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Full length paper

Karan Fries vs. Jersey Cattle in Southern Foothills of Bhutan

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ABSTRACT

A study was conducted to evaluate the performances of Karan Fries [KF] and Jersey Pure [JP] dairy cattle breeds managed at the government farm in the sub-tropical environment of Samtse, Bhutan. Quantitative data on production and reproduction were retrieved from 320 individual cow/calf performance records maintained at the farm from July 2014 to March 2018. Qualitative data on adaptability were congregated through key informant interviews. The mean birth weight and monthly weight gain in KF calves were significantly higher than JP. Mean age at first service and age at first calving for JP were 24.6 months and 33.9 months, respectively, which were significantly lower than KF. Mean daily milk yield [kg] in 1st lactation was significantly higher in JP than KF, but there was no yield variation in subsequent lactations. Mean lactation yield [305 days] for KF cows increased to 3823.9 kg in 4thlactation, which was 371 kg higher than JP, but not statistically significant. Milk production was closely associated with season in a year with higher production for both the breeds in winter.

KF had good foraging ability and was surefooted to survive in the rugged terrain. However, bad temperament and high quantity forage requirement for animals are the disadvantages. The study concluded that JP breed attains production at younger age and has medium body size requiring lesser fodder intake. Thus, JP and its crosses shall continue to be a breed of choice for the subsistence and semi-commercial dairy farms with limited fodder resources. KF may be recommended in commercial farm with adequate facilities and resources at hand to sustain them.

1. INTRODUCTION

Most Bhutanese are rural based and rely heavily on livestock, particularly dairy for meeting the household nutritional needs and cash income from sale of milk and milk products. Due to micro nature of farm operation in smallholder system, producers are unable to meet the rapidly growing demand for dairy products. This has led to substantial import of milk and milk products annually, resulting in balance of payment deficit.

Attaining self-sufficiency for dairy product is possible but it will take some time because of inherent difficulties: limited access to market, inadequate provision of finance/credit and slow adoption/non-adoption of better farming advisory services. These difficulties combine to create a trap that prevents smallholders from fully exploiting dairy productivity advantages. To overcome the insufficient returns to investment, interventions are made to improve quality of dairy animals and their management. Breed improvement through supply of quality breeding bulls and artificial insemination services, imparting knowledge and skills to farmers on better farming practice [feeding, housing and health care], provision of subsidy support to purchase improved cattle breeds to up-scale levels of production, and facilitation on product value addition are important steps taken up by Department of Livestock to accelerate livestock development.

Currently, most of the 300,000 [DoL, 2018] cattle are *Bos indicus* type, known locally as *Thrabam* [female] and *Nublang* [male], which is a Siri breed. Milk production from this breed is low, though it has potential to improve with selective and cross breeding. To enhance milk production, farmers are taking interest to cross local cows with exotic dairy breeds mainly Jersey and to some extent Brown Swiss and Holstein Friesian [*Bos taurus*] bulls/semen. The National Jersey Breeding Centre [NJBC], Samtse produces and supplies quality purebred Jersey breeding bulls to farmers. Lately, to offer more choices to farmers, Karan Fries [KF], a composite dairy breed was procured from India

and housed at NJBC because of space availability. This breed, although, is reported to be hardy with high milk production in India, its performance in comparison with JP cows remains to be studied. Therefore, there is a lack of understanding on the comparative advantage of KF breed in Bhutanese smallholder system. Hence, this study was undertaken with two main objectives. The first objective was to compare the performances [production, reproduction and adaptability] of Karan Fries with Jersey pure cattle, under same management conditions at NJBC, Samtse. Based on study results, the second objective was to make policy recommendations on the newly introduced KF, as an alternative dairy cattle breed for Bhutanese farmers.

