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RESEARCH ARTICLE

Effect of Feeding Intervention on Milk Production Performance of Crossbred Cows in Different Seasons of Bangladesh

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ABSTRACT

The study was conducted with 200 dairy cows mostly the crosses between Local and Holstein Friesian (LxF), Local and Sahiwal (LxSL) and also between Local, Holstein Friesian and Sahiwal (LxFxSL) to improve milk production performance through nutritional interventions. Rice straw based feeding intervention was composed mainly of Urea Molasses Straw (UMS) without green forage in monsoon, reduced quantities of legume forage in winter and increased amount of non-legume forage in summer. Feeding UMS instead of rice straw increased DCP and ME intake and slightly increased feed cost in monsoon. In winter, legume forage supply was curtailed over that supplied traditionally and rice straw was increased which reduced DCP and ME intake and also feed cost slightly. The intervention in summer season was to reduce rice straw and concentrates and to increase the supply of green grass. Results showed that DM, DCP and ME intake were improved in summer and feed cost reduced. In all the seasons, the highest milk yield was observed in L×F ($P<0.01$) followed by L×F×SL and the lowest was in L×SL cows irrespective of feeding intervention. Milk yield increased ($P<0.01$) in intervened feeding group than that of traditional feeding group irrespective of breed type. Milk fat, SNF and TS percentage was highest in L×SL followed by L×F×SL and the lowest was in L×F cows, irrespective of feeding intervention in all the seasons. Milk fat, SNF and TS percentage were highest in the cows of intervened feeding than that of traditional feeding irrespective of breed. The results of feeding intervention also indicated that genotype affects lactation length and milk yield per lactation irrespective of feeding intervention. Similarly, feeding intervention had significant effect on lactation length and milk yield per lactation irrespective of genotypes of the cows. Intervened feeding described in the present study was found effective for the improvement of nutritional status and productivity of dairy cows in Bangladesh.

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INTRODUCTION

Decreasing total quantity of milk produced immediately reflects any dietary deficiency of protein and energy, but only has a limited effect on the composition of milk (Meyer, 1973). Supplying a balanced ration with all the nutrients in adequate quantities, particularly energy and protein, to dairy cows is crucial for the improvement of milk production. Several studies indicate that better animal feeding and husbandry practices are necessary in order to improve production efficiency of dairy cows (Skunmun *et al.*, 1999). Feeding of low grade roughage to livestock is a common practice in India and developing countries (Murdia *et al.*, 1999) including Bangladesh (Akbar, 1992). Low quality roughages are characterized by their composition having low level of nutrients such as protein, vitamins and available minerals but high level of indigestible carbohydrates that leads to low feed intake (Akbar *et al.*, 1988; Schiere and Ibrahim, 1989). Therefore, in order to upgrade the nutritive value of low-grade roughage such as rice straw, which is the chief roughage source for ruminants in Bangladesh, several methods have been applied in the past (Ibrahim, 1982). These include treatment with urea and ensiling (UTS), urea molasses straw (UMS), and supplementation with legume forages and so on.

There are quite a few milk pockets in Bangladesh where many farmers as one of their major income sources traditionally rear cattle. They usually rear crossbred cows with reasonably high milk production and grow seasonal forages in sufficient quantity for feeding their cows. These milk pockets include Baghabarighat (Sirajganj district), Faridpur, Munshiganj, Manikganj and Tangail districts. Feeding legume forages in winter season is a common practice in most of the milk pockets of the country. Milk market in the milk pockets has made dairying a profitable enterprise and to take it as a profession for improving livelihoods of the farmers. Among the milk pockets, Baghabarighat is the most important one, since the number of societies as well as the level of milk production is higher than the remaining ones in the country. Therefore, the present experiment was designed to manipulate the existing feeding practice in order to check excess feeding of green forage during its available, balance of nutrients in feeding and to maintain the level of milk production throughout the year in Baghaberighat area.

