Dairy Potential of Pabna Cows and Crossbreds with Sahiwal and Friesian and Within- and Between-Breed Sire Effects

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ABSTRACT : Dairy performances of Pabna cows and its crossbreds with Sahiwal (SL) and Friesian (F) in the Baghabarighat dairying area of Bangladesh were evaluated. Four SL and three F sires were used for the crossbreeding. The exotic sire effect of individuals on their daughters were also evaluated in this study. It showed that the genetic group had a significant ($p<0.05$) effect on birth weight, age at first heat, calving interval, lactation length and lactation yield. The lowest birth weight (17.9 kg), longest age at first heat (39.2 m) and calving interval (16.3 m) shortest lactation length (199 d) and lowest lactation yield (728 L) were found in Pabna cows. The highest birth weight (22.5 kg), shortest age at first heat (25.5 m) and calving interval (13.7 m), longest lactation length (253 d) and highest lactation yield (1936 L) were found in the F crossbreds. Within the same breed, the effect of individual sire was significant ($p<0.05$) on age at first heat, lactation length and lactation yield. Individual sire effects of SL bulls differed significantly ($p<0.05$) but F sires had a non-significant ($p>0.05$) effect on calving interval in their progeny. The fat % and SNF % in milk and number of services required for conception did not differ ($p>0.05$) among inter- and intra- breed sire groups. (*Asian-Aus. J. Anim. Sci. 1999. Vol. 12, No. 2 : 161-164*)

Key Words : Birth Weight, First Heat, Service/Conception, Calving Interval, Length and Yield of Lactation, Milk Fat and SNF

INTRODUCTION

Intensive milk production organizations constituted as co-operatives have proved to be more successful than commercial dairies, especially in the least developed countries. The Baghabarighat area within the Bangladesh Milk Producers Co-Operative Union Limited (Milk Vita) is a large dairying district of Bangladesh covering the flood prone belt of the rivers Jamuna, Chalan and Boral in a low lying area of the Rajshahi region. The cattle population of Rajshahi included a notable dairy type long before the establishment of Milk Vita. According to Ahmed and Islam (1987), who have described the history of cattle improvement in the region, Lord Linlithgo the then British Viceroy brought some Hariana bulls and distributed them in locations where an abundance of green fodder existed. Udo et al. (1992) noted that Sahiwal and Red Sindhi bulls were also imported at that time for improving local cows. Through many generations of upgrading of Local cows with Sahiwal, Hariana and Red Sindhi bulls, the cattle of the area became the notable milch type popularly known as Pabna (Hoque et al., 1997; Bhuiyan et al., 1998). All their ancestors were of the *Bos indicus* species, and so Pabna cattle are characterized by a prominent hump and well developed dewlap. With the passage of time Milk Vita initiated a further program for the improvement of Pabna cattle through crossbreeding with Sahiwal and Friesian stud animals.

Milk Vita is a self sufficient and profitable milk producing, processing and marketing organization. It is believed that the exploitation of genetically suitable animals might be one of the most important elements behind its success. There has been considerable controversy about the type of cow to be bred, and their evaluation, for commercial dairy farming in the tropics (Bondoc et al, 1989; Cunningham, 1989). Economic evaluation is of prime importance in a quantitative study being made of the performances of the genotypes used in the Milk Vita program, and requires evaluation of reproductive and lactational potentials in the prevailing environment. This paper presents the results of studies designed to identify the most appropriate types of cows to be kept by members of the Co-Operative. It was also designed to obtain information required to promote the establishment of co-operatives of similar type elsewhere in developing countries.

MATERIALS AND METHODS

Milk Vita has been engaged in operating a co-operative system through which the produce of its members is bought at a fair price and a guaranteed market is created for them. Registered farmers own their herds and Milk Vita provides services for improved husbandry practices, veterinary care, artificial insemination (AI), and feeds and fodder production. A cattle improvement AI program was initiated in 1987 using frozen semen from Sahiwal (SL) (Pakistani) and Friesian (F) (Australian) bulls. In the present study, data on calf birth weight, age at first heat, services per conception, first calving interval, first lactation length, milk yield per lactation, and fat and solids-not-fat concentrations in milk were obtained from individual cows. Pregnancy was confirmed by rectal palpation at the 90th day following AI. Owing to lack of facilities it was not possible to weigh heifers at the age of first heat and first service. Cows under study were the progeny of Pabna cows × SL (SL cross), P × F (F cross), and purebred Pabna. Measurements were made from birth to 2nd calving during the period from July 1988 to June 1995.

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Daughters of individual sires within breed from each of four SL bulls (Nos. 101, 102, 103 and 104) and three F bulls (Nos. 111, 113 and 115) breed were studied to determine individual sire effects on performances.

From December to June each year cattle were fed and managed in 'Bathan' which is a large legume pasture (about 600 hectares) along the sides of rivers. In addition to grazing during that period, all animals were provided with a concentrate mixture (rice polishings, mustard oilseed cake, common salt) once a day. Animals were fed and managed during the remaining period of the year in the stall where a straw based diet supplemented with a similar concentrate mixture was given to each animal twice a day and the animals were milked and, at the appropriate times, were inseminated and calved.

