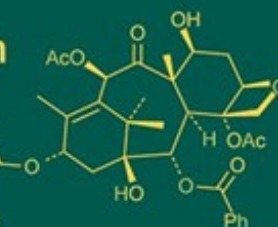


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Breeding and healthcare management practices of crossbred dairy cattle in Khasi and Jaintia Hill districts of Meghalaya

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ABSTRACT

A field-based assessment was conducted to document the housing, feeding, breeding, and healthcare management practices followed by dairy farmers rearing crossbred cattle in the Khasi and Jaintia Hill districts of Meghalaya. Information summarized from the study covered 120 dairy farmers categorized into small (10), medium (95), and large (15) herd sizes, with a mean herd strength of 2.27 ± 0.18 Standard Animal Units (SAU) per household. Artificial insemination (AI) was the predominant breeding method (95.83%), whereas natural breeding and combined natural breeding with AI accounted for 3.34% and 0.83%, respectively. Veterinarians performed 55.80% of inseminations, and conventional semen was utilized by 78.30% of farmers. Bellowing combined with clear mucus discharge served as the principal heat-detection method (75.00%), and all farmers reported monitoring heat during both morning and evening hours. Repeat breeding combined with anoestrus was the most frequently reported reproductive disorder (59.20%), with all farmers seeking veterinary consultation for reproductive management. Regarding healthcare, 62.50% of farmers dewormed calves under one year of age, fenbendazole was the most frequently administered anthelmintic (63.33%), and 44.17% dewormed cattle twice annually. Vaccination against foot-and-mouth disease (FMD) was undertaken by 58.33% of farmers, whereas 20.00% did not vaccinate their livestock. Veterinarians treated 70.00% of sick animals. The findings indicate high adoption of AI and reliance on veterinary services, alongside constrained shed space, limited feed diversification, and notable gaps in adult deworming schedules and full vaccination coverage.

Keywords: Artificial insemination, Crossbred dairy cattle, Deworming, Feeding management, Healthcare management, Housing management, Meghalaya, Reproductive problems, Vaccination

1. Introduction

Dairy cattle management in hilly regions is largely shaped by land availability, climatic conditions, access to institutional veterinary services, and the operational awareness of farmers. In the North-Eastern region of India, particularly in the Khasi and Jaintia Hill districts of Meghalaya, crossbred dairy farming serves as a vital component of rural livelihoods and livestock enterprise. Efficient herd productivity in these terrains is contingent upon sound reproductive techniques—such as accurate heat detection and artificial insemination—and systematic healthcare practices, including strategic deworming and routine immunization programs. Artificial insemination offers dairy farmers several advantages over natural service, including access to genetically superior sires at comparatively low cost, reduced risk of inbreeding, elimination of the expense and management burden of maintaining a breeding bull, and control of venereal disease transmission; in Meghalaya, AI services are further subsidized by the state Animal Husbandry and Veterinary Department, which has encouraged its widespread adoption. However, the reproductive benefit of AI can be undermined when animals suffer from common production diseases—such as fever, diarrhoea, mastitis, retention of placenta, and anoestrus—since these conditions are associated with delayed uterine involution, irregular ovarian cyclicity, and repeat breeding, all of which lower conception rates and prolong the calving interval irrespective of the breeding method used. Diseases affecting dairy cattle also depress milk yield and increase treatment costs, thereby reducing the overall profitability of crossbred dairy enterprises in the hill districts (Prajapati *et al.*, 2015; Sharma *et al.*, 2023) [1, 2].

This study was designed to document and systematically analyze the existing breeding and healthcare management practices adopted by crossbred dairy cattle keepers across the Khasi and Jaintia Hill districts of Meghalaya. By evaluating parameters such as breeding methods, semen selection, reproductive disorders, parasitic control, and prophylactic health measures, this study highlights critical operational strengths and identifies key management constraints within the regional livestock management systems.

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2. Materials and Methods

2.1 Study area and sampling

The field survey was carried out across selected dairy clusters in the Khasi and Jaintia Hill districts of Meghalaya, India. A total of 120 crossbred dairy cattle farmers were selected and stratified based on their herd size into three distinct operational categories:

- **Small herd owners:** ≤ 2 adult dairy cows ($n = 10$)
- **Medium herd owners:** 3–5 adult dairy cows ($n = 95$)
- **Large herd owners:** > 5 adult dairy cows ($n = 15$)

Farmers were selected through purposive sampling from active dairy clusters and cooperative societies operating within the two districts; households that had reared crossbred cattle continuously for at least one year, and were therefore familiar with routine housing, feeding, breeding, and healthcare protocols, were included in the survey. Across all respondents, the mean herd strength was 2.27 ± 0.18 adult cows expressed in Standard Animal Units (SAU), reflecting the generally small scale of dairy holdings in the study area.

2.2 Data collection and variable selection

Primary data were gathered using a pre-tested, structured questionnaire administered through direct farm observation and personal interviews with the principal decision-maker of each household. Key parameters investigated under Breeding Management included the system of breeding, type of breeding bull used, service provider/inseminator, semen type employed, heat detection methods and schedules, incidence of reproductive disorders, and corrective actions taken. Parameters under Healthcare Management evaluated calf and adult deworming practices, choice of anthelmintic drugs, frequency of anthelmintic administration, prophylactic vaccination coverage, prevalence of common morbidity, and health service providers consulted for animal treatment.

