Research Article

Evaluation of Milk Yield, Quality, Feed Efficiency, and Economic Performance of Holstein Friesian Crossbred Cows at Long Hoa and Evergrowth Cooperatives in Mekong Delta of Vietnam

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Abstract | This study evaluated the milk yield, quality, and feed efficiency of crossbred Holstein Friesian (HF) cows with varying proportions of HF genetics (1/2HF, 3/4HF, and 7/8HF) reared at Long Hoa and Evergrowth cooperatives in Vietnam. Results indicated that milk yield increased with higher HF genetic proportions, with 7/8HF cows producing the highest average daily milk yield (15.2 kg/day at Long Hoa and 14.1 kg/day at Evergrowth). However, milk fat and dry matter content decreased as the HF proportion increased, 1/2HF cows exhibiting the highest fat content (4.14%). Feed intake analysis showed that 7/8HF cows at Long Hoa and 3/4HF cows at Evergrowth had the lowest dry matter and crude protein intake per kilogram of milk produced, indicating superior feed efficiency. An economic evaluation revealed that 7/8HF cows at Long Hoa and 3/4HF cows at Evergrowth had the lowest feed cost per kilogram of milk. It was concluded that a higher proportion of HF genetics improves milk yield but may reduce milk fat and solids, while feed efficiency and milk profitability vary by crossbreed and management system. For optimal performance under cooperative conditions, 3/4HF cows are recommended for Evergrowth, while 7/8HF cows are best suited for Long Hoa. A more refined feeding strategy should be developed for both cooperatives to further enhance productivity and milk quality.

Keywords | Daily milk yield, Profitability, Feed utilization, Holstein crossbred cows, Milk performance, Milk quality

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INTRODUCTION

Vietnam's geographical features and tropical monsoon climate are favorable for developing pasturelands for dairy cow farming. However, dairy farming requires considerable investment in both technology and finance. There are two types of dairy farms in both the North and the South of Vietnam, which are large farms with good facilities, high technologies and pure Holstein breeds (with high milk yields of over 30 kg/day), while households with limited facilities and technical knowledge raise crossbred cows (Holstein x Red Sindhi) which produce lower milk yields (around 15 kg/day) but have higher milk quality that commands better prices. In practice, approximately 85% of dairy cows in Vietnam are raised on small-scale household farms (Thu *et al*., 2023). These smallholder farmers often fail to adequately track or record data on daily feed intake, nutrient composition, milk yield, or the milk production potential of their cows, which would help improve the technical and economic efficiency of dairy farming (Thanh, 2021).

In the Mekong Delta (MD), there are currently two relatively large dairy cow cooperatives: Long Hoa Dairy

Cow Cooperative in Can Tho City and the Evergrowth Cooperative in Soc Trang (Phong and Thu, 2016). Monitoring the milk production performance at these two cooperatives could help implement effective measures to improve both milk yield and quality. Therefore, this study was conducted with the objective of monitoring, recording, and analyzing the types and quantities of feed, rations, milk yield, and milk quality. The findings can help evaluate the effectiveness of dairy farming practices and provide recommendations to smallholder farmers and dairy cooperatives, contributing to the development of the dairy farming sector.

MATERIALS AND METHODS

Location and time

The investigation was conducted at Long Hoa Dairy Cow Cooperative in Long Hoa Ward, Binh Thuy District, Can Tho City, and Evergrowth Agricultural Cooperative in Tai Van Commune, Tran De District, Soc Trang Province. The study period was from April 2022 to April 2023.

Milk and feed samples were collected from the farms and analyzed for chemical composition in the Laboratory E205 of the Faculty of Animal Science, College of Agriculture, Can Tho University.

Experimental design and feeds

The study involved Holstein Friesian (HF) crossbred dairy cows with different genetic proportions: First generation (1/2 HF), second generation (3/4 HF), and third generation (7/8 HF), in their first, second, and third lactation stages, raised at Long Hoa and Evergrowth cooperatives. The average body weights of the 1/2 HF, 3/4 HF, and 7/8 HF crossbred dairy cows were 441 ± 5.25, 447 ± 6,71, and 452 ± 4,84 kg, respectively. The body condition scores (BCS) of all groups ranged from 3.0 to 3.5.

