Research Article:

INFLUENCE OF NON-GENETIC FACTORS ON MILK YIELD AND COMPOSITION IN JERSEY AND HOLSTEIN-FRIESIAN CROSSBRED COWS IN A COMMERCIAL CATTLE FARM OF CHITWAN, NEPAL

Surya Prasad Sharma* and Amita Gyawali
Department of Animal Breeding, Institute of Agriculture and Animal Science, Tribhuvan University, Kirtipur, Kathmandu, Nepal

*Corresponding author: surya.sharma@rc.tu.edu.np

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ABSTRACT

The study was carried out to find out the effect of non-genetic factors on milk yield and milk composition traits of Jersey and Holstein Friesian (HF) crossbred on farm from 2021 to 2023 at Shree Laligurans Dairy Farm and Research Center, Chitwan district of Nepal. Altogether, 2030 daily milk records of 400 lactating crossbred cows (HFX-271, JX- 129) maintained under uniform management were analyzed. Breed, parity, stage of lactation, season of milking, and month of calving were considered as non-genetic factors affecting average daily milk yield and milk composition traits (fat, SNF, and protein) significantly. The least square analysis was performed by using Harvey (1990) software package, and comparison of significant means was done by using Duncan's Multiple Range Test (DMRT). The least square mean and standard error for daily milk yield of Holstein and Jersey crossbred cows in the study were 9.65±0.92 and 9.54±1.20 liters, respectively. The result revealed the non-significant effect of breed on milk yield and fat%, but a significant effect on other milk composition traits such as SNF% and protein%. The overall means for fat, SNF, and protein were 4.56%, 8.68%, and 3.09%, respectively. Furthermore, stage of lactation, season of milking, and month of calving significantly affected both milk yield and composition. Based on these findings, Jersey crossbred cows are better suited for milk yield and composition quality within the sub-tropical agro-climatic conditions of Chitwan. To optimize commercial dairy productivity, it is recommended to synchronize calving and milking schedules with the spring season and keep the best milk-producing cows on the farm for three to six milking cycles (parity) before culling them.

Keywords: Calving month, lactation, parity, protein content, SNF

INTRODUCTION

Livestock contributes around 24 % of the national agricultural GDP, and 13% of the national GDP (MoALD, 2025). The dairy sector itself contributes nearly 8% of agricultural GDP and around 4% of Nepal's total national GDP (BEAM Exchange/GoN, 2025). The agriculture development strategy (ADS, 2015-2035) has prioritized the dairy value chain to enhance milk productivity and reinforce local milk cooperatives (MoALD, 2014). Though national milk production has steadily increased over the last decade, demand remains short by about 550,000 liters per day (BEAM Exchange/GoN, 2025). The structure and features of livestock farming in Nepal should be contextualized to understand the persistence of the national milk deficit. Historically, the geographical complexity of Nepal has led to a mixed crop-livestock system in which cattle farming was primarily for draught power and organic manure rather than for commercial dairy output (Tulachan & Neupane, 1999). Consequently, Nepalese livestock remains largely subsistence-based while the indigenous cattle breeds are low milk producers

(Neopane & Pokharel, 2005). Although these indigenous breeds possess resilience to harsh climates and endemic diseases, their genetic potential for milk yield is limited, averaging around 450 liters per lactation (Gorkhali et al., 2020).

Despite the artificial insemination program starting in 1969, low milk productivity remains a major challenge for the commercial sector (NLBC, 2011). Non-milking cows represent about 14% of the total cattle population, creating an economic burden to farmers (Khanal et al., 2022). The government has implemented a crossbreeding program for our indigenous cattle with Jersey and Holstein Friesian (HF) breeds to meet the growing milk demand (Pradhan et al., 2008). Among these two breeds, Jerseys are better known for butterfat (4.84%) and protein (3.95%) while the Holsteins are known for their higher milk yield (Capper & Cady, 2012). Despite their potential, all breeds do not perform equally well in all climatic and geographical conditions. Limited scientific research has been done to compare the performance of Jersey and HF crossbreeds regarding milk yield and composition under a particular condition. Both the quality and quantity of milk are affected by complex non-genetic factors such as parity, stage of lactation, and season (Bajwa et al., 2004; Javed et al., 2004). Understanding these non-genetic effects is very important for establishing effective selection and breeding programs. However, commercial dairy farms in Nepal lack localized scientific research regarding the performance of crossbred cattle under specific climatic conditions, such as the sub-tropical conditions of Chitwan. Genetic evaluations become invalid if raw phenotypic data is not pre-adjusted for these complex environmental (non-genetic) variables (Henderson, 1984). Therefore, the primary objective of this study is to evaluate the influence of non genetic factors-namely parity, stage of lactation, and season of calving on milk yield and milk composition of Jersey and Holstein-Friesian crossbred cattle managed in the subtropical environment of Chitwan, Nepal.

