



Current scenario of milk production in the North-eastern states of India: Challenges and mitigation strategies to address milk shortfall

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The livestock sector is an integral part of India's agricultural economy, fostering strong backward and forward linkages that provide farmers with valuable income and employment opportunities, while reducing poverty (Enahoro *et al.* 2019, Kadirvel *et al.* 2019). Additionally, it enhances the nutritional value of the food supply for both rural and urban population by combating food insecurity and malnutrition (Enahoro *et al.* 2019). This sector contributed 2.07% to the total GDP and 10.63% of the total agricultural GDP in the NE region, compared to the national averages of 4.11% and 25.6%, respectively (NEDFi 2021). Total livestock population in the NE region was 24.3 million in 2019 (20th Livestock Census 2019), which contributed to 4.5% of India's entire livestock population. Cattle constitute 54.84% of the total livestock population, where goats represent approximately 22%, and pigs account for approximately 17% (Sharma and Omena 2024). Additionally, Mithun is a unique domestic animal of Nagaland (4.18%), Manipur (1.65%), and Arunachal Pradesh (30.1%), whereas Yak is unique animal of Arunachal Pradesh (2.1%) and Sikkim (1.9%), respectively (20th Livestock Census 2019, NEDFi 2021). These animals play multifaceted roles by providing essential animal protein sources, extra income, and assets for farmers (Sharma and Omena 2024), as well as have socio-economic, cultural, and religious significance (Kadirvel *et al.* 2019). Crossbred cattle have emerged as the primary dairy animals in the NE states (20th Livestock Census 2019). The contribution of Mithun (1–2.5 kg/day) and Yak (1.3±0.6 kg/day) to total milk production is minimal (Medhi *et al.* 2016, Khan and Mitra 2020). Despite the considerable potential of the dairy sector in NE states to address nutritional needs and economic growth, a substantial gap remains between the demand for milk and its

supply. Therefore, in this study, milk production scenarios associated with livestock population dynamics and the current challenges in developing mitigation strategies to meet the milk requirements of the NE states were analyzed.

This study is based on secondary data on livestock population, productive performance, per capita availability of milk, and the current market value to address milk requirements of the NE states. Data were collected and compiled from the Livestock Census-2019 and Basic Animal Husbandry Statistics, 2019 and 2023 (BAHS 2019, BAHS 2023), Government of India (GoI), and other online sources. The projected population of NE states was obtained from the Report of the Technical Group on Population Projections-2020 by the National Commission on Population, Ministry of Health and Family Welfare, New Delhi (GoI 2020).

The Compounded Annual Growth Rate (CAGR), or percentage change in the population over the base year for the t^{th} year was calculated according to Dinesh *et al.* (2023) as follows:

$$\text{Percentage change in population} = \frac{X_t - X_{t-1}}{X_{t-1}} \times 100$$

where, X_t and X_{t-1} , population in t^{th} and $(t-1)^{th}$ years, respectively.

The total annual milk requirement (A) of NE states for the year 2022-23 was calculated by multiplying the annual requirement of milk per person by the projected human population of the NE states. According to the ICMR, the milk requirement per person is 300 g/day. The milk production (ΔP) requirement from each state to meet the shortfall in milk requirements at the current production trends was calculated as follows:

$$\Delta P = (A - P) / P$$

The total monetary value of milk (M) required for addressing the gap or shortfall in milk production in NE states was calculated as:

$$M = \sum g_s r_s$$

where, g_s , gap or shortfall in milk production for each state (s); r_s , rate per kilogram of milk.

The milk production scenario in the NE states and at

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Table 1. Milk production trends in the NE states and at the all India from 2013-14 to 2022-23