METHODOLOGY

Location, farms and animals

Baghabarighat milk pocket under Siraqjgonj district was selected for the present study. Two hundred crossbred dairy cows were randomly selected from 50 farms and were divided into 2 groups for traditional and intervened feeding. Average age of the animals was 5 years and milk production level ranged from 6 to 8 liters. Animals are mostly the crosses between Local and Holstein Friesian (LxF), Local and Sahiwal (LxSL) and also between Local, Holstein Friesian and Sahiwal (LxFxSL).

Nutrient requirements and feeding intervention

Total dry matter (DM), digestible crude protein (DCP) and metabolizable energy (ME) of the animals were calculated based on ARC (1980). In monsoon, usual feeding practice was to supply concentrates and rice straw only where concentrate mixture was prepared by wheat bran (*Triticum aestivum*), pea bran (*Pisum sativum*), chola bran (*Cicar ariatenum*) and sesame oil cake (*Sesamum indicum*) at a ratio of 50:20:15:15. However, in intervened feeding, urea molasses straw (UMS) was prepared by rice straw, molasses, urea and water in the proportion of 10.0, 2.1, 0.3 and 5.0 kg respectively (BLRI, 2003). Concentrate mixture was as similar as in traditional feeding. In winter, cows were fed legume forages *ad libitum* in traditional feeding. Rice straw and concentrate mixture were supplied in small amount where the concentrate mixture was prepared by wheat bran, rice polish, pea bran and mustard oilcake in the proportion of 60:20:10:10. In intervened feeding, supply of rice straw was increased in order to reduce the quantity of legume forages. Concentrate mixture was prepared with wheat bran and pea bran in the proportion of 80 and 20. In summer, animals were supplied rice straw, non-legume green forage (*Cynodon dactylon, Pennisetum purpureum* and *Zea mays*) and concentrates. The concentrates were wheat bran, pea bran, matikalai bran and mustard oil cake was mixed at the ratio of 50:20:20:10. However, in intervened feeding, supply of rice straw was reduced and that of napier grass was increased to make the ration more balanced in terms of nutrients availability. Concentrate mixture consisting of wheat bran, pea bran, khesari bran and mustard oil cake at the ratio of 50:20:20:10. Cost and nutritional values of the ingredients were considered to include in the concentrate mixture. Daily feed supplied to the animals in traditional and intervention feeding is shown in Table 1. Feeding intervention was carried out to correct the nutrient deficiency or excess based on the comparison of ARC (1980) standard.

Table 1: Feeding interventions of crossbred cows in different seasons of a year

Feed ingredients (kg DM/cow/day)	Traditional feeding (mean± sd)	Intervention feeding (mean± sd)
Monsoon		
Rice Straw	5.55±1.46	-
Urea molasses straw (UMS)	-	5.77±0.91
Concentrate mixture[1]	4.59±1.20	4.28±1.10
Winter		
Rice straw	1.09±0.32	2.08±0.48
Legume forage	7.91±1.22	6.20±1.05
Concentrate mixture[2]	2.52±0.37	2.52±0.34
Summer		
Rice straw	4.99±1.12	3.66±0.82
Green forage (non-legume)	1.97±1.67	4.15±0.66
Concentrate mixture[3]	3.85±1.06	3.50±0.61

[1]Proportion of concentrate mixture of wheat bran, pea bran, chola bran and sesame oilcake was 50:20:15:15 both for traditional and intervention feeding; [2]Proportion of concentrate mixture of wheat bran, rice polish, pea bran and mustard oil cake for traditional feeding was 60:20:10:10 and for intervened feeding the mixture of wheat bran and pea bran at a ratio of 80:20 respectively; [3]Proportion of concentrate mixture in traditional feeding for wheat bran, pea bran, matikalai bran and mustard oilcake was 50:20:20:10 and intervened feeding the mixture of wheat bran, pea bran, khesari bran and mustard oilcake was the same ratio of traditional feeding

Feeding management

In monsoon, rice straw was supplied to the cows in the morning and evening after milking traditionally. Daily average requirement of UMS of animals was determined based on their live weight and milk yield. Preparation of UMS was done twice daily at 8:00 and 15:00 hours and was supplied to the animals after half an hour of its preparation. UMS was used as sole roughage source for the animals. In winter, excess feeding of legume forage was reduced to save some forage by making hay for future feeding. One of the aims of feeding restricted amount of legume forage was to minimize the cost of feeding simultaneously keeping the nutrient supply as per requirements of the animal. On the other hand, in summer season, the supply of rice straw was reduced and that of napier grass was increased in order to make the ration more balanced in terms of nutrients availability. Napier grass was supplied as cut and carries system at the rate of about 20 kg/cow/d. In all the seasons, the concentrates were supplied to cows before milking at 7:00 and 14:00 hours.