RESEARCH METHODS

Study area and duration

The research was conducted at Shree Laligurans Dairy Farm and Research Center, Khairaheni, Chitwan, Nepal $27^0 37' 17''$ N latitude and $84^0 35' 43''$ E longitude. This farm was selected because it is a large-scale commericial farm with relatively extensive data available and is therefore suitable for study in a subtropical context. The site is situated at an altitude of 208 meters above the sea level. The study utilized production data spanning three years, from November 2021 to June 2023.

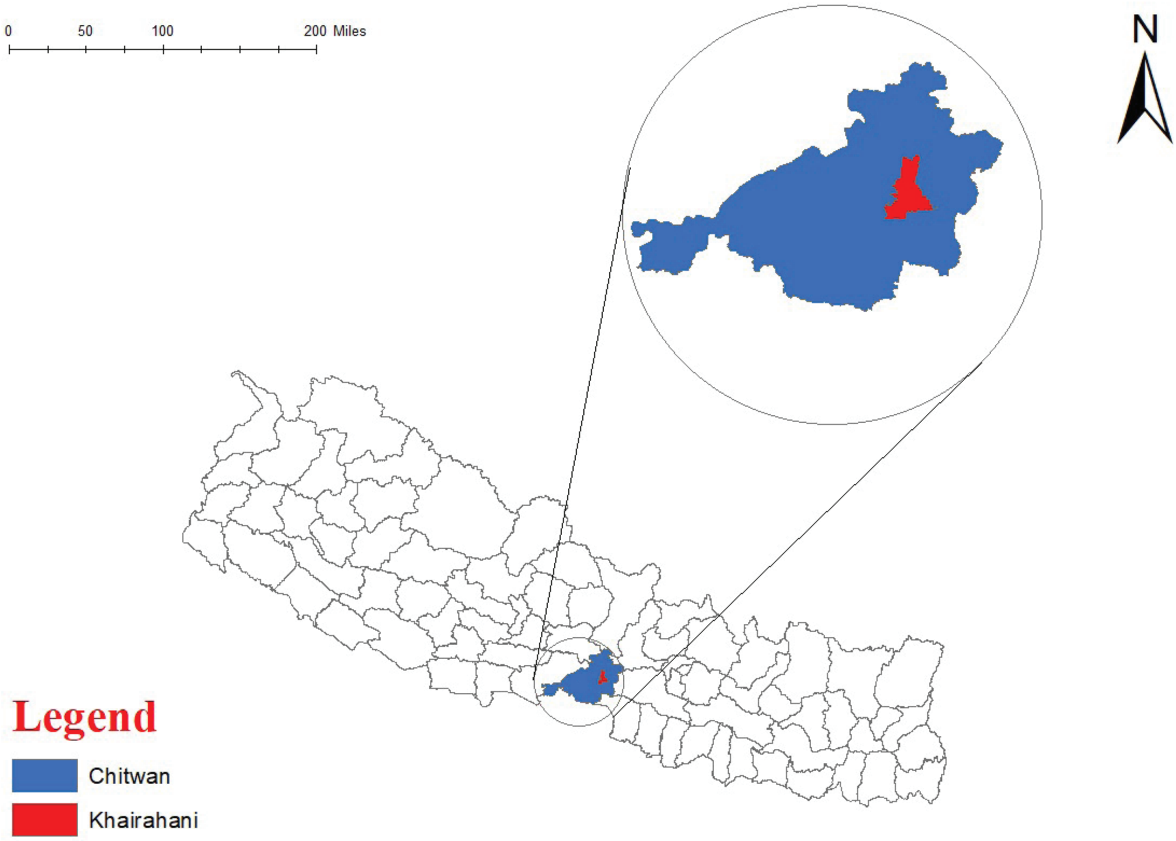

Fig. 1. Map of Nepal showing the location of research site (Chitwan)