Measurements taken

Milk yield

Daily milk yield and monthly milk production over a 300-day lactation period were measured using a milking machine. Milk yield data were collected by providing farmers with logbooks and instructions for data recording. The research team conducted regular site visits to collect and verify the data.

Milk quality

The samples were stabilized and analyzed using a Master Milkotester automatic milk analyzer (European-made) for the following parameters: Total solids, milk fat, protein, lactose, and minerals. Milk quality was assessed through 183 milk samples collected near the end of the research period, including all HF crossbred generations, lactation stages, and milking months at both cooperatives. Milk samples (300 ml) were taken immediately after milking, and each cow's milk was analyzed separately for each milking session.

Feed efficiency

feed intake per kg of milk and feed cost per kg of milk.

Feed intake and chemical analysis

Feed was weighed each morning before feeding, and leftovers or spilled feed from each individual cow was recorded. For three days in the middle of each lactation month, feed intake was directly measured to verify data. The mixed feed used at Evergrowth was labeled as concentrate 1 (2.400 kcal ME/kg), and while at Long Hoa was labeled as concentrate 2 (2.300 Kcal ME/kg). The feed types were analyzed for Dry Matter (DM), Organic Matter (OM), Crude Protein (CP), and Total Ash according to AOAC (1990). Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were analyzed using the Van Soest *et al.* (1991) method.

Feed conversion ratio (FCR) per kg of milk was calculated as: FCR = Feed intake (kg DM/day) / Milk yield (kg/day)

Data analysis

All data were calculated using Microsoft Excel 2019. Descriptive statistics (mean, standard error) were then applied. To compare means of different indicators between the two groups of dairy cows, two-sample mean comparison was conducted using Minitab version 18.1 (Minitab, 2017).

RESULT AND DISCUSSIONS

Chemical composition of feeds

The chemical composition of the feed used in dairy cattle farming is presented in Table 1.

Table 1: Chemical composition of the feeds used for dairy cows in the study.

Item	DM (%)	Composition (% of DM)				
		OM	CP	NDF	ADF	Ash
Fermented pineapple peels	9.50	93.0	5.28	58.6	28.5	7.00
Natural mixed grasses	12.6	94.2	8.93	65.8	33.8	5.78
Napier grass	16.4	87.2	11.5	63.7	38.9	12.8
Concentrate 1 (Soc Trang)	87.0	90.2	15.9	52.2	19.4	9.81
Concentrate 2 (Can Tho)	94.0	90.1	15.4	43.2	16.8	9.90

DM: Dry Matter, OM: Organic Matter, CP: Crude Protein, NDF: Neutral Detergent Fiber, ADF: Acid Detergent Fiber.

As shown in Table 1, fermented pineapple peel had the lowest DM content (9.50%), while the concentrates 1 and 2 had the highest (87.0% and 94.0%). The highest CP

contents were found in concentrate 1 and concentrate 2 (15.9% and 15.4%) respectively, indicating they are the main protein sources in the dairy cow diet. The NDF contents of Napier grass and natural mixed grasses are 63.7% and 65.8%, respectively. Thus, Napier grasses were the main fiber source in the ration.

Milk production

Data on actual milk yields from monitored cow groups are presented in Table 2.

Table 2 shows that 7/8HF cows had the highest 300-day milk yield (4,322 kg), followed by 3/4HF (4,180 kg), and the lowest was 1/2HF (3,289 kg). The difference in milk yield between 1/2HF and both 3/4HF and 7/8HF was statistically significant (P<0.05), while the difference between 3/4HF and 7/8HF was not statistically significant.

