Coat Color	Light red (50.7%), Dark red (14.02%), Black (17.6%), Fawn (2.5%), Grey (7.19%) and White (7.91%)
Skin Color	Black (54.3%), Non-pigmented (24.8%) & Mixed/Other (20.9%)
Eyelid Color	Black (88.84%), non pigmented (7.91 %) and grayish (3.23%)
Ear Size & Orientation	Oriented laterally (74.10%) & Erect outward (25.89%)
Ear Shape	Elongated (83.45%) and Short-edged (16.5%)
Udder Size	Medium (40.78%), large (11.76%) and small (47.45%)
Udder Shape	Bowl (72.1%), Round (24.3%), and Trough (3.52%)
Milk Veins	Prominent (39.60%) and not prominent (60.4%)
Teat Shape	Cylindrical (74.5%) and Funnel (25.4%)
Teat Type	Pointed (51.75%) and Tip (48.23%)
Naval Flap Size	Large-1.07%, Medium-25.89%, Small-73.02%
Tail Switch Colour	Black (67.98%), Brown (22.32%) and White (9.71%)
Penis Sheath	Large-13.04%, Medium-30.43%, Small-56.52%

Table 2: Quantitative Morphological Measurements of Indigenous Cattle

Measurement	Mean $\pm$ SE
Body Weight (kg)	154.49 $\pm$ 1.86
Ear Length (cm)	19.00 $\pm$ 0.21
Horn Length (cm)	12.82 $\pm$ 0.28
Muzzle Circumference (cm)	34.57 $\pm$ 0.26
Head Length (cm)	35.54 $\pm$ 0.28
Head Width(cm)	15.74 $\pm$ 0.14
Neck Length(cm)	36.04 $\pm$ 0.42
Tail Length(cm)	65.00 $\pm$ 0.68
Switch Length(cm)	26.6 $\pm$ 0.57
Hock Circumference (cm)	27.05 $\pm$ 0.23
Cannon Bone Circumference(cm)	20.87 $\pm$ 0.23
Height at Withers (cm)	99.44 $\pm$ 0.50
Height at Girth (cm)	131.42 $\pm$ 0.51
Height at Rump (cm)	105.00 $\pm$ 0.51
Heart Girth (cm)	128.84 $\pm$ 0.57
Body Length(cm)	99.42 $\pm$ 0.50
Chest Height (cm)	56.61 $\pm$ 0.33
Rump Length (cm)	29.52 $\pm$ 0.26
Paunch Girth(cm)	135.14 $\pm$ 0.63
Rump Width (cm)	28.15 $\pm$ 0.24
Bi-costal Diameter(cm)	161.29 $\pm$ 0.88

Manure Production

Indigenous cattle of Tripura produce 16-22 kg of manure daily, which is higher than Balang cattle (Kadirvel *et al.*, 2022) ^[4]. This organic fertilizer is highly valued by farmers for agriculture, as an integral part of farming systems as reported by Chakrabarti *et al.* (2022) ^[3]

Draught Performance

Tripura indigenous bullocks can plough about 0.3 acres in 5-6 hours, similar to Balang cattle (0.50 acres in 5-6 hours) (Kadirvel *et al.*, 2022) ^[4]. Earlier reports estimated 0.16 hectare (0.4 acres) in 3-4 hours (Pundir *et al.*, 2014) ^[9], 0.50 acre in 5-6 hours (Pundir *et al.*, 2015a) ^[11, 12] in Mizoram

cattle, highlighting the importance of draught ability in hilly regions with limited mechanisation.

Reproductive Performance

In males, the average age at 1st ejaculation and 1st matting is 30.34 $\pm$ 2.85 and 34.42 $\pm$ 0.72, respectively. The age at first estrus in Tripura cattle is 32.04 $\pm$ 0.18 months, with age at first mating at 34.07 $\pm$ 0.18 months and age at first calving at 43.56 $\pm$ 0.21 months. This age at first calving is comparable with earlier reports of 44 months by Pundir *et al.* (2014) ^[9] in Tripura Cattle and higher than Manipur cattle (37.35 months), Singh *et al.*, 2025 ^[13]; Balang cattle (37.54 months) Kadirvel *et al.*, (2022) ^[4] and 38.7 months in Mizoram cattle (Pundir *et al.*, 2015a) ^[11, 12]. The age at first puberty in Indigenous Cattle of Tripura is comparable to Balang cattle as reported 32.18 $\pm$ 2.88 months (Kadirvel *et al.*, 2022) ^[4], while higher than Manipur local cattle (Meetei San) at 26.00 $\pm$ 0.36 months, age at first service at 27.00 $\pm$ 0.36 months (Singh *et al.*, 2025) ^[13]. The differences in the first puberty, mating and calving may reflect differences in nutritional management, as Tripura cattle are reared under more extensive, low-input systems.

Calving Interval and Dry Period

The calving interval in Indigenous cattle of Tripura is estimated to be 454.81 $\pm$ 4.68 days (approximately 15.2 months) with a dry period of 301.88 $\pm$ 4.27 days (approximately 10.1 months). These values differ from the earlier report by Pundir *et al.* (2014) ^[9] as calving interval of 424 days (12-24 months range) and dry period of 122 days (3-6 months range).

The estimated dry period in the Indigenous Cattle of Tripura of 301.88 days is relatively long compared to other indigenous populations. Balang cattle showed a calving interval of 555.23 $\pm$ 3.97 days (approximately 18.5 months) with a dry period of 148.00 $\pm$ 3.00 days (Kadirvel *et al.*, 2022) ^[4], Manipur local cattle exhibited a calving interval of

555.23±3.97 days with a dry period of 160.51±9.22 days (Singh *et al.*, 2025) ^[13]. Mizoram cattle demonstrated a calving interval of 638 days (12-24 months range) with a dry period of 132 days (120-150 days range) (Pundir *et al.*, 2015a) ^[11, 12].