2. MATERIALS AND METHOD

2.1 Study location

The study site is located at NJBC, Samtse, Bhutan. Samtse *Dzongkhag* [district] has an elevation ranging from 300-800 m asl. The *Dzongkhag* has sub-tropical environment with temperature varying from 15 to 30ºC and receives an annual rainfall of 1500-4000 mm [SD 2010].

KF breed was developed in hot and dry environment at Karnal, Haryana, India by crossing Tharpakar as a Zebu breed with other exotic breeds mainly Holstein Friesian. KF is reported to have high milk production [8,383l per lactation] with milk fat of 4% [NDRI 2018]. The performance of KF in subtropical environment of NJBC Samtse [Figure 1] was compared with JP breed, which produces lactation milk yield of 4500 kg with 4.5% fat.

Figure 1: Karan Fries [left] and Jersey Pure [right] cattle at NJBC, Samtse.

2.2 Data collection

The farm records of 247 cows and 71 calves, maintained by NJBC, were used as a source of data. From the records, data extracted were daily, monthly and annual milk production and individual weight of calves. The production parameters covered were; milk production [daily, monthly and 305 days lactation yield at different lactation numbers] and seasonal variation in milk production. Breeding and reproduction parameters were; age at first service, age at first calving, calving interval, conception and calving rate. Information on adaptability was collected through informal discussions with key informants who are farm officials and workers. The key informants had several years of experience with Jersey cows and they were able to detect differences in behavioral patterns of JP and KF animals. The parameters included for assessing adaptability were; temperament and behavior to indicate the ease of management, foraging capacity, sure footedness, and disease susceptibility/resistance. Feeding, breeding and health records were also retrieved, covering the period from July 2014 to March 2018. The data were classified according to breed and lactation of animals for analysis.

2.3 Data analysis

The statistical package Minitab version-18 was used to analyze quantitative data. Descriptive statistics such as mean, standard deviation and percentage were used for quantitative variables. ANOVA and chi-square test of association were applied. Qualitative data were described**.**

3. RESULTS AND DISCUSSION

3.1 Mean birth weight and weight gained in one year [mean] for KF and JP calves

Analysis of mean birth weight of 71 calves [27 KF and 44 JP] born at NJBC from July 2014-June 2017 revealed that the mean birth weight of calves was 36.5 kg and 27.9kg for KF and JP, respectively. Similarly, the mean body weight of 128 kg at one year of age for KF was significantly higher [$p<0.004$] than JP, which gained 94 kg weight in a year. In Bangladesh, Rahman et al. [2015] reported mean birth weight of 29.33 kg and weaning weight of 151.7 kg for a crossbreed cow with 62.5% Friesian and 37.5% local bloodline. However, the birth weight reported is lower and weaning weight is higher than the finding of present study. Different feeding and management could have contributed to the differences. The greater weight gain of KF calves indicates that it has higher genetic potential than JP. Conversely,

feed requirement for maintaining their body condition and production could also be higher. It raises a question on whether Bhutanese farmers with limited feeding resources will be able to manage KF breed in a smallholder system.

3.2 Reproductive efficiencies between breeds: Age at first service, age at first calving, service period and calving interval between breeds

Table 1 shows the mean age at first service [AFS], age at first calving [AFC], service period, and calving interval of JP and KF breeds. The age at first service and age at first calving were significantly lower in JP, compared with KF [$p<0.001$ and $p<0.01$]. The AFS and AFC are important economic traits. Lower AFS and AFC in JP breed is an advantage over KF. Thus, JP breed could start producing at an earlier age than KF, which could help farmers to get earlier returns from the investment. However, AFC of JP in the present study [33.9 months] is slightly higher than AFC [29.9 months] reported for JP in Ethiopian highland [Direba et al. 2015]. But the service period [129.9 months] and calving interval [13.7 months] were significantly lower in KF, compared with JP. In this study, the service period and calving interval of KF are similar to the findings of Japheth et al. [2015] and Singh and Gurani [2004]. As calving interval is an important indicator of herd reproductive efficiency, shorter calving interval and lesser service period are positive attributes. Short service periods of KF indicate that there are greater chances for KF cows to produce a greater number of calves in a given period of time.