These results are consistent with those reported by Hanh (2010), who found that in Lam Dong province of Vietnam, 7/8HF cows produced the highest milk yield (4,919 kg), followed by 3/4HF (4,339 kg) and 1/2HF (3,934 kg) over an average lactation period of 309.6 days. However, Tue *et al*. (2010) reported the highest 305-day yield in 3/4HF cows, followed by 7/8HF and then 1/2HF cows (4,231 kg; 4,134 kg; and 3,449 kg, respectively) in Bac Ninh. According to Dat (1999), milk yields of 1/2HF, 3/4HF, and 7/8HF cows in Ho Chi Minh City were 3,643 kg, 3,796 kg, and 3,415 kg, respectively. This difference was likely due to the limited adaptation of 7/8HF cows to the hot and humid conditions in Ho Chi Minh City, combined with the less advanced management practices of farmers at that time relative to current standards at both cooperatives. In Lam Dong and Bac Ninh, the cooler climate likely favored the adaptation of 7/8HF cows, supporting improved performance under those conditions.

Table 3 shows that the average milk yield (kg/day) of each cow group at both cooperatives peaked in the second month and then gradually declined over the lactation cycle. The highest yields in month 2 were recorded in the 7/8HF group [19.6 ± 0.024 (kg/day) at Long Hoa; 18.6 ± 0.454 (kg/day) at Evergrowth], while the lowest yields were in the 1/2HF group (16.2 ± 0.113 kg/day at Long Hoa; 15.3 ± 0.174 kg/day at Evergrowth). The average milk production (kg/day) of one lactation for 1/2HF, 3/4HF, and 7/8HF dairy cows were 11.6, 13.9, and 15.2 for the LH cooperative, and 10.8, 13.9, and 14.1 for the Evergrowth cooperative.

Table 2: Comparison of 300-day milk yield (kg) among HF-crossbred cows at Long Hoa and Evergrowth cooperatives.

	Cow groups			P-values are for comparisons between groups (1), (2), and (3)		
	1/2HF (1)	3/4HF (2)	7/8HF (3)	P (1 - 2)	P (2 - 3)	P (1 - 3)
N	30	38	28	0.001	0.128	0.001
Mean±SE	3,289 ± 47.0	4,180 ± 40.0	4,322 ± 39.0			

Statistical analysis used a t-test; Holstein Friesian (HF) crossbred dairy cows with different genetic proportions: 1st generation (1/2 HF), 2nd generation (3/4 HF), and 3rd generation (7/8 HF)

Table 3: Monthly milk production (kg/day) of HF crossbred cow groups at the Long Hoa and Evergrowth cooperatives.

Lactation month	Long Hoa cooperative (Mean±SE)			Evergrowth cooperative (Mean±SE)		
	1/2HF	3/4HF	7/8HF	1/2HF	3/4HF	7/8HF
	n=6	n=8	n=7	n=24	n=30	n=21
1	14.9±0.095	17.5±0.252	18.8±0.025	14.0±0.183	17.6±0.142	18.1±0.122
2	16.2±0.113	18.5±0.214	19.6±0.024	15.3±0.174	18.6±0.136	18.6±0.452
3	15.2±0.114	17.5±0.322	18.9±0.033	14.3±0.192	17.5±0.164	18.3±0.124
4	14.2±0.142	16.6±0.349	17.8±0.041	13.1±0.220	16.4±0.193	16.9±0.126
5	12.7±0.122	14.8±0.394	16.3±0.044	11.8±0.189	14.9±0.173	15.3±0.128
6	11.0±0.151	13.5±0.415	14.9±0.059	10.4±0.175	13.4±0.176	13.8±0.150
7	10.2±0.093	12.3±0.476	14.0±0.039	9.18±0.205	12.4±0.194	12.6±0.167
8	8.79±0.092	11.0±0.457	12.5±0.046	7.90±0.181	11.1±0.177	11.0±0.163
9	7.57±0.099	9.69±0.400	11.0±0.036	6.65±0.167	9.68±0.173	9.22±0.197
10	5.73±0.234	7.77±0.421	8.18±0.258	5.17±0.151	7.82±0.182	7.54±0.155
Average	11.6±0.089	13.9±0.354	15.2±0.041	10.8±0.176	13.9±0.155	14.1±0.123

Holstein Friesian (HF) crossbred dairy cows with different genetic proportions: 1st generation (1/2 HF), 2nd generation (3/4 HF), and 3rd generation (7/8 HF).