Data collection and record keeping

Data on feed intake and milk yield for the cows in each farm were recorded at weekly interval. Daily feed intake was quantified by taking weight of each of the feed items separately before supplying to animals and also of the left over, if any, after 24 hours. Cut and carry grasses were weighed directly before supplying to animals. The quantity of grasses available from the grazing land was estimated from a 1×1 meter patch marked at different locations of the grazing land. Then the animals were allowed to graze and after grazing, the remaining grass that was refused by the cattle was harvested and measured. The total intake of grass was determined by subtracting from the estimated grass of the grazing land. Milk samples were collected in a plastic pot with identifying marks and transferred to the laboratory for analysis of chemical composition. Lactation length was recorded in days from the day of yielding first milk to the last day of milking, for each individual cow in each farm. Milk yield of the individual cow and total milk yield per lactation per cow in each farm was recorded. The cost of feed was calculated based on the local price of feed ingredients in local currency (Tk) during the experimental period and expressed per cow per day. Income of the farm was calculated based on the monetary benefit earned from selling of additional milk produced due to feeding intervention. In addition to that, savings of feed cost during different seasons were also considered as benefit. To find out the net benefit of the farm, additional labour cost for intervention feeding was deducted from the gross income.

Chemical and statistical analysis

Fat contents of milk samples were determined by Gerbar method (Jacobs, 1958). A lactometer was used to measure the corrected lactometer reading (CLR) of milk samples. Lactometer reading (LR) of the milk was taken and CLR was determined for recording density of milk samples. Solids-not-fat (SNF) was determined using the following formula:

SNF % = $\frac{CLR}{4}$ + (Fat %×0.2) +0.14. Where, CLR = corrected lactometer reading

Total solids (TS) were determined by adding Fat% with SNF%. The data of feed and nutrient intake and cost of feeding were analyzed following *paired t-test* to determine the level of significance. Effect of breed and feed and their interaction on milk yield and composition were analyzed to compute ANOVA in 2×3 factorial experiments in Completely Randomized Design (CRD) using MSTAT statistical programme. Treatment sum of squares are partitioned into three components such as main effects of feeding systems and breeds and their interaction effects.

RESULTS

Feed and nutrient intake

Daily rice straw intake was increased from 5.55 to 5.77 kg DM/d with intervened feeding in monsoon, meanwhile, concentrate intake was decreased (P>0.05) over that of conventional feeding. However, total DM intake was almost similar between conventional and intervention feeding. Feeding intervention increased (P<0.01) DCP intake from 0.38 to 0.68 kg/d by the crossbred cows by intervened feeding. Similarly, ME intake of the animals on intervened feeding was 85.20 MJ/d which was higher (P<0.01) than that of traditional feeding (71.51 MJ/d). Rice straw intake in winter increased (P<0.001) from 1.09 to 2.08 kg DM/d due to modify traditional feeding. Meanwhile, daily intake of green forage was decreased (P<0.001) due to feeding intervention (Table 2). Concentrate intake was not significantly changed (P>0.05) in intervened feeding compared to that of traditional feeding. However, total DM intake was decreased (P<0.05) from 11.52 to 10.80 kg/d due to feeding intervention. As regards to nutrient intake, feeding intervention decreased DCP (P<0.001) intake from 1.53 to 1.25 kg/d and ME (P<0.01) intake from 113.77 to 100.91 MJ/d. Intake of rice straw by crossbred cows during feeding intervention in summer was decreased (P<0.01) compared to that of traditional feeding (Table 2). Besides, green forage consumption (kg/d) was increased (P<0.01) with feeding intervention (from 1.97 to 4.15 kg/d). Intervened feeding resulted in decreased (P<0.05) concentrate intake by the animals. However, total DM intake of the animals was increased (P<0.05) from 10.81 to 11.31 kg/d due to feeding intervention. As regards to nutrient intake, DCP and ME intake during intervention were significantly (P<0.01) higher than those without intervention.