Herd Life and Lifetime Productivity

Indigenous cattle of Tripura demonstrate remarkable longevity with a lifespan of 15-18 years and 5-9 calvings during their lifetime, which is consistent with the earlier estimate of 12-15 years with 8-10 calvings by Pundir *et al.* (2014) ^[9]. The average life span is comparable to Balang cattle with a herd life of 16.24±1.55 years and 10.64±1.42 calvings (Kadirvel *et al.*, 2022) ^[4], and Mizoram cattle with a herd life of 15-20 years and 8-10 calvings (Pundir *et al.*, 2015a) ^[11, 12]. The lengthy life span represents a significant economic advantage of indigenous breeds adapted to low-input systems in the state of Tripura.

Table 3: Production Traits of Indigenous Cattle of Tripura

Trait	Value/Range
Birth weight (Male calves)	10.78 to 13.26 kg
Birth weight (Female calves)	9.34 to 12.46 kg
Average Daily Milk Yield(kg/day)	1.32±0.03
Peak Milk Yield(kg/day)	2.02±0.04
Lactation Length(days)	153.24±1.54
Lactation Milk yield (Kg)	216.01±5.83
Lactation Milk yield (Kg) (1st Lactation)	182 (approx)
Milk Fat (%)	4.98±0.04
SNF (%)	8.57±0.02
Daily Manure Production	16-22 kg/day
Bullock Work Output	Can plough 0.3 acres in 5-6 hours

Table 4: Reproductive Traits of Indigenous Cattle of Tripura

Trait	Mean ± SE
Age at First estrus (months)	32.04±0.18
Age at First Mating (months)	34.07±0.18
Age at First Calving (months)	43.56±0.21
Dry Period (days)	301.88±4.27
Calving Interval (days)	454.81±4.68
Breeding System	Natural breeding with local non-descript bulls
Management System	Grazing-based; cows let loose for field grazing
Lifespan (years)	15-18 years
Number of Calving (per life time)	5-9

Breeding Systems

Natural breeding is the predominant practice for Indigenous cattle of Tripura, with local non-descript bulls which is in consistent with Tripura cattle by Pundir *et al.* (2014) ^[9], in Balang cattle (Kadirvel *et al.*, 2022) ^[4] in Manipur local cattle (Singh *et al.*, 2025) ^[13] and in Thutho cattle of Nagaland by Pundir *et al.*, (2018).

Management Practices Housing Systems

Indigenous cattle of Tripura are typically housed in low-cost traditional cow sheds made of bamboo, thatch, and wood, occasionally with tin sheet roofs and kutcha floors, part of the owner's residence. According to Chakrabarti *et al.* (2022) ^[3], 84% of farmers maintained separate cattle sheds from their residences, which contrasts with the earlier report

by Pundir *et al.* (2014) ^[9] indicating that 96% of animal houses were part of the owner's residence. Similar systems exist in Balang cattle (90.2% sheds) (Kadirvel *et al.*, 2022) ^[4] and Mizoram cattle (88% kachha houses) (Pundir *et al.*, 2015a) ^[11, 12].

Feeding Practices

Indigenous Tripura cattle are managed under extensive/semi-intensive systems, with grazing from 6:00 am-5:00 pm, with about 20 kg green grass/day and very limited concentrate (2-3 kg/day) as also reported by Chakrabarti *et al.*, 2022 ^[3]. Fodder cultivation is not popularly practiced; straw is used during lean periods. Similar grazing systems exist in Balang cattle (7:00 am-3:00 pm) (Kadirvel *et al.*, 2022) ^[4] and Mizoram cattle (Pundir *et al.*, 2015a) ^[11, 12], with forest grazing widely practiced. In the lean season, forest grazing, fallen tree leaves, bamboo shoots, banana leaves, jackfruit leaves, subabul, and various locally sourced trees leaves are used.

Health Management

Healthcare practices for Indigenous cattle of Tripura mostly involve vaccination for HS, BQ, and deworming. Some common disease occurrence are FMD, HS, BQ, mastitis, and parasitic infections etc as also reported by Chakrabarty *et al.*, 2022. Vaccination for HS, FMD, and BQ is practiced but not universal (Pundir *et al.*, 2014) ^[9]. Similar issues were also reported in Balang cattle with FMD (56%), parasitic infestation (22%), diarrhea (15%), leech infestation (7%) (Kadirvel *et al.*, 2022) ^[4] and in Mizoram cattle (Pundir *et al.*, 2015a) ^[11, 12].

Conclusion

Due to inbreeding and replacement by crossbred/exotic cattle, low input farming system the indigenous cattle populations are declining with time, highlighting the need for conservation and genetic improvement programs (Behl *et al.*, 2020; Kadirvel *et al.*, 2022) ^[2, 4]. The indigenous cattle in North-Eastern India show some common traits and regional adaptations. The indigenous cattle of Tripura evolved in this agroclimatic region display some unique features like coat colour, horn pattern, hairy hump, udder shape, forehead, birth weight and adult body weight, milk production, milk fat %, different body measurements, age at first estrus, age at first calving, calving interval, etc., with neighbouring populations. This resilient, unique cattle germplasm requires urgent intervention to conserve with breed recognition and genetic improvement programs.

Acknowledgments

The author would like to extend cordial thanks to the Director of ARDD, the CEO of Tripura Livestock Development Agency, and the Managing Director of TLDA for extending every possible funding for this study. The author would also like to thank the Principal of the College for providing all possible support for the successful completion of the research, and to all the heads of the departments, faculties, and staff of the College.

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