Milk yield

A comparison of 300-Day Lactation Milk Yield of Dairy Cows at Long Hoa and Evergrowth Cooperatives is presented in Table 4.

The 300-day lactation milk yields of 1/2HF and 3/4HF cows at the Long Hoa cooperative were 3,493 ± 29.0 kg and 4,179 ± 78.0 kg, respectively, which were higher than those of the same crossbred groups at Evergrowth Cooperative (3,238 ± 53.0 kg and 4,180 ± 47.0 kg). However, these differences were not statistically significant (P>0.05). The milk yield of 7/8HF cows at Long Hoa Cooperative was higher than that at Evergrowth Cooperative, with values of 4,556±33.1 kg and 4,243±37.0 kg, respectively, showing a statistically significant difference (P<0.05). This difference likely reflects the feeding practices at Long Hoa, where farmers commonly use fermented pineapple peel together with natural grasses as the main roughage sources. These practices may have contributed to the better adaptability of the 7/8HF cows under the cooperative's production conditions.

Milk quality

Milk quality is crucial for both nutritional value and economic significance. It is determined by the components present in the milk. The milk composition by cow groups, lactating months and cooperatives are presented in Tables 5, 6, and 7.

Table 4: Comparison of 300-day lactation milk yield (kg) of 1/2HF, 3/4HF, and 7/8HF dairy cows between long hoa and evergrowth cooperatives.

	1/2HF-EV	1/2HF-LH	3/4HF-EV	3/4HF-LH	7/8HF-EV	7/8HF-LH
n	24	6	30	8	21	7
Mean±SE	3,238±53.0	3,493±29.0	4,180±47.0	4,179±78.0	4,243±37.0	4,556±33.0
P	0.556		0.994		0.001	

EV= Evergrowth Cooperative; LH= Long Hoa Cooperative; Statistical Analysis used a t-test; P-values indicate statistical significance between groups.

Table 5: Comparison of milk quality (%) among HF crossbred cow groups at Long Hoa and Evergrowth cooperatives.

Item	Parameters	Cow groups			P		
		1/2HF (1)	3/4HF (2)	7/8HF (3)	1 vs 2	1 vs 3	2 vs 3
		n=50	n=83	n=50			
Fat	Mean±SE	4.14±0.061	3.80±0.037	3.56±0.039	0.001	0.001	0.001
Protein	Mean±SE	3.63±0.024	3.57±0.019	3.59±0.018	0.064	0.162	0.604
DM	Mean±SE	13.4±0.072	12.9±0.063	12.7±0.047	0.001	0.001	0.003

P-values indicate statistical significance between groups, DM: Dry Matter; Statistical Analysis used a t-test; Holstein Friesian (HF) crossbred dairy cows with different genetic proportions: 1st generation (1/2 HF), 2nd generation (3/4 HF), and 3rd generation (7/8 HF).

Table 6: Monthly milk fat percentage of dairy cow groups at long Hoa and ever growth cooperatives.

Lactation month	1/2HF (n=50)		3/4HF (n=83)		7/8HF (n=50)	
	Mean	± SE	Mean	± SE	Mean	± SE
1	3.85	0.139	3.59	0.090	3.30	0.099
2	3.76	0.172	3.54	0.117	3.28	0.094
3	3.82	0.190	3.62	0.105	3.44	0.121
4	4.03	0.170	3.78	0.121	3.48	0.088
5	3.93	0.163	3.90	0.096	3.54	0.088
6	4.23	0.189	3.93	0.108	3.65	0.074
7	4.29	0.178	4.00	0.126	3.68	0.101
8	4.52	0.103	3.88	0.088	3.70	0.113
9	4.45	0.091	3.89	0.076	3.85	0.113
10	4.61	0.073	3.97	0.215	3.82	0.109

Holstein Friesian (HF) crossbred dairy cows with different genetic proportions: 1st generation (1/2 HF), 2nd generation (3/4 HF), and 3rd generation (7/8 HF).