Milk yield and composition

The highest milk yield was observed in L×F (8.33±1.14 l/d) followed by L×F×SL (7.62±1.84 l/d) and the lowest was in L×SL (6.05±0.84 l/d) cows irrespective of feeding intervention in monsoon (Table 3). However, the difference of milk yield was not significant (P>0.05) between L×F and L×F×SL, but significant (P<0.01) difference was observed with L×SL. Milk yield was increased (P<0.01) in intervened feeding group (7.82±1.64 l/d) than that of traditional feeding group (6.83±1.48 l/d) irrespective of breed type. The interactive effect among breed and feeding intervention was not significant. From the Table 3 it was showed that the highest milk fat% was observed in L×SL (4.74±0.15, P<0.01) followed by L×F×SL (4.54±0.15) and the lowest was in L×F (4.16±0.12) cows irrespective of feeding intervention. Milk fat% was increased (P<0.05) in the cows of intervened feeding group (4.52±0.27) than that of traditional feeding group (4.44±0.29) irrespective of breed type. As in milk fat%, the highest SNF and TS percentage were recorded in L×SL (P<0.01) cows followed by L×F×SL and the lowest in L×F cows irrespective of feeding intervention. SNF% and TS% were significantly (P<0.01) increased in intervened feeding group than that of traditional feeding group. Interactive effect for milk fat, SNF and total solids among breed type and feeding intervention was not significant.

Table 2: Feed and nutrient intake of animals in traditional and intervention feeding during different seasons

Feed and nutrients intake	Traditional feeding (mean± sd)	Intervention feeding (mean± sd)	t-value	Level of significance
Monsoon				
Rice straw[1] DM (kg/d)	5.55±1.46	5.77±0.91	- 1.161	NS
Concentrates, DM (kg/d)	4.59±1.20	4.38±1.10	1.715	NS
Total DM (kg/d)	10.14±1.60	10.15±0.99	0.596	NS
DCP (kg/d)	0.38±0.08	0.67±0.11	-13.535	*
ME (MJ/d)	71.51±5.60	85.2±4.82	-6.559	**
Winter				
Rice straw, DM (kg/d)	1.09±0.32	2.08±0.48	-8.719	***
Green forage, DM (kg/d)	7.91±1.22	6.20±1.05	5.332	**
Concentrates, DM (kg/d)	2.52±0.37	2.52±0.34	0.000	NS
Total DM (kg/d)	11.52±1.32	10.80±1.19	2.016	*
DCP (kg/d)	1.53±0.21	1.25±0.18	4.971	*
ME (MJ/d)	113.77±14.03	100.91±12.21	3.458	**
Summer				
Rice straw, DM (kg/d)	4.99±1.12	3.66±0.82	4.710	**
Green forage, DM (kg/d)	1.97±1.67	4.15±0.66	- 7.206	***
Concentrates, DM (kg/d)	3.85±1.05	3.50±0.61	1.944	*
Total DM (kg/d)	10.81±1.93	11.31±1.19	-1.437	*
DCP (kg/d)	0.55±0.20	0.70±0.07	-3.802	**
ME (MJ/d)	80.05±15.91	87.80±9.01	-2.689	**

[1]Rice straw used as untreated in traditional feeding and as treated (with urea-molasses) in intervention feeding; NS = Not significant; * = Significant at 5% level; **= Significant at 1% level; ***= Significant at 0.1% level

Table 3: Effect of feeding intervention on milk yield and composition (mean ± sd) of crossbred cows in different seasons