2.3 Statistical analysis

The collected qualitative and quantitative data were coded, compiled, and summarized using standard statistical metrics including frequency distribution (N) and percentages (%). For continuous variables such as floor space and manger dimensions, herd-size category means were compared using one-way analysis of variance (ANOVA); means bearing different superscripts within a row differ significantly ($P < 0.01$). Descriptive analysis was utilized to evaluate the trends across different management variables.

3. Results and Discussion

3.1 Breeding management practices

Artificial insemination (AI) was found to be the overwhelmingly primary breeding method, utilized by 95.83% ($n = 115$) of the surveyed farmers (Table 4). Natural breeding alone accounted for 3.34% ($n = 4$), while a combination of natural breeding and AI was practiced by 0.83% ($n = 1$) of respondents. Correspondingly, 95.83% of farms did not maintain a breeding bull on site; only 3.34% maintained their own bull and 0.83% relied on community/village bulls.

Veterinarians were the primary inseminators, delivering AI services in 55.80% ($n = 67$) of instances, followed by doorstep AI technicians (15.80%, $n = 19$) and a combination of both (25.00%, $n = 30$). Conventional unsexed semen was used by 78.30% ($n = 94$) of farmers, whereas 18.30% ($n = 22$) utilized a combination of conventional and sexed semen. The high preference for conventional semen was linked to its lower cost, higher perceived conception rates, and lower abortion concerns compared to sexed semen options. High AI adoption aligns with prior reports on dairy production systems in similar agro-climatic zones (Sabapara *et al.*, 2016; Tewari *et al.*, 2018; Deb, 2022) [4, 5, 3].

The present survey did not record breed-wise conception rates, calving outcomes, or the comparative cost of veterinary AI relative to natural service; capturing such reproductive-outcome and economic indicators in future studies would help clarify how affordability and access to professional breeding services shape farmers' choice of breeding method and its resulting fertility performance in this hill terrain.

Table 1. Distribution of dairy farmers based on breeding management practices ($n = 120$).

Breeding Parameter	Category / Response	Overall Frequency (N)	Percentage (%)
Method of Breeding	Natural breeding	4	3.34
	Artificial Insemination (AI)	115	95.83
	Natural + AI	1	0.83
Type of Bull Used	Own bull	4	3.34
	Village bull	1	0.83
	No bull kept (AI relied)	115	95.83
Type of Inseminator	Qualified Veterinarian	67	55.80
	Doorstep AI worker	19	15.80
	Both Veterinarian & AI worker	30	25.00
	AI not performed	4	3.40
Type of Semen Used	Conventional semen	94	78.30
	Conventional + Sexed semen	22	18.30

3.2 Heat detection and reproductive problems

Bellowing accompanied by clear vulval mucus discharge was recorded as the principal heat detection index, reported by 75.00% ($n = 90$) of dairy farmers (Table 5). Clear mucus discharge alone was utilized by 15.80% ($n = 19$). Combined clinical signs including bellowing, mucus discharge, frequent urination, and mounting behavior were observed by only 2.50% ($n = 3$) of farmers, primarily due to housing conditions with restricted physical space limiting heterosexual or homosexual mounting behaviors. All surveyed farmers

(100.00%) routinely monitored their cattle for estrus signs during both morning and evening hours.

Repeat breeding concurrent with anoestrus represented the major reproductive constraint, reported by 59.20% ($n = 71$) of households. Multiple reproductive issues including repeat breeding, anoestrus, and abnormal vaginal discharge were reported by 20.00% ($n = 24$), while 16.60% ($n = 20$) observed these issues alongside delayed onset of post-partum cyclicity. Uncomplicated repeat breeding was recorded in 4.20% ($n = 5$) of cases. All farmers (100.00%) consulted veterinary professionals to treat reproductive disorders. Nutritional deficiencies, lack of adequate mineral mixture supplementation during the dry pe

riod, variable estrus detection precision, and purchasing cows without recorded reproductive histories were key contributing factors behind these reproductive anomalies (Prajapati *et al.*, 2015; Sharma *et al.*, 2023) [1, 2].

The high prevalence of repeat breeding and anoestrus reported here likely reflects constraints identified in the housing and feeding sections above (Sections 3.1 and 3.2): restricted per-animal floor space in tie-barn sheds limits movement and expression of overt oestrus signs such as mounting, while mineral mixture supplementation reaching

only 35.63% of farmers, and largely confined to lactating animals, can impair ovarian function and delay resumption of post-partum cyclicity. This suggests that the comparatively high conception failure observed despite near-universal AI coverage is driven less by the breeding technique itself than by underlying nutritional and housing-related stress, consistent with the view that AI cannot fully compensate for poor body condition and chronic micronutrient deficiency in dairy cows (Sharma *et al.*, 2023) [2].

Table 2. Heat detection methods, reproductive problems, and therapeutic remedies reported by dairy farmers (*n* = 120).