Table 7: Comparison of Milk Quality (Mean±SE, %) between Long Hoa (LH) and Evergrowth (EV) Cooperatives

Item	LH (n=58)	EV (n=125)	P
Fat	3.51±0.047	3.98±0.031	0.001
Protein	3.64±0.019	3.57±0.015	0.009
DM	12.83±0.57	13.03±0.54	0.024

Statistical Analysis used a t-test; P-values indicate statistical significance between groups; EV = Evergrowth Cooperative; LH = Long Hoa Cooperative

Milk quality among Holstein crossbred groups

Milk quality, primarily influenced by fat, protein, and dry matter (DM) content, is a critical indicator of both nutritional value and marketability. Table 5 summarizes the comparative milk composition among three Holstein crossbred groups (1/2HF, 3/4HF, and 7/8HF) at Long Hoa and Evergrowth cooperatives. The milk fat content

significantly decreased with an increasing proportion of Holstein genetics. These differences were statistically significant (P<0.05 for all comparisons). The decline in milk fat content with increasing HF proportion aligns with the breed's genetic selection for higher milk volume rather than richness. Cows with lower HF inheritance retained more indigenous traits that promote greater fat synthesis. The observed reduction in milk fat percentage is influenced by multiple factors. Genetically, HF cows are selected for high milk yield, which typically results in lower milk fat due to a dilution effect (Lim *et al*., 2020; Bondan *et al*., 2018). In addition, lactation stage and energy balance affect fat content, as early lactation and negative energy balance can reduce milk fat synthesis (Nogalski *et al*., 2024). Protein content showed no significant differences across groups. This suggests that Protein content may be more stable across different HF crossbreeds and less sensitive to genetic variation compared to fat or dry matter. While dry matter followed a similar trend to fat content. higher dry matter in lower HF-percentage cows reflects the overall denser nutritional profile of milk from animals with more native genetics. which can be advantageous in cheese or yogurt production.

Table 6 shows how milk fat content changed monthly across lactation in different cow groups. All groups followed a similar trend with fat content increasing steadily from month 1 to month 10 for 1/2HF, 3/4HF and 7/8HF cows. These changes reflect physiological adaptations during lactation. As milk yield declines over time, fat concentration naturally increases due to the reduction in overall milk volume. Notably, cows with a higher proportion of native genetics (1/2HF) exhibited greater increases in fat content over time, likely due to more robust energy partitioning toward milk solids.

A comparison of milk quality between cooperatives shows that fat and dry matter contents were significantly higher at Evergrowth (Table 7), likely due to feed composition differences such as higher use of fermented pineapple waste and natural grasses. Protein content was slightly higher at Long Hoa (3.64%) than Evergrowth (3.57%) a statistically significant difference (P= 0.009) though biologically modest. These differences highlight how management practices, forage types, and environmental factors between cooperatives can impact milk composition. Evergrowth's higher milk fat and dry matter levels suggest a possible focus on milk quality, whereas Long Hoa may prioritize Protein-rich diets.

In summary, milk fat and dry matter contents decline as HF blood level increases, while Protein remains stable, milk fat content rises throughout lactation, with the highest increases in 1/2HF cows. Evergrowth cooperative showed higher fat and dry matter but slightly lower Protein than Long Hoa. These results emphasize the importance of aligning breeding strategies and nutritional management with production goals whether for volume, quality or a balance of both.

Feed consumption per kg of milk

The feed consumption to produce 1 kg of milk by dairy cows is presented in Table 8.

Table 8: Feed consumption to produce 1 kg of milk by dairy cows at Long Hoa and evergrowth cooperatives.