Breed (B)	Feeding system (F)	Parameter			
		Milk Yield (l/d)	Milk composition (%)		
			Fat	SNF	TS
Monsoon					
L×F	Traditional feeding	7.75±0.95	4.12±0.11	8.20±0.09	12.31±0.21
	Intervention feeding	8.90±1.05	4.21±0.11	8.29±0.10	12.50±0.21
L×SL	Traditional feeding	5.64±0.66	4.71±0.16	8.62±0.05	13.33±0.16
	Intervention feeding	6.45±0.83	4.78±0.15	8.71±0.03	13.49±0.16
L×F×SL	Traditional feeding	7.11±1.78	4.51±0.16	8.40±0.07	12.97±0.15
	Intervention feeding	8.12±1.84	4.57±0.14	8.52±0.07	13.09±0.15
SEM		0.402	0.044	0.024	0.056
[#]Level of significance	B	**	**	**	**
	F	**	*	**	**
	BF	NS	NS	NS	NS
Winter					
L×F	Traditional feeding	10.37±1.82	4.31±0.12	8.34±0.09	12.65±0.21
	Intervention feeding	10.14±1.75	4.34±0.12	8.42±0.11	12.76±0.22
L×SL	Traditional feeding	7.40±1.27	4.83±0.12	8.76±0.04	13.59±0.15
	Intervention feeding	7.40±1.30	4.84±0.12	8.83±0.04	13.68±0.15
L×F×SL	Traditional feeding	8.85±1.24	4.56±0.12	8.61±0.05	13.17±0.14
	Intervention feeding	8.91±1.21	4.58±0.13	8.70±0.04	13.28±0.14
SEM		0.460	0.039	0.022	0.055
Level of significance	B	***	**	**	**
	F	NS	NS	**	*
	BF	NS	NS	NS	NS
Summer					
L×F	Traditional feeding	8.20±1.18	4.19±0.09	8.26±0.08	12.45±0.17
	Intervention feeding	9.10±1.51	4.25±0.11	8.33±0.08	12.58±0.19
L×SL	Traditional feeding	6.55±1.06	4.71±0.15	8.71±0.06	13.42±0.16
	Intervention feeding	7.60±0.94	4.80±0.13	8.77±0.07	13.56±0.14
L×F×SL	Traditional feeding	8.03±1.55	4.50±0.14	8.57±0.06	13.07±0.14
	Intervention feeding	9.00±1.73	4.57±0.14	8.63±0.06	13.18±0.15
SEM	0.429	0.040	0.022	0.050	0.054
[#]Level of significance	B	**	**	**	**
	F	**	*	**	**
	BF	NS	NS	NS	NS

NS = Not significant; * = Significant at 5% level; **= Significant at 1% level; ***= Significant at 0.1% level; [#] Contrasts; F = main effect of feeding systems; B= main effect of breed; BF= interaction between feeding system and breed

As in monsoon, the highest milk yield (P<0.001) was observed in L×F followed by L×F×SL and the lowest in L×SL cows both for winter and summer season (Table 3). Milk yield was not significantly changed (P>0.05) due to feeding intervention in winter but in summer milk yield was increased (P<0.01) in intervened feeding (8.56±1.55 l/d) than that of traditional feeding (7.59±1.45 l/d) irrespective of breed type. The interactive effect on milk yield among the breed type and feeding intervention was not statistically significant. Both in winter and summer the highest milk fat% was observed in L×SL followed by L×F×SL and the lowest in L×F cows and the difference was significant (P<0.01) among three different crossbred cows (Table 3). Milk fat% was not significantly (P>0.05) increased due to feeding intervention in winter season but it was increased (P<0.05) in the cows of intervention feeding (4.54±0.26) than that of traditional feeding (4.46±0.25) in summer. Significant (P<0.01) difference was found in SNF and TS percentage in L×SL followed by L×F×SL and the lowest in L×F cows in both the seasons. SNF and TS percentage increased (P<0.01) with intervened feeding group than that of traditional feeding group irrespective of breed type (Table 3). However, the interactive effect on SNF and TS among the breed type and feeding intervention was not significant.