	Milk Production (Figures in in '000 Tonnes)										CAGR (%)
	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	
Arunachal	43.35	46.07	50.13	52.53	54.02	55.1	60.63	43.89	46.01	45.54	-1.03
Assam	814.52	829.47	843.46	861.27	871.89	882.27	919.94	954.07	982.02	1006.42	2.42
Manipur	81.7	82.17	78.97	78.82	81.66	85.75	89.65	71.05	75.55	71.87	-5.12
Meghalaya	82.16	82.96	83.95	83.96	85.03	86.61	87.6	89.14	90.23	93.51	3.51
Mizoram	15.13	20.49	22	24.16	25.02	25.75	23.53	25.38	24.59	24.48	-0.45
Nagaland	80.61	75.69	77	79.37	74.09	72.57	61.64	55.93	61.07	49.57	-23.20
Sikkim	45.99	49.99	66.74	54.35	58.56	60.85	83.94	73.85	86.52	86.53	0.01
Tripura	129.7	141.23	152.23	159.59	174.26	185.27	198.6	206.17	216.96	230.12	5.72
NE States	1293.16	1328.07	1374.48	1394.05	1424.53	1454.17	1525.53	1519.48	1582.95	1608.04	1.56
All India level	137685.9	146313.5	155490.0	165404.4	176347.4	187749.5	198439.7	209959.9	222068.6	230577	3.69

Source: Livestock Census, 2012, 2019; BAHS (2023).

the all-India level between 2013-14 and 2022-23 is shown in Table 1. The total milk production in the NE states was 1,608.04 thousand tonnes during 2022-23, while the total milk production for the entire country was 230,577 thousand tonnes. The percentage share of milk from NE states to country's total production during 2013-14 was 0.94 %, which declined to 0.70% in 2022-23. The per capita availability of milk in Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura during 2022-23 was 81 g/day, 78 g/day, 62 g/day, 77 g/day, 55 g/day, 61 g/day, 347 g/day, and 153 g/day, respectively. Overall, in the NE states, per capita milk availability (85.26 g/day) was significantly lower than the all-India average of 459 g/day and the ICMR recommended value of 300 g/day, except for Sikkim during 2022-23. This resulted in a deficit of 5,657.865 tonnes of milk to meet the ICMR recommendation, indicating a substantial milk deficiency of approximately 71.58% in entire NE states. In Sikkim, the per capita milk availability was 347 g/day. High milk consumption (approximately 2 kg/day) in almost every household and well-developed cooperative milk societies with a sound mark chain play a crucial role in the dairy industry of Sikkim (Kharel and Choubey 2022).

Low milk production in the NE states is closely linked

Table 2. Milk yield of per milch animals of NE states as well as India during 2023

State	Exotic/ crossbred cattle (kg/ day/animal)	Non-descript/ Indigenous (kg/day/ animal)	Buffalo (kg/day/ animal)	Goat (kg/day/ animal)
Arunachal	6.57	1.42	2.45	0
Assam	4.56	1.11	3.61	0.14
Manipur	8.38	1.53	3.27	0
Meghalaya	9.04	0.79	1.77	0
Mizoram	7.87	1.71	0	0
Nagaland	6.39	2.29	3.41	0.22
Sikkim	5.26	4.3	5.78	0
Tripura	6.08	2.02	2.97	0.34
All India	8.55	3.44	6.06	0.5

Source: BAHS (2023).

to the low productivity of milch animals compared to the all-India level (Table 2) as well as a decline in the number of dairy animals. Crossbred cattle are the primary milk-producers in NE states, except for Arunachal Pradesh, Assam, and Manipur (Fig. 1). The decline in milk production in Arunachal Pradesh, Nagaland, Manipur, and Mizoram during 2022-23 was primarily due to a decreased