Item		Long Hoa cooperative			Evergrowth cooperative		
		1/2HF	3/4HF	7/8HF	1/2HF	3/4HF	7/8HF
Concentrated Feed (kg/day)	As Fed	4.15	4.91	5.32	3.61	4.29	4.46
	DM	3.90	4.62	5.00	3.14	3.73	3.88
	CP	0.601	0.711	0.770	0.499	0.593	0.618
Fermented Pineapple Peel (kg/day)	As Fed	34.88	38.06	36.79	-	-	-
	DM	3.31	3.62	3.49	-	-	-
	CP	0.175	0.191	0.184	-	-	-
Napier grass / Mixed Grass* (kg/day)	As Fed	12.3	12.0	12.0	43.6	47.6	46.7
	DM	2.01	1.97	2.00	5.50	6.00	5.89
	CP	0.231	0.226	0.230	0.491	0.536	0.526
Total (kg/day)	DM	9.22	10.21	10.49	8.64	9.73	9.77
	CP	1.01	1.13	1.18	0.99	1.13	1.14
Milk Yield (kg/day)	-	11.6	13.9	15.2	10.8	13.9	14.1
Feed Intake per kg Milk (kg)	DM	0.795	0.735	0.690	0.800	0.700	0.693
	CP	0.087	0.081	0.078	0.092	0.081	0.081
Feed Conversion Efficiency (%)		22,6	25,3	28,1	22,9	26,8	27,6

Napier grassused at Long Hoa Cooperative; natural mixed grass used at Evergrowth Cooperative; Feed Conversion Efficiency (FCE% = Milk Output / Feed Input * 100).

Table 9: Gross margin (VND/kg milk) at long Hoa and evergrowth cooperatives.

	Long Hoa cooperative			Evergrowth cooperative		
	1/2HF	**3/4HF**	**7/8HF**	**1/2HF**	**3/4HF**	**7/8HF**
Concentrated feed	2,795	2,719	2,746	2,625	2,434	2,53
Fermented pineapple peel	1,199	1,075	969			
Napier grass/ Mixed grass	528	424	395	1,982	1,688	1,656
Total feed cost	4,522	4,218	4,110	4,607	4,122	4,186
Milk price	14,000	14,000	14,000	12,800	12,800	12,800
Gross margin	9,478	9,782	9,890	8,193	8,678	8,614

Concentrated feed cost: Long Hoa: 7.840 (VND/kg); Evergrowth: 8.000 (VND/kg); Fermented pineapple peel: 400 VND/kg; Napier grassat Long Hoa and natural grasses at Evergrowth: 500 VND/kg; Holstein Friesian (HF) crossbred dairy cows with different genetic proportions: 1st generation (1/2 HF), 2nd generation (3/4 HF), and 3rd generation (7/8 HF).

Table 8 shows that the dry matter (DM) intake for 1/2HF, 3/4HF, and 7/8HF cows at the Long Hoa Cooperative was 9.22 (kg/day), 10.21 (kg/day) and 10.49 (kg/day), respectively. At Evergrowth Cooperative**,** the values were 8.64 (kg/day), 9.73 kg/day and 9.77 (kg/day). These results show that DM intake for each crossbred group at Long Hoa was higher than that at Evergrowth. The crude Protein (CP) intake of 1/2HF, 3/4HF and 7/8HF cows at Long Hoa was 1.01 (kg/day), 1.13 (kg/day) and 1.18 (kg/day), respectively. At Evergrowth the values were 0.99 (kg/day), 1.13 (kg/day) and 1.14 (kg/day). Dry matter consumption per kg of milk for 1/2HF, 3/4HF, and 7/8HF cows at Long Hoa was 0.795, 0.735, and 0.690 (kg), respectively. CP consumption per kg of milk was 0.087, 0.081, and 0.078 (kg). At Evergrowth, DM consumption per kg of milk was 0.800, 0.700, and 0.693 (kg), and CP consumption per kg of milk was 0.090, 0.080 and 0.081 (kg), respectively. Feed intake per kg milk of cow groups was similar at both cooperatives.

Among the groups, the 7/8HF cows at Long Hoa had the lowest DM and CP consumption per kg of milk, while at Evergrowth, 3/4HF and 7/8HF cows had the lowest values. These values are higher than those reported in the study by Hanh (2010), where DM consumption per kg of milk for 1/2HF. 3/4HF. and 7/8HF cows was 0.583; 0.560 and 0.564 (kg), respectively.