Lactation length and total milk yield

The lactation length was highest in L×F followed by L×F×SL and the lowest in L×SL cows irrespective of feeding intervention (Table 4) and the difference was significant (P<0.01) in all the seasons. Lactation length (d) increased (P<0.05) in intervened feeding (245.60±24.88) against traditional feeding (241.44±26.72) irrespective of breed although the interactive effect on lactation length among breed and feeding intervention was not significant. At the same time, the highest milk yield (l/lactation) was observed in L×F (2315.21±180.44) followed by L×F×SL (2012.41±224.48) and the lowest was in L×SL (1388.94±155.73) cows irrespective of feeding intervention and the difference was significant (P<0.01). Total milk yield (l/lactation) was increased (P<0.01) in intervention feeding (2046.31±415.18) than that of traditional feeding (1764.74±397.93) irrespective of breed type. The interactive effect among breed type and feeding intervention was also significant (P<0.01). It can be mentioned here that the improved feeding resulted in a trend to increase the total milk yield per lactation.

Cost and benefit from intervened feeding

The daily feed cost for the cows on intervened feeding was slightly higher (5.93%) than that on traditional feeding in monsoon (Table 5) although the difference was not significant (P>0.05). In winter, intervened feeding had no significant (P>0.05) effect on the cost of feeding although the overall cost of feeding was decreased (5.39%). On the other hand, the feed cost of the intervention group was lower (10.44 %) than that of the animals in traditional group and the differences

Table 4: Effect of feeding intervention on lactation length and total milk yield of crossbred cows in milk pocket (Baghabarighat) area

Breed (B)	Feeding system (F)	Parameter: Lactation length (d)	Parameter: Total milk yield / lactation (l)
L×F	Traditional feeding	262.12±14.71	2185.64±122.30
	Intervention feeding	265.80±12.03	2444.78±128.69
L×SL	Traditional feeding	212.66±20.32	1271.74±121.91
	Intervention feeding	216.40±11.49	1506.14±78.12
L×F×SL	Traditional feeding	249.54±13.92	1836.83±132.71
	Intervention feeding	254.60±15.42	2187.99±145.88
SEM		2.111	17.452
#Level of significance	B	**	**
	F	*	**
	BF	NS	**

NS = Not significant; * = Significant at 5% level; **= Significant at 1% level; ***= Significant at 0.1% level; # Contrasts; F = main effect of feeding systems; B= main effect of breed; BF= interaction between feeding system and breed

Table 5: Feeding cost and benefit from additional milk yield (cow/day) in three different seasons

Feeding system	Monsoon			Winter			Summer		
	Feeding cost (Tk./d/cow)	Milk yield (l/d/cow)	Milk price (Tk./l)	Feeding cost (Tk./d/cow)	Milk yield (l/d/cow)	Milk price (Tk./l)	Feeding cost (Tk./d/cow)	Milk yield (l/d/cow)	Milk price (Tk./l)
Traditional	52.62	7.60	12.0	42.47	10.1	14.0	53.46	8.8	14.0
Interventional	55.94	8.45	13.0	40.18	10.0	15.5	47.88	9.7	15.0
Balance	- 3.32	0.85	----	2.29	- 0.07	----	5.58	0.93	----
t- value	- 2.22	- 8.74	----	1.468	-3.621	----	3.951	-9.01	----
Level of significance	NS	NS	----	NS	NS	----	*	*	----

Additional income and expenses:

Attributes	Monsoon	Winter	Summer
Feed cost balance (Tk/d/cow)	- 3.32	2.29	5.58
Price of additional milk (Tk/d/cow)	0.85×13.00 = 11.05	- 0.07×15.50 = - 1.08	0.93×15.00 = 13.95
Legume forage saved (kg/d/cow)	----	11.00×0.75 = 8.25	----
Extra labor cost (Tk/d/cow)	- 3.00	- 3.00	- 6.00
Net benefit (Tk/d/cow)	= 4.73	= 6.46	=13.53

1US $= 70.00 Tk (BDT); NS = Not significant; * = Significant at 5% level between the two groups were significant (P<0.05) in summer. The decrease in feeding cost was the highest in summer followed by winter. However, during monsoon, the cost of feeding was increased in intervention feeding compared to that in traditional feeding. The extra labor cost was included for the animals of intervention feeding group in all the seasons.