3.3 Reproductive efficiencies between breeds: conception and calving rates

The conception rate, calving rate, and AI index of KF were better than JP [Figure 2]. Hence, the reproductive efficiency of KF surpasses JP. AI index is significantly lower in KF [1.7 AI, n=116] than in JP [2.4 AI, n=83].

Table 1: Reproductive traits of KF Jersey cattle at NJBC Samtse

Reproductive traits	KF Breed	JP Breed	p value
Age at first service[months]	31.7±13.5[n= 41]	24.6± 4.7 [n=49]	0.001
Age at first calving [months]	41.4±16.2[n= 31]	33.9±4.2 [n=37]	0.009
Service period[months]	129.9±69.9[n=69]	174.4±109.1[n=45]	0.009
Calving interval [months]	13.7±2.4 [n= 57]	15.4±4.1 [n=39]	0.013

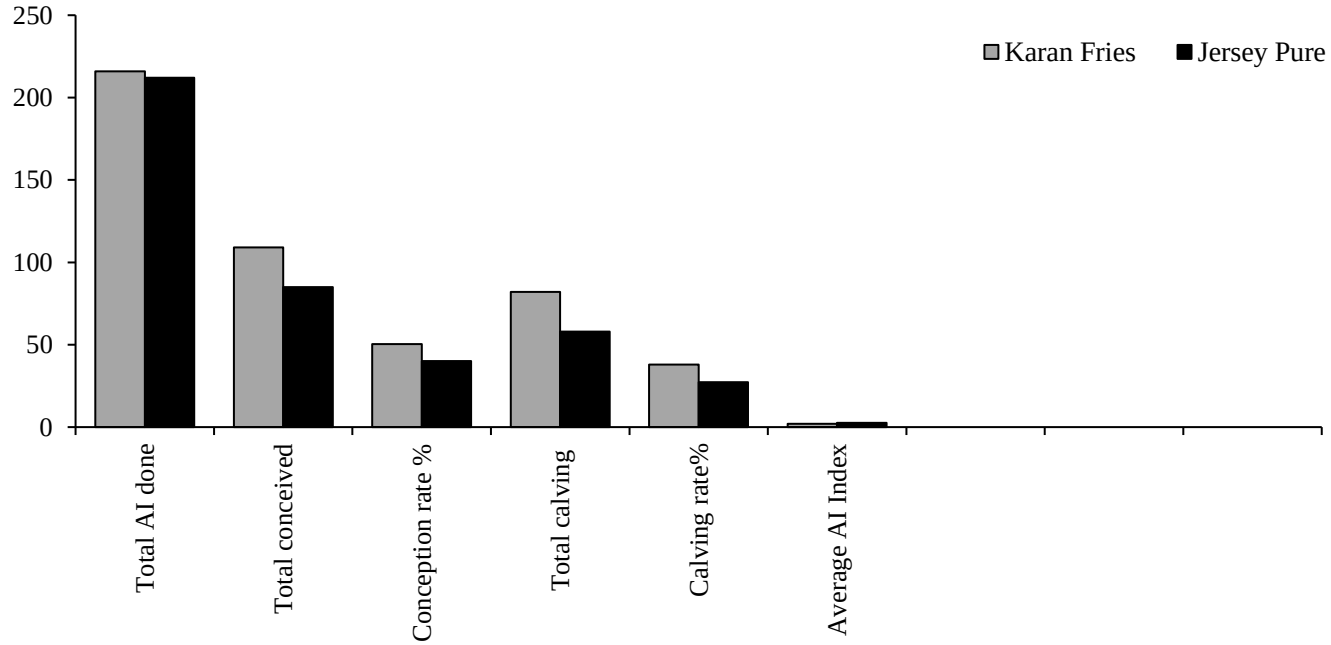

Figure 2: Conception and calving of KF and JP 2014-18.