Estimated feed cost for producing 1 kg of milk

From Table 9 with feed prices of 7,840 (VND/kg) for Long Hoa and 8,000 (VND/kg) for Evergrowth and forage prices of 400 (VND/kg) (for fermented pineapple peel) and 500 (VND/kg) (grass), the estimated feed cost per 1 kg of milk at Evergrowth was 1/2HF: 4,607 VND, 3/4HF: 4,122 (VND) and 7/8HF: 4,186 (VND) and at Long Hoa, the costs were 1/2HF: 4,522 VND, 3/4HF: 4,218 VND and 7/8HF: 4,110 (VND). The lowest feed cost per 1 kg of milk was for 7/8HF cows at Long Hoa and 3/4HF cows at Evergrowth.

The observed difference in milk price 12,800 VND/kg at Evergrowth and 14,000 VND/kg at Long Hoa, appears to result from differences in cooperative marketing and milk delivery systems. At Evergrowth Cooperative, milk is first collected by the cooperative and then transported to the purchasing company, incurring additional handling and logistical costs. In contrast, farmers at Long Hoa Cooperative deliver milk directly to the purchasing company, reducing intermediary expenses and achieving higher farm-gate prices. The gross margin (Revenue - Feed Cost only) per kg of milk was Evergrowth: 1/2HF: 8,193 (VND), 3/4HF: 8,678 (VND) and 7/8HF: 8,614 (VND); and Long Hoa: 1/2HF: 9,478 (VND), 3/4HF: 9,782 (VND) and 7/8HF: 9,890 (VND).

CONCLUSIONS

The milk yield of the cow groups at the Long Hoa and Evergrowth cooperatives increased as the proportion of Holstein Friesian (HF) blood increased. The average daily milk yield (kg/day) of 1/2HF, 3/4HF, and 7/8HF cows at Long Hoa Cooperative was respectively: 11.6±0.089, 13.9±0.354 and 15.2±0.04. While at Evergrowth Cooperative, the corresponding values were: 10.8±0.176. 13.9±0.155 and 14.1±0.123 (kg/day), respectively.

The average total milk yield over a 300-day lactation period was highest in 7/8HF cows (4,322 kg), followed by 3/4HF cows (4,180 kg), and lowest in 1/2HF crossbreds (3,289 kg). All crossbred HF groups at both cooperatives reached peak monthly milk yield in the second month then gradually declined through the remainder of the lactation cycle.

Milk fat and total solids content decreased as the proportion of HF genetics increased. However, there was no significant difference in milk Protein content among the crossbreds. In terms of dry matter (DM) and crude Protein (CP) consumption per kg of milk, the most efficient group at Long Hoa was 7/8HF and at Evergrowth it was 3/4HF.

These results indicate that aligning breeding strategies and nutritional management with both Holstein Friesian (HF) inheritance and the specific conditions of each cooperative is critical. Such alignment can optimize milk yield, milk composition and feed efficiency.

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NOVELTY STATEMENT

This study evaluated milk yield, milk composition, feed efficiency, and gross margin of crossbred Holstein Friesian cows with different HF genetic proportions (1/2HF, 3/4HF, and 7/8HF) under cooperative farming conditions in the Mekong Delta of Vietnam. Results showed that milk yield increased with higher HF genetic proportion, whereas milk fat and solids decreased, and feed efficiency and gross margin varied depending on both genetic level and management system. Based on these findings, practical recommendations are provided for selecting appropriate crossbreeding strategies to optimize dairy productivity and profitability in cooperative farming systems.

AUTHOR'S CONTRIBUTION

LVP and NVT conceived and designed the experiments. LVP and NVT performed the experiments. LVP analyzed the data. NVP and NVT wrote the paper. All authors reviewed and approved the final manuscript.

Generative AI and AI-assisted technology statement

The authors confirm that no generative artificial intelligence or AI-assisted tools were used in preparing this manuscript

Conflict of interest

The authors have declared no conflict of interest.

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