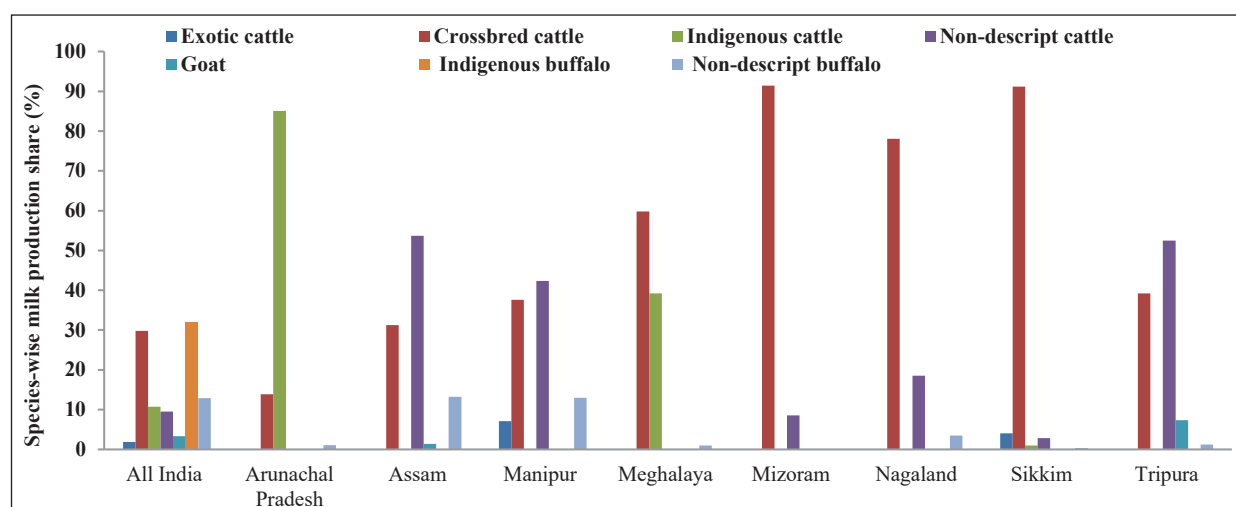


Fig. 1. Species-wise share (%) of total milk production in the NE states and all of India during 2022-23. Source: BAHS (2023).

Table 3. Dairy animal population dynamics between 2018-19 and 2022-23 in the NE states

State	2018-2019				2022-23			
	Exotic/ crossbred cattle	Indigenous/Non- descript cattle	Buffalo	Goat	Exotic/ crossbred Cattle	Indigenous/Non- descript cattle	Buffalo	Goat
Arunachal Pradesh	16.48	74.81	0.75	0	6.32	74.8	0.56	-
Assam	281.63	1253.61	93.65	331.47	319.36	1337.04	100.84	276.81
Manipur	44.47	48.53	13.05	-	32.12	54.42	7.81	-
Meghalaya	50.56	123.69	1.34	-	55.91	127.06	1.46	-
Mizoram	23.61	3.68	-	-	22.39	3.34	-	-
Nagaland	55.85	15.57	4.4	19.39	37.91	10.76	1.35	10.5
Sikkim	60.85	-	-	-	82.94	2.12	0.13	-
Tripura	68.71	148.66	1.88	135.02	90.22	163.76	2.56	131.04

*, Figure in 000.

number of milch animals compared to the 20th Livestock Census (2019) (Table 3). In contrast, Assam, Meghalaya, Sikkim, and Tripura showed an increase in milk yield, largely because of an increase in the number of milch animals, particularly crossbred cattle (Table 3). Crossbred cows are known for their superior productive performance, including a higher milk yield, compared to indigenous cows (Chakravarthi *et al.* 2017, Prasanna *et al.* 2023). These trends highlight the importance of breed selection for sustainable dairy development in NE states.

In the NE states, there are only a few recognized milch animals, such as the Lakhimi cattle of Assam, Thutho cattle of Nagaland, Siri cattle of Sikkim, Luit (Swamp) buffalo of Assam and Manipur, Assam Hill goat of Assam, and Sumi-Ne goats of Nagaland (Kadirvel *et al.* 2019). The milk yields of these animals are very low (Pundir *et al.* 2016, Pundir *et al.* 2018, Savalia *et al.* 2019, Sarma *et al.* 2023). Limited dairy animal genetic resources with high milk yield, contribute to challenges in meeting milk production demand. However, indigenous animals survive and reproduce better under the adverse agro-climatic conditions of the NE states, even in low/zero-input production systems (Kadirvel *et al.* 2019). Therefore, genetic upgrading and conservation of indigenous animals are essential for sustainable dairy production in this region.

Other major challenges contributing to low milk production in the NE states include inadequate feed and fodder availability, limited cold storage and milk-chilling plants, underdeveloped cooperative societies, poor veterinary healthcare services including Artificial

Insemination (AI) facilities, and a lack of organized market chains (Sharma and Omena 2024). The region's hilly terrain and dense forests (over 64%) worsen the feed and fodder shortage, particularly during summer, with a 75% deficit in concentrated feed (Gupta 2007, Baruah *et al.* 2014). The NE region has fewer milk cooperative societies and milk-chilling facilities than the national average (DAHD 2018-19, Mandal *et al.* 2020). AI coverage is as low as 1% in Arunachal Pradesh and ranges from 10-30% in other NE states, below the national average of 30% (DAHD 2018-19, Mandal *et al.* 2020). Milk marketing systems in NE states involve many intermediaries that reduce producer efficiency and profits (Chale *et al.* 2019). Over 80% of milk is marketed by unorganized sectors, while less than 20% is handled by organized sectors, highlighting industry challenges.