DISCUSSION

Feed and nutrient intake

In monsoon, whole study area was inundated with floodwater and the animals were fed only with rice straw and concentrate. As there was no green forage for feeding to the animals the animals of intervened group were supplied with UMS to upgrade nutritional value of straw resulted in significantly higher DCP and ME than those of the traditional feeding. This might be due to the higher intake of UMS where urea supplying nitrogen yielding to microbial as well as animal body protein and molasses giving energy. There are evidences that feeding UMS supplied higher amounts of protein and energy to the animals (Islam and Huque, 1995 and Biswas *et al.*, 2002). Although cost of feeding animals of intervention group was slightly higher than that of traditional group the difference was insignificant. This might be the result of insignificant increase of UMS intake with insignificant decrease of intake of concentrates in the ration of intervention group compared to those in the traditional feeding group (Table 2).

In winter, the idea of intervened feeding was to reduce the quantity of leguminous forage without altering milk yield and make some of the forges saved for future feeding resulted in lower intake of legume forages when compared to that found in animals fed traditional diet. It is important to mention here that the amount of legume forage saved for future feeding was 1.71 kg DM per day which is equivalent to about 11.0 kg fresh forage per day per animal. The supply of rice straw was increased to meet up the DM requirement of the animals since the supply of concentrates was unchanged between the two dietary regimes. Although the intake of DM, DCP and ME were significantly (P<0.05) lowered in the animals of intervention group compared to that of traditional group, the animals of the former group did not suffer from nutrient deficiency. The feeding intervention resulted in significant decrease in the total feed cost of the animals, which indicated that it saved money of the farmers. The feeding cost was reduced in intervention group due to cut down of legume forage (Table 5).

In summer season, the reason for inclusion of napier grass in the diet of intervened group due to its nutritive value and yield per hectare were higher compared to other grasses. In addition, the roots and cuttings of napier were easily available in the study area. The average CP and ME contents of napier grass were 10.60% and 8.50 MJ/kg DM and, therefore, increase in its amounts in intervened feeding would raise the level of these nutrients in the diet as well as intake of animals (Table 2). As because the green forage intake was higher, intake of rice straw was decreased to minimize the cost of feeding as well as to keeping the ratio of roughage and concentrate similar. As a result, total DM intake was increased in the intervention group compared to that of the traditional group. The higher intake of both DCP as well as of ME might be because of the significant increase in green grass intake and also of the decreased rice straw intake.

Milk yield and composition

The increased milk yield of the cows of intervention feeding group compared to those of the traditional group in monsoon might be due to DCP and ME intake that were significantly higher in the intervention group than traditional group. Although the intake of UMS in the cows of intervened feeding group was not significantly increased it contributed to the significant increase in protein and energy intake, as it contains urea and molasses. The results are in supported by other reports (BLRI, 2003 and Islam and Huque, 1995). The feeding intervention significantly increased milk yield of cows (L×F and L×F×SL) breed; however, it increased (P>0.05) in the case of L×SL which might be that the former two crossbreds utilized feed nutrients more efficiently to convert into milk. The significant (P<0.01) increase in milk fat, SNF and TS contents of the animals of intervention group could be due to efficient utilization of feed nutrients in intervention feeding compared to that of traditional group converted into milk composition.

Total milk yield did not increase due to feeding intervention in winter season which might be expected that the amounts of legume forage was significantly reduced in the intervention feeding compared to that in the traditional feeding. Meanwhile, milk yield was not reduced which might be due to the fact that the nutrient supply still met the requirement of the animals of intervention group. Although farmers are not getting benefits instantly from increased milk yield due to feeding intervention but they are saving forages for future feeding which can increase milk yield in the forage scarcity period resulting in increased income. The significant variation among the mean values for milk yield of different crossbred cows fed on two different diets (Table 3) indicated that the differences in the dietary regimes of the present study had no significant effect on milk yield of genotypes of cows. Despite the significant (P<0.05) reduction in legume forage supply in intervention feeding group compared to traditional feeding group, milk yield of the animals of the two feeding groups remained similar. The reason could be due to supplied in much higher amounts nutrients in intervened group than the requirements of the animals. From the results it also appeared that it happened to each of the genotypes under study further indicating that within each genotype the difference in dietary regime had no significant effect on milk yield of cows.