Feed and feeding management

Animals were managed under an intensive system with seasonal forage cultivation. The feeding consisted of low-quality oat and vetch supplemented with silage and paddy straw for winter whereas, summer forages included Sorghum, Napier and Maize which were supplemented with paddy straw to maintain adequate dry matter intake. A standardized non-pellet concentrate feed was formulated in 450 kg batches. The feed composition included rice bran (29.82%), mustard cake (20.52%), wheat bran (14.90%), maize (14.90%), and soya cake (10.23%), along with molasses (6.63%), minerals (2%), and salt (1%). While the laboratory proximate analysis was not conducted to estimate the nutrient content of these feeds, the nutritional profile in the final concentrate mixture was calculated using the standard region feed composition table (ICAR, 2013). On this basis, the formulated ration estimation for 19.8% for crude protein (CP) and 70% for total digestible nutrient (TDN) on a dry matter basis. To avoid the risk of glucosinolate toxicity from mustard cake (20.52%), the mustard cake was soaked in water overnight before being mixed with the concentrates.

Animal description and sampling design

Two types of crossbred cows, Jersey crossbred (JX) and Holstein Friesian crossbred (HFX), whose blood level was maintained above 50% for their respective breeds, were considered for the study.

All cattle were bred via artificial insemination technology using the semen produced at the National Livestock Breeding Office (NLBO), Pokhara. From the total sample size of 400 lactating cows (HFX=271; JX=129), 2,030 daily milk records were analyzed to evaluate milk yield and composition. Milk records were taken by a trained farm technician daily. Yields were measured using graduated volumetric jars to ensure precision. Twenty milliliters of milk were collected from each cow in a plastic vial and stirred for 10-15 seconds before the samples were placed in an automated milk analyzer to find the milk composition reading. The final digital database was maintained by the farm supervisor, ensuring the accuracy of the data.

Classification of non-genetic factors

Non-genetic factors, in this study, were categorized as follows:

- Parity: Classified as: early parity (1st and 2nd), mid parity (3rd and 4th), and late parity (5th and 6th).
- Season of Milking: Classified as: Rainy season (June-August), Autumn season (September-November), Winter season (December-February), and Spring season (March-May).
- Stage of Lactation: Classified into Early stage (7–100 days), Mid stage (101–190 days), and Late stage (191–305 days).
- Month of Milking: Analyzed across all twelve calendar months.

Data collection and milk analysis

Cows were milked twice daily (05:00–07:00 and 15:00–17:00 hours) using a machine milking system. Individual daily milk yield (DMY) was calculated by summing the morning and evening yields. Milk samples (20 ml) were collected in plastic vials after thorough mixing and processed in a stirrer to remove air spaces. Compositional traits, including Fat, Solids-Not-Fat (SNF), and Protein, were determined using an automated milk analyzer within 45 seconds of sampling.

Statistical model and analysis

Data were analyzed using a fixed-effect model to account for disproportionate subclass numbers. Model for estimating daily milk yield and milk composition traits

$$\mathbf{Y_{ijklm} = \mu + a_i + b_j + c_k + d_l + e_{ijklm}}$$

Where, μ is the overall mean

a_i is the effect of i^{th} breed (i=Jersey crossbred and Holstein Friesian crossbred)

b_j is the effect of j^{th} stage of lactation (j= Early, Mid, Late)

c_k is the effect of k^{th} season of milking (k= Rainy, Autumn, Winter, Spring)

d_l is the effect of l^{th} month of calving (l= January to December, all twelve months)

e_{ijklm} is the random element (error mean) assumed to be normally and independently distributed among the sampled population.

Microsoft office Excel 2019 was used to enter, clean, code and record the data. Statistical analysis was performed using the Harvey (1990) software package for least-squares analysis. Mean comparisons were conducted via Duncan's Multiple Range Test (DMRT) at significant levels of 5%, 1%, and 0.1%.

RESULTS AND DISCUSSION

Non genetic influences on milk yield

The overall average daily milk yield (ADMY) was found to be 9.60 ± 0.86 liters, with morning yields 5.07 ± 0.45 liters consistently exceeding evening yields 4.52 ± 0.43 liters (Table 1).