In NE states, there was a significant difference between milk requirements and actual production during 2022-23 as shown in Table 4. Except for Sikkim, all states were the shortest in meeting the ICMR-recommended milk intake values for the projected population of 2022-23. Mizoram had the most severe deficit, followed by Nagaland, Manipur, Meghalaya, Arunachal Pradesh, Assam, and Tripura, in decreasing order of shortfall. In contrast, Sikkim exceeded its milk production needs by approximately 15.70% during the same period. This difference highlights the substantial market potential (Table 4) of the region to address milk shortages, presenting a promising opportunity for investment and development in the dairy sector.

Several strategic actions are essential for improving the

Table 4. Milk requirement and shortfall with their market value at current prices in the NE states

Sate	Milk production during 2022-23 (000 tones)	Milk requirement (000 tonnes)	Gap/shortfall (%)	Market value (in Millions)
Arunachal Pradesh	45.54	169.51	-73.13	7.44
Assam	1006.42	3873.89	-74.02	172.05
Manipur	71.87	349.74	-79.45	16.67
Meghalaya	93.51	363.32	-74.26	16.19
Mizoram	24.48	134.36	-81.78	6.59
Nagaland	49.57	242.32	-79.54	11.57
Sikkim	86.53	74.79	+15.70	0.70 (surplus market)
Tripura	230.12	449.94	-48.85	13.19

dairy sector in the NE region. The importance of revisiting and implementing state-specific breeding policies focused on upgrading and crossbreeding with suitable germplasm is crucial (Mandal *et al.* 2020, Singh *et al.* 2021), along with the expansion of dairy processing, milk chilling, and cold storage facilities for storage and transportation of value-added milk products (Mandal *et al.* 2020). Furthermore, providing greater access to the organized milk market for rural milk producers can help integrate farmers' involvement in dairy as a means of livelihood or a source of extra income. Strengthening veterinary services in remote areas is vital for healthcare and AI services. Capacity building for farmers on AI, silage-making, feed preservation techniques, scientific breeding and feeding, healthcare management, and entrepreneurship development are also important.

SUMMARY

Livestock husbandry is an inseparable part of the rural economy of Northeastern (NE) states. The local market demand for milk is expanding, indicating the need for intervention in dairy development. This study focussed on the current status of milk production and the challenges faced in improving dairy production. Secondary data were collected from the Livestock Census (2019) and Basic Animal Husbandry Statistics (2019 and 2023), Government of India. The results revealed that total milk production in the NE states was 1608.04 thousand tonnes in 2022-23, accounting for only 0.70% of the country's milk production during the same year. The compounded annual growth rate (CAGR) of milk in the NE states was 1.59%, significantly lower than that in India (3.83%). Among NE states, Tripura registered the highest CAGR in milk production (5.2%), followed by Meghalaya (3.51%), Assam (2.42%), and Sikkim (0.01%). The remaining NE states experienced negative growth. Except for Sikkim, the per capita milk availability in the NE states was considerably lower than that in India. Additionally, there were significant gaps in meeting milk requirements according to the ICMR recommendations in these states. Mizoram had the highest shortfall of milk (-81.78%), followed by Nagaland (-79.54%), Manipur (-79.45%), Meghalaya (-74.26%), Arunachal Pradesh (-73.13%), Assam (-74.02%), and Tripura (-48.85%) during 2022-23. Sikkim had a surplus milk production of 15.70%. Addressing this shortfall represents substantial market potential opportunity to expand the milk market across all NE states, thereby enhancing livelihoods, food security, and the socio-economic status of millions of people.