3.4 Milk production of KF and JP breeds: Mean daily milk yield and days in milk

The mean daily milk yield in first lactation period was significantly lower in KF than in JP [Table 2]. The lower milk yield of KF could be explained by the fact that KF is first imported from hot environment of India and needed time to adapt to Bhutanese subtropical environment. However, in subsequent 2nd, 3rd and 4th lactations, the mean daily milk yields, although not statistically significant, were slightly higher for KF breeds. Singh and Gurnani [2004] reported that the yield per day for KF cow in 1st lactation is 10.6±0.2 kg, which is higher than the present finding. For JP, Prendiville et al. [2010] reported a daily milk yield of 14.2 kg. Both the findings are higher than the result of the present study. However, in this study, the yield per day of KF in 4th lactation is at par with the findings of Japheth et al. [2015]. For the outstanding cow at NDRI, it is reported that the peak milk yield is 46.5 kg per day [NDRI 2018], almost two-fold to that of 27 kg per day recorded for KF at NJBC. The mean days in milk for JP was 296±116 days, which is significantly higher than 256±60 days for KF [$p<0.01$]. Hence, Jersey is likely to produce more milk in a lactation period.

3.5 Milk production of KF and JP breeds: Adjusted 305 days lactation yield

Analysis of 305 days adjusted lactation yield of 123 cows revealed that the lactation yield of KF cows steadily increased from 2657 kg in 1st lactation to 3824 kg in 4th lactation wherein the yield was 371 kg higher than JP, although not statistically significant [Table 2]. The first lactation yield [305 days] for KF has been reported to be 3,173±82 kg [Singh and Gurnani 2004] and 3393.0 kg [NDRI 2018]. Goni et al. [2015] reported a lactation yield of 5398 ± 95 kg in 305 days for Jersey [pure] cows managed in pasture-based feeding system, whereas Borland and Moyo [1996] reported a lactation yield of 3504 kg in Zimbabwe. In this study, the lactation yield was lower than the finding from elsewhere, which could have been affected by year of calving, feeding and management, proportion of dairy breed bloodline and herd size.

Table 2: Milk production traits of JP and KF breeds.

Milk Production Traits	KF Breed	JP Breed	p value
Average daily milk yield [kg]			
Lactation 1	8.2±2.6	10.6±1.9	0.006
Lactation 2	10.4±2.8	10.1±3.0	ns
Lactation 3	11.4±2.9	9.9±2.2	ns
Lactation 4	12.5±4.6	11.3±3.7	ns
Adjusted 305 days lactation yield [kg]			
Lactation 1	2657±774 [n=27]	3235±586 [n=13] 3286±648 [n=11]	
Lactation 2	3082±805 [n=23]	3041±727 [n=9] 3452±1137 [n=3]	
Lactation 3	3432±948 [n=21]		
Lactation 4	3824±1163 [n=10]		

3.6 Milk production of KF and JP breeds: Seasonal variation in total milk production

The total milk production of KF cows increased gradually as winter ended and peaked in spring when lust green grasses were available in plenty [Figure 3]. Similarly, the seasonal milk production was lowest in summer for Jersey and peaked in autumn and remained stable in winter and spring. The lower milk production in summer could be related to the climate and its consequent effects. Heat stress under high humidity could also have contributed to lower milk yield. Besides, the forages available during summer are more succulent with lesser nutrient content. On the contrary, the higher milk production in winter is attributed to pleasant climate and better forages, including maize silage with higher nutritive value that were fed during the entire winter months.