Reproductive Parameter	Category / Response	Overall Frequency (N)	Percentage (%)
Heat Detection Method	Clear mucus discharge	19	15.80
	Bellowing + Clear mucus discharge	90	75.00
	Bellowing + Mucus + Frequent urination	8	6.70
	Bellowing + Mucus + Urination + Mounting	3	2.50
Time of Heat Detection	Morning inspection	120	100.00
	Evening inspection	120	100.00
Reproductive Problems	Repeat breeding	5	4.20
	Repeat breeding + Anoestrus	71	59.20
	Repeat breeding + Anoestrus + Vaginal discharge	24	20.00
	Repeat breeding + Anoestrus + Discharge + Delayed cyclicity	20	16.60
Remedies Consulted	Qualified Veterinarian	120	100.00

3.3 Healthcare management practices

Anthelmintic administration was largely concentrated on young stock, with 62.50% (*n* = 75) of farmers deworming calves under one year of age (Table 6). Deworming of adult cattle exclusively was reported by 5.83% (*n* = 7), whereas only 3.34% (*n* = 4) dewormed both young and adult animals; 28.33% (*n* = 34) did not follow any systematic deworming protocol. Fenbendazole was the dominant broad-spectrum anthelmintic used (63.33%, *n* = 76), followed by Albendazole (6.67%, *n* = 8). Regarding deworming frequency, 44.17% (*n* = 53) treated their animals twice a year, and 25.83% (*n* = 31) administered anthelmintics once a year.

Immunization against Foot-and-Mouth Disease (FMD) alone was practiced by 58.33% (*n* = 70) of respondents. Broader prophylactic coverage—including combined FMD and Goat Pox vaccines—was reported by 17.50% (*n* = 21), while FMD with Brucellosis was practiced by 3.33% (*n* = 4). Overall, 20.00% (*n* = 24) of farmers failed to vaccinate their dairy herd against endemic infectious diseases. Vaccination was initiated predominantly at four months of age or above (69.17%).

Generalized disease conditions—characterized by fever, diarrhea, coughing, retained placenta, anorexia, mastitis, and functional

anoestrus—were reported as major production-limiting health issues by 95.00% (*n* = 114) of farmers, whereas 5.00% (*n* = 6) reported severe disease complexes of FMD, Brucellosis, and mastitis. Veterinary clinical interventions were sought by 70.00% (*n* = 84) of farmers for diseased stock, while 14.17% (*n* = 17) utilized Veterinary Field Assistants (VFAs) and 15.83% (*n* = 19) engaged both personnel. Environmental factors such as inadequate shed hygiene, unscientific housing, unbalanced feeding regimes, low mineral mixture inclusion, and irregular deworming schedule exacerbated general morbidity (Patel *et al.*, 2019; Pasare *et al.*, 2022) [7, 6].

Sustaining and expanding these healthcare outcomes depends substantially on the state Animal Husbandry and Veterinary Department, which currently provides subsidized AI, organizes annual mass FMD vaccination camps, and deploys veterinarians and Veterinary Field Assistants to remote hill villages where private practitioners are largely absent. Strengthening the Department's outreach—through additional doorstep AI and vaccination personnel and improved cold-chain vaccine delivery—would likely help close the 20.00% vaccination gap and the 28.33% deworming gap identified in this study, particularly among the more remote small- and medium-herd households.

Table 3. Healthcare management practices adopted by dairy farmers in the study area ($n = 120$).

Healthcare Parameter	Category / Response	Overall Frequency (N)	Percentage (%)
Age Group Dewormed	Calves (< 1 year old)	75	62.50
	Adults (> 1 year old)	7	5.83
	Both Calves and Adults	4	3.34
	Not dewormed	34	28.33
Anthelmintic Used	Fenbendazole	76	63.33
	Albendazole	8	6.67
	None (Not dewormed)	36	30.00
Frequency of Deworming	Once annually	31	25.83
	Twice annually	53	44.17
	None (Not dewormed)	36	30.00
Vaccination Coverage	FMD only	70	58.33
	FMD + Brucellosis	4	3.33
	FMD + Brucellosis + HS & BQ	1	0.83
	FMD + Goat Pox	21	17.50
	Unvaccinated	24	20.00
Treatment Service Provider	Qualified Veterinarian	84	70.00
	Veterinary Field Assistant (VFA)	17	14.17
	Both Veterinarian & VFA	19	15.83

4. Conclusion

Crossbred dairy cattle owners in the Khasi and Jaintia Hill districts of Meghalaya demonstrate a high adoption rate of artificial insemination, routine estrus monitoring, and reliance on professional veterinary care for treatment and reproductive management. However, significant constraints persist regarding the high incidence of reproductive disorders (notably repeat breeding and anoestrus), inadequate parasite control in adult cows, and gaps in complete livestock vaccination schedules. Targeted extension interventions focusing on improved strategic adult anthelmintic regimes, and full prophylactic immunization coverage are essential to enhance herd reproductive efficiency and health status in the region.

Conflict of Interest

The authors declare that there are no competing financial or institutional interests regarding the publication of this manuscript.

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