The collected data were subjected to statistical analysis using the technique of a completely randomized design to compute analysis of variance and to calculate the means for each variate with standard error (SE) according to Steel and Torrie, 1980. The general statistical model was:

$$Y_{ij} = \mu + B_i + e_{ij}$$

Where, Y_{ij} = measurement of ith breed/bull within breed breed in jth animal
μ = general mean
B_i = effect of breed/bull within breed
e_{ij} = random error

For meaningful comparison of sub-class means, a Least Significant Differences (LSD) test was performed.

RESULTS AND DISCUSSION

Birth weight of dairy heifer calves within a genetic group is an indication of their future performance. In this study, birth weight was significantly lower ($p<0.05$) for Pabna calves than for both SL and F crossbred calves; those for the crossbreds did not differ significantly (table 1). The mean value for Pabna calves is consistent with the findings of Hossain and Routledge (1982) and Udo et al. (1990) who reported 16.37 and 15.60 kg respectively. There appear to be no published reports for SL or F×Pabna cross calves, but Nahar et al. (1989) found that the mean birth weights of SL×Local and F×Local halfbred calves were 18.12 and 22.00 kg respectively; this difference was significant ($p<0.05$). Within breed, individual sire effect on calf birth weight was not significant ($p>0.05$) in either the SL or the F sire group (tables 2 and 3).

Ages at first heat in heifers in descending order were Pabna > SL cross > F cross, although the values for Scross and Pabna heifers were non-significant (table 1). These results are supported by those of Nahar et al. (1992), who noted that the ages at first heat of F×Local (920 d) and of SL×Local (1059 d) did differ significantly ($p<0.05$). Progeny of SL bull No. 104 reached sexual maturity much earlier than those of the other 3 bulls of that breed (table 2). Progeny of individual sire belonged to F breed behaved similarly as found in SL progeny (table 3).

Number of services per conception were similar in all genetic groups (table 1), and sire effect was non-significant (tables 2 and 3). These results are in agreement with Sultana (1995) who found a non-significant ($p>0.05$) effect of genetic group on this trait, and with Khan (1990) who concluded from an analysis of data from five different genotypes on service per conception that there was no significant difference amongst these. He also reported that the average number of services required per conception for Pabna cattle was 1.57. It therefore appears that service per conception is mostly determined by environmental attributes rather than by heredity.

Genetic group affected calving interval significantly ($p<0.05$) in this study (table 1). The shortest and longest calving intervals were in F cross and Pabna respectively. Nahar et. al. (1989) analysed the performance of 196 cows of 4 genetic groups using data collected at the Bangladesh Agricultural University Dairy Farm and found a highly significant ($p<0.01$) variation among these. They also reported calving intervals of SL×Local and F×Local to be 436.3 d and 435.2 d respectively.

Table 1. Mean comparision of productive and reproductive traits in different genotypes

Parameter	Genotype								
	SL × Pabna			F × Pabna			Pabna		
	n	$\bar{x}$	SE	n	$\bar{x}$	SE	n	$\bar{x}$	SE
Birth weight (kg)	42	21.26[a]	2.89	38	22.50[a]	4.88	24	17.92[b]	3.47
Age at first heat (m)	62	35.10[a]	9.24	38	25.53[b]	5.59	24	39.23[a]	4.31
Service/conception	62	1.59	0.31	38	1.35	0.26	24	1.32	0.22
Calving interval (m)	36	15.46[ab]	4.09	30	13.71[a]	3.57	18	16.34[b]	4.28
Lactation length (d)	41	236.93[a]	51.78	38	253.12[a]	41.91	22	198.92[b]	11.52
Milk yield/Lactation (Lt)	36	1249.53[a]	66.58	36	1936.44[b]	89.24	22	727.97[c]	6.28
Milk fat (%)	64	4.63	0.57	40	4.31	0.58	24	4.50	0.88
SNF (%)	64	7.54	0.37	40	7.94	0.24	24	7.58	0.71

[a,b] Means with different superscripts in the same row differ significantly ($p<0.05$).

In the present study there were significant individual sire effects ($p<0.05$) of SL bulls but not of F bulls ($p>0.05$) on calving interval in their progeny (tables 2 and 3).

Genetic group had a significant ($p<0.05$) effect on lactation length (table 1). Sultana (1995) also found a highly significant ($p<0.01$) variation between genetic groups and reported that the longest lactation length in 8 genetic groups was 293 d in SL cows. Nahar et al. (1989) observed that the lactation length of SL×local cows was 195 d, and Hossain and Routledge (1982) reported 286 and 260 d for Pabna and Local cows respectively. In the present study F cross and SL cross ranked highest in lactation length followed by Pabna cows; individual sire effect was also significant ($p<0.05$; tables 2 and 3).