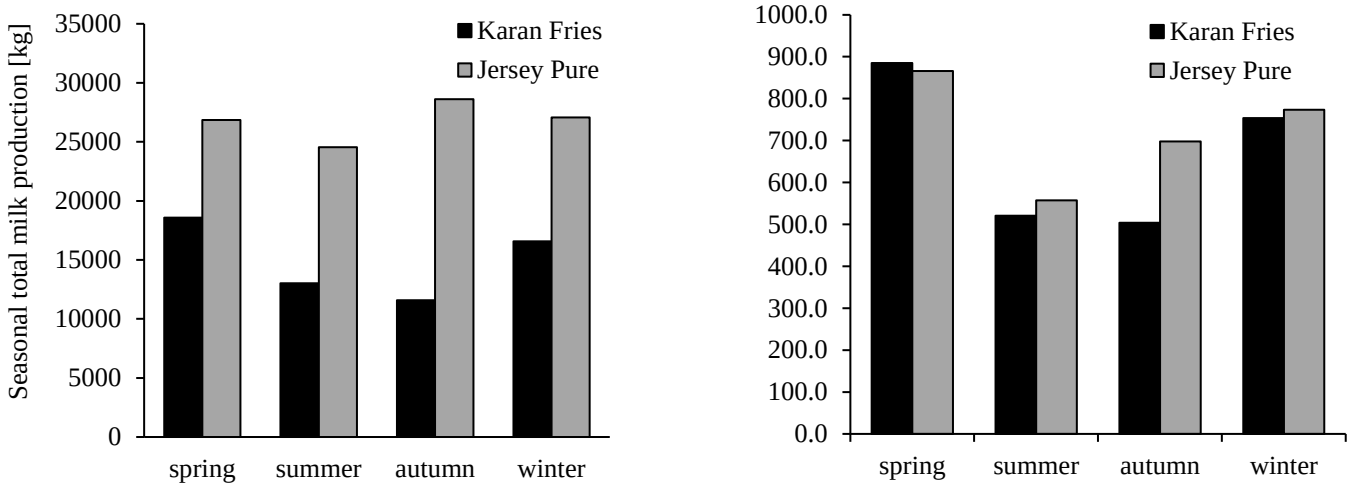

Figure 3: Seasonal variation in milk production in KF and JP cows.

3.7 Adaptability of breeds

Adaptability of breed and other parameters as per informal interview with respondents are presented in Table 3. Though, all respondents [100%] reported that KF is surefooted, the same proportion of respondents also said KF has bad temperament, suggesting that the management of this breed may be difficult at farmers' level.

3.8 Incidences of diseases in KF and JP herd: Brucellosis storm and its effect on JP nucleus herd

According to respondents, introduction of KF breed in June 2014 at NJBC Samtse has created havoc. There was abortion storm caused mainly by this disease in 2015-16 and 2016-17. Animals aborted mostly in third trimester of pregnancy [>6 months] and resulted in loss of calves, milk and farm revenue. Some imported KF animals in carrier stage could have been inducted in JP nucleus farm and that led to transmission of disease in other animals in the herd. The number of animals infected soared to 19 cases by 2015-16 up by six to that of 2014-15, which is 31% higher than previous year [Table 4].

Chi-square test of association confirmed that brucellosis is independent and not associated with breed types. Hence both the breeds [KF and JP] were equally infected with brucellosis. Despite serious effort made via strict isolation, hygiene and sanitation, infection is still prevalent. This observation is supported by findings of Tenzin [2015], who reported that prevalence of brucellosis is highest [24.6%] at NJBC, Samtse [among the Government farms].

3.9 Incidences of diseases in KF and JP herd: Incidences of mastitis

Of the 53 incidences of mastitis cases reported between 2014-2018, the incidences of clinical mastitis were higher in JP [39%], whereas the cases of sub-clinical mastitis were higher in KF [67%]. However, the cases of chronic mastitis were not observed in KF [Figure 4]. Chi-square test of association revealed that incidences of mastitis are associated with breed of animals [$p<0.01$]. Similar to the present findings, Mehla et al. [2012] reported incidences of mastitis in Karan Fries, Karan Swiss, Sahiwal, Tharparkar cows as 36.90%, 38.46%, 33.98% and 33.44%, respectively, which suggests that susceptibility is influenced by breed of cattle.