Effect of breed

Holstein crossbred showed average daily milk yield of (9.65 ± 0.92 liters), which was almost similar to that of Jersey crossbred cows (9.54 ± 1.20 liters), and hence the difference in milk yield was statistically non-significant (p>0.05). This does not match with the findings of Xue et al. (2011) and Paneru et al. (2015), who found a significant effect of breeds on average daily milk yield. The similarity in yield between these two crossbreds in this study might be due to the superior adaptation of Jersey crosses to Chitwan's hot and humid climate, which may allow them to match the production potential of Holstein crosses that are more sensitive to thermal stress. This fact was supported by the finding of Liu et al., (2019) where he revealed that Holstein are highly susceptible to thermal stress in tropical and subtropical environments due to their lower surface area-to-body weight ratio and limited heat dissipation capacity. Conversely, Jersey cattle and their crossbreds exhibit superior thermo tolerance. Likewise, physiological resilience of the Jersey crosses to environmental heat stress likely allowed them to match the production output of the thermally stressed Holstein crosses (Habimana et al., 2023; Lee et al., 2022). The higher morning yield across both breeds aligns with the "a.m.-p.m. effect" noted by Everett and Wadell (1970), where diurnal variation and milking intervals naturally boost morning volume.

Effect of stage of lactation

Lactation stage significantly influenced yield ($p < 0.001$). The highest average daily milk yield was observed in the early stage (11.05 ± 0.79 liters), followed by the mid stage (9.34 ± 0.96 liters) and late stages (7.40 ± 2.07 liters). This trend is consistent with Bhoite and Padekar (2002). The decline in milk yield with stages is biologically driven by hormonal shifts and the diversion of nutrients to the fetus during later pregnancy, which triggers the gradual regression of mammary tissues. After lactation reach peak, the rate of cell proliferation is outpaced by mammary epithelial cell apoptosis (programmed cell death), resulting in reduction in the gland's synthesizing capacity (Capuco et al., 2001; Stefanon et al., 2002). Moreover, gradual decrease in galactopoietic hormones causes natural decline in lactation persistency as lactation stage advances (Bell et al., 2000).

Effect of season and monthly variation

Season of milking significantly affected milk yield ($p < 0.01$), with the highest yield recorded in spring (9.96 ± 1.13 liters) and the lowest in winter (9.41 ± 1.47 liters). In intensive management system, where nutrition is maintained via formulated ration, this spring peak was driven biologically by increasing photoperiods which stimulate prolactin secretion resulting with better galactopoiesis (Dahl et al., 2012). Month of calving also showed high significance ($p < 0.001$); cows calving in October reached peak ADMY (10.24 ± 1.47 liter), while those calving in March yielded the lowest (9.01 ± 2.42 liter).

Cows calving in October achieve their 90-day peak lactation during optimal, cool winter conditions, which elevates their entire lactation curve and overall ADMY (Van Eetvelde et al., 2020). While this might seem to contradict the finding that the highest seasonal milk yield occurs in the spring, it is important to distinguish between an individual cow's yearly average and the entire herd's daily average. "Month of calving" measures a single cow's performance over her full 305-day cycle, whereas "season of milking" measures the daily output of the whole farm.

Table 1. Least squares means and standard errors of morning milk yield, evening milk yield, and average daily milk yield (ADMY) as influenced by different non-genetic factors