Means with SE for lactation yield presented in table 1 show that genetic group had a significant effect on lactation yield. Total yield was highest in F cross followed by SL cross, while Pabna type took third position. Bhuiyan and Sultana (1994) collected data from the Central Cattle Breeding Station (CCBS), Bangladesh, and analysed milk yield of exotic breeds and their crosses with Local. They found that total yields of Local and Local×F were 724 and 2793 L respectively. Hossain and Routledge (1982) reported that a lactation yield for Pabna cows of 803 kg, and Khan et al. (1991) found daily milk yields by Pabna and SL×Local cows were 1.60-4.16 and 0.93-2.39 kg with corresponding lactation lengths of 184-256 and 213-315 d. Nahar et al. (1989) analysed the data obtained from four F_1 crossbreds and reported that genetic group had a significant ($p<0.01$) effect on total lactation yield. In the present study individual sires within both breeds had a significant ($p<0.05$) effect on the lactation yield of their progeny (table 2 and 3). This finding, in agreement with Islam et al. (1995), signifies that there is much variability in the milk production potentiality of bulls within breeds and, therefore, a response can be obtained to sire selection even in a well defined breed in a grading program. As lactation yield is a multivariate function of yield per day and lactation length, the magnitude of their individual contributions could not be determined.

Mean fat % according to genetic group are presented in table 1, and of the SL and F sire groups in tables 2 and 3 respectively. Neither genetic group nor individual sire effects were significant ($p>0.05$). Similar results were found by Chaudhury et al. (1994). Mannan (1989)

Table 2. Mean comparison of progeny showing the individual sire (SL) difference for 50% SL×50% Pabna genotype

Parameter	SL-Bull											
	101			102			103			104		
	n	$\bar{x}$	SE	n	$\bar{x}$	SE	n	$\bar{x}$	SE	n	$\bar{x}$	SE
Birth weight (kg)	8	21.50	2.56	12	20.33	2.77	14	22.13	3.28	8	20.89	2.36
Age at first heat (m)	8	37.25[a]	6.69	20	35.88[a]	9.70	24	37.64[a]	8.14	10	25.72[b]	7.53
Service/conception	8	1.54	0.28	20	1.62	0.34	24	1.56	0.42	10	1.64	0.36
Calving interval (m)	8	17.49[a]	5.66	8	14.68[b]	2.55	14	13.12[b]	4.83	6	19.25[a]	6.35
Lactation length (d)	10	297.75[a]	74.64	8	209.13[b]	62.12	14	208.57[b]	69.02	9	238.18[ab]	43.93
Milk yield/Lactation (Lt)	8	952.50[a]	97.81	8	1458.13[b]	231.95	14	1238.79[b]	162.39	6	1392.50[b]	364.96
Milk fat (%)	8	5.01	0.26	21	4.71	0.52	25	4.45	0.67	10	4.21	0.46
SNF (%)	8	7.49	0.21	21	7.68	0.29	25	7.62	0.22	10	7.09	0.51

[a,b] Means with different superscripts in the same row differ significantly ($p<0.05$).

Table 3. Mean comparison of progeny showing the individual sire (F) differences for 50% F×50% Pabna genotype

Parameter	F-Bull								
	111			113			115		
	n	$\bar{x}$	SE	n	$\bar{x}$	SE	n	$\bar{x}$	SE
Birth weight (kg)	20	22.61	3.79	10	23.22	4.91	8	21.37	3.86
Age at first heat (m)	20	26.08[a]	4.34	10	22.88[b]	3.65	8	27.47[a]	4.16
Service/conception	20	1.32	0.24	10	1.38	0.26	8	1.39	0.32
Calving interval (m)	16	13.12	3.42	70	14.73	4.18	7	14.04	3.89
Lactation length (d)	20	282.80[a]	32.02	10	238.33[a]	40.12	8	197.41[b]	21.38
Milk yield/Lactation (Lt)	18	2109.32[a]	82.83	10	2059.41[a]	98.82	8	1393.75[b]	113.61
Milk fat (%)	20	4.58	0.69	12	4.33	0.47	8	4.60	0.59
SNF (%)	20	7.97	0.32	12	7.92	0.18	8	7.81	0.24

[a,b] Means with different superscripts in the same row differ significantly ($p<0.05$).

reported a slightly high fat % in the milk of indigenous (Local) compared with crossbred cows.

Average SNF % according to genetic group are given in table 1 and according to sire group in tables 2 and 3. Effects of both genetic group and of individual sire were not significant ($p>0.05$). This is partially in agreement with the results of Islam et al. (1995) who found a significant difference ($p<0.01$) in average SNF % between 50% SL/50% Pabna and 75% SL/25% Pabna cows, but no significant effect ($p>0.05$) of individual sires within the same genotype.

When values for all the dairy traits studied are considered, the F cross ranked first in overall merit followed by SL cross and then Pabna cows. Significant variation between the performances of progeny within the SL and F sire groups in several important traits - age at first heat, calving interval, lactation length, milk yield - indicates the scope for sire selection to improve dairy merit. The results of this study provide guidelines, but it is desirable that they be confirmed by further studies on the performances of pure and crossbred Pabna cows in a wider context.

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