Table 3: Adaptability traits of KF and JP breed

Adaptability trait	Respondents% Yes	No	Don't know
• KF cows have bad temperament, compared with JP cows	100	0	0
• KF cows are efficient foragers	80	20	0
• KF cows are resistant to diseases	90	10	0
• KF cows are surefooted in difficult terrain	100	0	0

Table 4: Abortion cases 2014-2018 at NJBC

Year	Karan Fries		Jersey [pure]		Total
	Cow	Heifer	Cow	Heifer	
2014-15	0	4	7	2	13
2015-16	9	0	9	1	19
2016-17	3	0	10	3	16
2017-18	1	0	6	2	9
Total	13	4	32	8	57

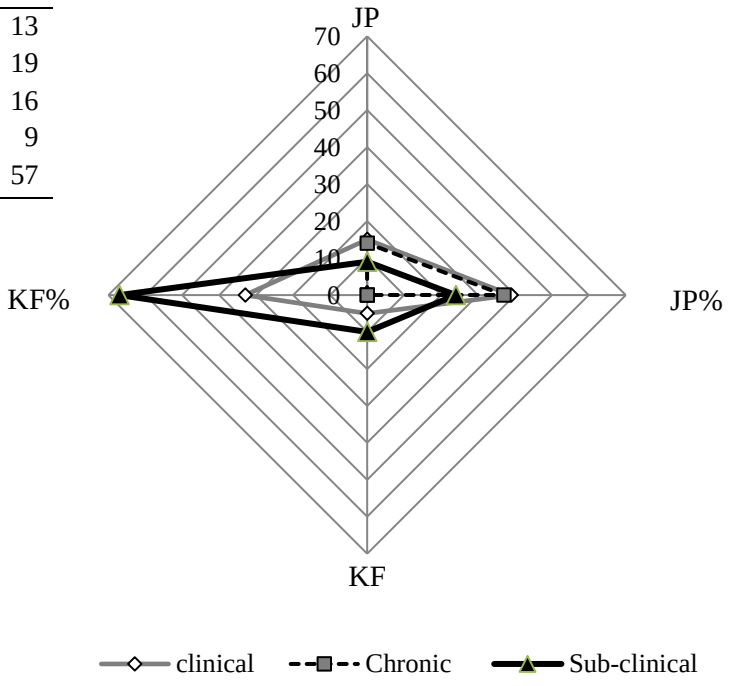

Figure 4: Incidences of mastitis in JP and KF cattle.

4. CONCLUSIONS

- KF is a heavy composite breed with higher body weight than JP, which would require higher quantity of feed and fodder for maintenance and production. Hence KF may be more suitable for commercial farms with adequate facilities and resources at hand. At the small farmer's level [subsistence and semi commercial] where feed and fodder availability is a bottleneck, JP and their crosses may continue to remain a breed of choice.
- Jersey [pure] breed with lower age at first service and age at first calving, medium body size and lower fodder intake will enable it to start producing at an earlier age than KF. Hence JP could be an advantage to resource poor farmers to get faster returns to their investment in dairy farming.
- Induction of imported KF breed into nucleus Jersey herd eased incursion of brucellosis into the farm. The storm of abortion caused by this disease reduced the scarce JP gene pool at NJBC, thereby hampering the mandated task of supplying Jersey breeding bulls to the needy farmers. Hence, to save the limited JP germplasm available at NJBC, sero-positive animals [JP and KF] at the farm may be stamped out and vaccination against Brucellosis may be instituted.
- In future, induction of imported breed into nucleus herd should be done only under unavoidable circumstances. In doing so, appropriate precautions, including disease screening measures, have to be put in place, pros and cons on mixing of breed are to be thoroughly weighed, so as to enable science-based decision making to prevail.

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