Factors		NoS	LSM±SEm		
			Milk at morning(L)	Milk at evening(L)	ADMY(L)
Overall		2030	5.07±0.45	4.52±0.43	9.60±0.86
Breed			NS	NS	NS
	HFX	1388	5.09±0.48	4.55±0.46	9.65±0.92
	JX	642	5.05±0.63	4.48±0.60	9.54±1.20
Stage of lactation			***	***	***
			LSD=0.10	LSD=0.97	LSD=0.19
	Early	1099	5.79±0.41[a]	5.24±0.39[a]	11.05±0.79[a]
	Mid	784	4.95±0.50[b]	4.38±0.48[b]	9.34±0.96[b]
	Late	147	4.47±1.09[c]	3.92±1.04[c]	7.40±2.07[c]
Season of milking			*	**	**
			LSD=0.18	LSD=0.17	LSD=0.35
	Rainy	332	5.05±0.74[ab]	4.43±0.71[b]	9.48±1.41[b]
	Autumn	353	5.05±0.87[ab]	4.49±0.83[b]	9.54±1.65[b]
	Winter	613	4.96±0.77[b]	4.45±0.74[b]	9.41±1.47[b]
	Spring	732	5.22±0.59[a]	4.70±0.57[a]	9.96±1.13[a]
Month of calving			***	***	**
			LSD=0.30	LSD=0.28	LSD=0.57
	Jan	170	5.29±1.04[ab]	4.59±1.00[abc]	10.01±1.98[ab]
	Feb	141	5.28±1.17[ab]	4.74±1.12[ab]	10.01±2.22[ab]
	March	111	4.71±1.27[d]	4.34±1.22[c]	9.01±2.42[d]
	April	124	4.83±1.22[cd]	4.34±1.17[c]	9.16±2.33[cd]
	May	115	4.92±1.46[cd]	4.33±1.40[c]	9.26±2.78[cd]
	June	82	5.04±1.78[bcd]	4.46±1.70[bc]	9.51±3.38[bcd]
	July	121	4.88±1.22[cd]	4.33±1.16[c]	9.22±2.31[cd]
	Aug	113	4.83±1.18[cd]	4.38±1.13[c]	9.21±2.25[cd]
	Sep	198	5.12±1.11[abc]	4.53±1.06[abc]	9.61±2.11[abcd]
	Oct	319	5.42±0.77a	4.82±0.74[a]	10.24±1.47[a]
	Nov	330	5.15±0.88[abc]	4.57±0.84[abc]	9.72±1.68[abc]
	Dec	206	5.36±1.15[ab]	4.76±1.10[ab]	10.14±2.19[ab]
Range			3-9	2-8.5	6.6-17
CV%			22.26	23.65	22.21

Note: p<0.001= significant at 0.1%, p<0.01 = significant at 1%, p<0.05 = significant at 5%, p>0.05= Non significant, LSM: Least square mean, SEm: Standard error of mean, CV: Coefficient of variation, LSD= Least Significant Difference, ADMY: Average daily milk yield, NoS: Number of Samples

Effect of parity

Parity had a significant effect on milk yield ($p < 0.001$), with ADMY increasing as cows matured (Table 2). The lowest yield was observed in early parities (10.03 ± 1.07 liters), while the mid (10.67 ± 1.09 liters) and late parities (10.87 ± 1.77 liters) had no significant difference between their yields. It means milk yield increased significantly from early to mid-parities and then plateaued. This happened because of the change in physiology of the cow with age, where body size increases, and mammary tissues fully develop over repeated pregnancies, allowing for greater capacity. The lower yield in early parities occurs because younger animals must partition nutrients between their own physical growth and milk synthesis (Capuco et al., 2001). Consequently, the full biological potential of mammary gland secretory cells is achieved by the 3rd or 4th parity (Chegini et al., 2015). Finally, the late parity (5th - 6th) cows being able to maintain their potential without a significant decline from mid parity yield is a common phenomenon in a herd driven by selective culling (Fetrow et al., 2006).

Table 2. Least squares means and standard errors of morning milk yield, evening milk yield, and average daily milk yield (ADMY) as influenced by parity

Factors		NoS	LSM±SEm		
			Milk at morning(L)	Milk at evening(L)	ADMY(L)
Overall		1261	5.57±0.42	5.01±0.40	10.60±0.80
Parity			***	***	***
			LSD=0.153	LSD=0.146	LSD=0.292
	Early (1-2)	547	5.34±0.56^{b}	4.79±0.53^{b}	10.03±1.07^{b}
	Mid (3-4)	512	5.63±0.57^{a}	5.10±0.55^{a}	10.67±1.09^{a}
	Late (5-6)	202	5.74±0.93^{a}	5.13±0.89^{a}	10.87±1.77^{a}
Range			3-9	2.5-8.5	6.6-17
CV%			23.38	24.79	23.38

Note: $p<0.001$= significant at 0.1%, $p<0.01$ = significant at 1%, $p<0.05$ = significant at 5%, $p>0.05$= Non significant, LSM: Least square mean, SEm: Standard error of mean, CV: Coefficient of variation, LSD= Least Significant Difference, ADMY: Average daily milk yield, NoS: Number of Samples

Non genetic influences on milk composition

The overall mean values for Fat, SNF, and Protein were 4.56%, 8.68%, and 3.09%, respectively.