The higher milk production of the cows in intervention group than that of traditional group might be due to significantly higher intake of green grass in summer by the cows of intervention group (Table 2). The increased protein and energy supply in the rumen might have enhanced microbial activity, hence increased digestibility of other feeds leading to increased milk yield (Khan *et al.*, 1991). Straw-based diets supplemented with napier grass in summer could be attributed to more improved rumen environment due to supply of both degradable nitrogen and available energy which enhanced microbial activity, thereby, increasing digestibility and nutrient intake and subsequently better lactation performance (Abdulrazak *et al.,* 1996 and Masama *et al.,* 1997). Like milk yield feeding intervention significantly increased milk fat, SNF and TS contents that might be due to higher feed intake as well as nutrients those were contributes milk composition. It depends on several factors of which feed composition is one of them (Adachi *et al.,* 2000 and Garg *et al.,* 2002). Production performance of different crossbred cows of traditional and intervention groups suggests that the breed has significant (P<0.01) effect on milk yield and composition of the cows. The reason might be that each type of crossbred cows has its individual genetic potentiality for milk yield and composition. There is evidence that different crossbred cows yield different quantities of milk with different milk composition (Rahman *et al.,* 2001). On the contrary when the combined effect of breed and feed was studied it was found that the interaction of these attributes had no significant effect on either milk yield or composition.

Lactation Length and milk yield per lactation

In intervened feeding, lactation length of L×F, L×SL and L×F×SL crossbred cows was increased by 3.68, 3.74 and 3.06 days respectively than that of traditional feeding. Choudhury *et al.,* (1994) observed that the average lactation length of 4 genetic groups of F×SL grades and Sahiwal were 362, 312, 350, 383 and 262 days respectively those were increased by feeding intervention. In the present experiment, the lactation length of LxFxSL due to feeding intervention was 254 days which was lower than FxSL grades observed by Chowdhury *et al.,* (1994). This was due to lower genetic effects of local breeds. However, there were no significant effects of interaction between feed type and breed type on lactation length.

In intervened feeding, total milk yield (l/lactation) of different crossbred cows increased (P<0.01) by 204.14, 116.40 and 170.16 in three types of crossbred cows over those of the traditional feeding. This was presumably due to the effect of improved feeding and higher amount of nutrient intake during the three different seasons compared to that of traditional feeding. The significant difference in the total milk yield per lactation among different crossbred cows indicated that within a given feeding regime genotype of cows had considerable effect on their total milk yield per lactation. Choudhury *et al.,* (1994) reported that the average milk yield (l/laction) of 4 genetic groups of F×SL and Sahiwal cows were 3209, 2436, 2773, 3252 and 1915 liters, respectively. In another experiment, Syed *et al.,* (1996) showed that the average milk yield of F×SL crossbred (25 to 87.5% Holstein) ranged from 2063 to 2552 l/lactation and that of Sahiwal cows was 1226 l/lactation. They concluded that breed type and season of calving had significant effect on lactation yield. Ashraf *et al.* (2000) and Talukder *et al.,* (2001) reported that the lactation yield of different crossbred cows affected by genetic groups. Nahar *et al.,* (1989) was also found the similar effect in Friesian purebred and crossbreds and in Local-Friesian graded cattle.

Conclusion

Milk yield was increased in the cows of intervention feeding than the cows of traditional feeding. The level of milk yield was recorded the highest in winter compared to other seasons due to feeding legume forage. During intervened feeding the highest milk yield was observed in summer followed by monsoon. The extra milk yield was higher and cost of feed was lower in summer compared to other two seasons. Lactation length and total milk yield per lactation of different crossbred cows was increased significantly due to intervened feeding. Feeding intervention also positively influenced fat content of milk. As a result, feeding intervention to cows in three different seasons has been found to be profitable in terms of milk yield, milk fat content, length of lactation and total milk yield per lactation of crossbred cows. For the improvement of nutritional status and productivity of dairy cows, intervened feeding described in the present study was found effective in Baghabarighat milk pocket area of Bangladesh.

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