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REFERENCES

- Baruah U, Bandyopadhyay S and Reza S K. 2014. Land use planning and strategic measures in North Eastern Region of India. *Agropedology* **24**(2): 292–303.
- Basic Animal Husbandry Statistics. 2019. Government of India, Ministry of Fisheries, Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, Krishi Bhawan, New Delhi.
- Basic Animal Husbandry Statistics. 2023. Government of India, Ministry of Fisheries, Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, Krishi Bhawan, New Delhi.
- Chakravarthi M K, Ekambaram B and Naik B R. 2017. Growth and production performance of Sahiwal cattle in Andhra Pradesh. *International Journal of Science Environment and Technology* **6**(2): 1140–42.
- Chale S, Anju Choudhury A, Datta K K, Devarani L and Hemochandra L. 2019. Milk marketing in Nagaland. *Indian Journal of Hill Farming* **32**(1): 42–45.
- DAHD. 2018-19. Annual Report 2018-19. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi.
- Dinesh K, Thakur D, Sankhyan V and Suman M. 2023. Dynamics of livestock and poultry population in India and Himachal Pradesh: A comparative temporal analysis. *The Indian Journal of Animal Sciences* **93**(12): 1216–22.
- Enahoro D, Mason-D Croz D, Mul M, Rich K M, Robinson T P, Thornton P and Staal S S. 2019. Supporting sustainable expansion of livestock production in South Asia and Sub-Saharan Africa: Scenario analysis of investment options. *Global Food Security* **20**: 114–21.
- Government of India. 2020. Report of the technical group of population projections-2020', National Commission of Population, Ministry of Health and Family Welfare, Nirman Bhawan, New Delhi.
- Gupta J J. 2007. Status and technology of fodder production, pp 59-66. *Sustainable Crop Production - for Food Sufficiency in NE India*. (Eds) Panwar A S, Ngachan S V, Munda G C and Das Anup. ICAR Publication, ICAR Research Complex for NEH Region Barapani.
- Kadirvel G, Singh L A, Rahman M and Singh M. 2019. Farm animal genetic resources in agro ecosystem of north east India. *Indian Journal of Animal Sciences* **89**(11): 1175–83.
- Khan M H and Mitra A. 2020. Mithun (*Bos frontalis*) farming: Potential, threats and conservation strategies. *Indian Farming* **70**(07): 11–15.
- Kharel N and Choubey M. 2022. Economics of production and marketing behaviour of dairy-farmers of the Himalayan state of Sikkim: A case study of South Sikkim district. *Indian Journal of Hill Farming* **35**(1): 182–90.
- Mandal D K, Mohammad A, Rai S and Ghosh M K. 2020. *Present Challenges and Future Prospect of Dairy Sector in Eastern and North Eastern India*. Policy paper No.: NDRI-ERS-1/2020. ICAR-National Dairy Research Institute Eastern Regional Station, Kalyani, Nadia, West Bengal, India.
- NEDFi. 2021. *Data Bank Journal on North Eastern States Economy (Livestock & Poultry)* **49**: 2021.
- Prasanna J S, Viroji Rao S T, Prakash M G, Kalyani R S P and Sharma M J. 2023. Production and Reproduction

- Performance of Sahiwal and HF $\times$ Sahiwal Cows. *Indian Journal of Animal Research* **57**(6): 698–701.
- Pundir R K, Singh P K, Dangi P S and Singh B. 2016. Siri cattle – An endangered breed of Sikkim, India. *The Indian Journal of Animal Sciences* **86**(8): 947–49.
- Pundir R K, Singh P K, Dangi P S and Zeliang H. 2018. Characterisation and evaluation of Tho-Tho cattle of Nagaland. *The Indian Journal of Animal Sciences* **88**(4): 434–37.
- Sarma M, Das G C, Kalita D, Zaman G U, Das B and Phookan A. 2023. Milk constituents of Luit buffalo of upper Brahmaputra valley of Assam. *The Pharma Innovation Journal* **12**(8): 1850–52.
- Savalia K B, Ahlawat A R, Gamit V V, Parikh S S and Verma A D. 2019. Recently recognized indigenous cattle breeds of India: A review. *International Journal of Current Microbiology and Applied Science* **8**(12): 161–68.
- Sharma H I and Omena T. 2024. Livestock economy in North East India: emerging patterns and its implications. *Journal of Livestock Science* **15**: 60–68.
- Singh M, Pongener N, Mollier R T and Rajkhowa D J. 2021. Dairy farming in Nagaland: An emerging enterprise. *Indian Farming* **71**(02): 23–24.