Effect of breed

While breed did not significantly affect fat percentage, it had a highly significant influence on SNF and Protein ($p < 0.001$). Jersey crosses were superior in both SNF (8.70%) and Protein (3.11%) compared to Holstein crosses (8.66% and 3.07%). Purebred Jersey is globally recognized for a better fat percentage than purebred Holstein. However, the lack of a significant difference in fat percentage between the two crossbreds in this study (JX: 4.57% vs. HFX: 4.54%) may be due to the genetic contribution of the *Bos indicus* base breeds involved in the crossbreeding (Banjade et al., 2021). Fat percentage being a highly heritable trait, the additive genetic effects elevate the baseline fat percentage of the HFX offspring toward the mid-parent value, which made the milk fat percentage of both crossbreds similar (Lopez-Villalobos et al., 2000). Furthermore, environmental variation in fat synthesis was minimized as both crossbreds were managed under identical feeding with proper effective fiber, resulting in uniform rumen acetate production (Allen, 1997). Ultimately, these findings are nearly similar with that of Mishra (2000) and Vance et al. (2013), supporting that HFX being better in milk volume, JX had higher nutrient density, making them valuable for the Nepalese dairy market where SNF is a key quality measure.

Effect of stage of lactation

Fat, SNF, and Protein percentages increased significantly toward the end of lactation ($p < 0.001$ for Fat and SNF, $p < 0.01$ for Protein). Early lactation milk had the lowest fat and SNF (4.39% Fat, 8.66% SNF). This inverse relationship between yield and composition is well known science; as milk volume drops in late lactation, the concentration of solids naturally rises.

Effect of season and monthly variation

Season of milking significantly impacted all composition traits ($p < 0.001$). Fat percentage peaked in winter (4.59%) and was lowest in spring (4.51%), likely due to the dilution effect associated with higher milk yield during spring, revealing the negative relationship between milk volume and fat concentration (Batra et al., 1969). A related trend was observed in Table 1, where milk volume was higher during spring. Monthly data showed the highest fat in March and August (4.63%) and the lowest in December (4.47%). At first glance, it might look like a contradiction that cows calving in the spring months (March, April, and May) end up with the highest yearly fat percentage, even though the spring season itself has the lowest fat. However, there is no actual contradiction here because they measure two different timelines. The spring season measures the whole farm's daily milk yield whereas, month of calving tracks a single cow's total milk over her entire year. A cow that give birth in spring hits its peak milking days in the middle of summer. The summer heat consequently drops the milk yield, which avoids fat from getting watered down making fat stays more concentrated (Bernabucci et al., 2015). SNF and Protein levels were highest in late summer/monsoon months (July-September), likely benefiting from specific forage availability during those periods.

Table 3. Least squares means and standard errors of Fat%, SNF%, and Protein % as influenced by different non-genetic factors

Factors		NoS	LSM±SEm		
			Fat %	SNF%	Protein%
Overall		2030	4.56±0.10	8.68±0.03	3.09±0.03
Breed			NS	***	***
				LSD=0.072	LSD=0.0072
	HFX	1388	4.54±0.11	8.66±0.03[b]	3.07±0.03[b]
	JX	642	4.57±0.14	8.70±0.05[a]	3.11±0.05[a]
Stage of lactation			***	***	**
			LSD=0.023	LSD=0.081	LSD=0.0081
	Early	1099	4.39±0.09[c]	8.66±0.03[c]	3.08±0.03[c]
	Mid	784	4.58±0.11[b]	8.68±0.04[ab]	3.09±0.04[b]
	Late	147	4.71±0.25[a]	8.69±0.08[a]	3.11±0.08[a]
Season of milking			***	***	***
			LSD=0.042	LSD=0.014	LSD=0.014
	Rainy	332	4.57±0.17[a]	8.70±0.06[a]	3.07±0.06[c]
	Autumn	353	4.57±0.20[a]	8.69±0.07[a]	3.10±0.07[ab]
	Winter	613	4.59±0.17[a]	8.67±0.06[b]	3.11±0.06[a]
	Spring	732	4.51±0.13[b]	8.66±0.04[b]	3.09±0.04[b]
Month of calving			***	***	***
			LSD=0.069	LSD=0.024	LSD=0.024
	Jan	170	4.51±0.24[bcd]	8.66±0.08[cd]	3.08±0.08[d]
	Feb	141	4.53±0.27[bcd]	8.69±0.09[ab]	3.08±0.09[d]
	March	111	4.63±0.29[a]	8.66±0.10[cd]	3.08±0.10[d]
	April	124	4.62±0.28[a]	8.64±0.09[d]	3.09±0.09[cd]
	May	115	4.59±0.33[ab]	8.67±0.11[bc]	3.08±0.11[d]
	June	82	4.58±0.41[ab]	8.69±0.14[ab]	3.09±0.14[cd]
	July	121	4.59±0.28[ab]	8.71±0.09[a]	3.11±0.09[bc]
	Aug	113	4.63±0.27[a]	8.71±0.09[a]	3.13±0.09[ab]
	Sep	198	4.54±0.25[bcd]	8.69±0.09[ab]	3.14±0.08[a]
	Oct	319	4.48±0.18[cd]	8.69±0.06[ab]	3.09±0.06[cd]
	Nov	330	4.55±0.20[abc]	8.68±0.07[bc]	3.08±0.07[d]
	Dec	206	4.47±0.26[d]	8.66±0.09[cd]	3.07±0.09[d]
Range			3.6-4.9	8.5-8.8	2.8-3.5
CV %			6.28	1.13	3.16

Note: $p<0.001$= significant at 0.1%, $p<0.01$ = significant at 1%, $p<0.05$ = significant at 5%, $p>0.05$= Non significant, LSM: Least square mean, SEm: Standard error of mean, CV: Coefficient of variation, LSD= Least Significant Difference, ADMY: Average daily milk yield, NoS: Number of Samples

Effect of parity

Parity had significant influence on Fat ($p < 0.001$) and SNF ($p < 0.01$), but had no significant effect on Protein ($P > 0.05$). Early parity cows had the highest fat content (4.50%), which decreased in mid and late parities (4.41 %). There is a common local belief that first parity cows have less fat, but the real confusion is understanding the difference between fat percentage and total fat. First parity cows produce a lower total milk volume as the udders of cows are not fully developed yet. Since the milk volume is lower, the fat does not get diluted, making the fat percentage higher. However, the total fat is lower as the overall milk volume is less. As cow reaches mid parities, milk volume surges, which naturally dilutes the fat concentration (lower fat percentage) but increases overall total fat. This trend matches Yang et al. (2013) who suggested that younger cows may maintain higher solids concentration before the diluting effect of higher yields in later lactations takes over.

Table 4. Least squares means and standard errors of Fat%, SNF%, and Protein % as influenced by parity

Factors		NoS	LSM±SEm		
			Fat%	SNF%	Protein%
Overall		1261	4.44±0.09	8.67±0.03	3.09±0.03
Parity			***	**	NS
			LSD=0.353	LSD=0.118	
	Early (1-2)	547	4.50±0.13[a]	8.68±0.04[a]	3.08±0.04
	Mid (3-4)	512	4.41±0.13[b]	8.67±0.04[a]	3.09±0.04
	Late (5-6)	202	4.41±0.21[b]	8.65±0.71[b]	3.07±0.06
Range			3.6-4.9	8.5-8.8	2.8-3.5
CV %			6.70	1.15	3.26

Note: $p<0.001$= significant at 0.1%, $p<0.01$ = significant at 1%, $p<0.05$ = significant at 5%, $p>0.05$= Non significant, LSM: Least square mean, SEm: Standard error of mean, CV: Coefficient of variation, LSD= Least Significant Difference, ADMY: Average daily milk yield, NoS: Number of Samples

CONCLUSION

The study revealed almost similar milk yield performance of both Jersey and Holstein crossbred cows in the subtropical climate of Chitwan. However, higher levels of SNF and protein in Jersey crossbreds make their milk better in overall quality. Because Chitwan is hot and humid, Jersey crosses are a better choice for farmers since they tolerate the heat well while still providing nutrient-rich milk. Regarding age, milk production surges and reaches its peak during cow's third and fourth parities and stays steady and plateaus right through her fifth and sixth parities. Looking at the lactation stage, milk yield is highest in the early stage and slowly goes down, while the milk becomes thicker and more concentrated in the late stage. In summary, the dairy industry in Nepal can grow by focusing on these non-genetic factors. To maximize the earnings, farmers should prioritize keeping cows in their herd through their highly productive third to sixth parities. Also, to get maximum yearly milk volume, farmers should arrange for cows to calve in October, so that the peak milk yield period falls in the cool winter rather than hot summer.

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AUTHOR CONTRIBUTIONS

SPS: Methodology, Formal analysis, Writing – original draft; **AG:** Investigation, Writing – review & editing.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ETHICAL APPROVAL AND PERMITS

This study did not require any ethical approval, as the authors worked on the "farm data" maintained by the farm. We did not have any contact with animals.

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