

Performance of Crossbred Sahiwal Cattle at the Pabna Milkshed Area in Bangladesh

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ABSTRACT : The present study analysed the various productive and reproductive characteristics of 1/2 Pabna Milking Cows (PMC)-1/2 Sahiwal (S) and 1/4 PMC-3/4 S collected from the Pabna milkshed area at Baghabarighat, Sirajgonj, Bangladesh.

The studied traits were birth weight (BWT), age at puberty (AP), number of services per conception (NSC), post partum heat period (PPHP), gestation period (GP), daily milk yield (DMY), lactational production (LP), lactation length (LL), fat percentage and solids-not-fat percentage (SNFP). Five individual Sahiwal sires were used for the upgrading of Pabna Milking Cows. The used data covered from 1987 to 1994. Least-squares analysis of variance showed that genetic group had a significant effect on BWT ($p < 0.05$), AP ($p < 0.01$), DMY ($p <$

0.01), LP ($p < 0.001$), LL ($p < 0.05$), FP ($p < 0.05$) and SNFP ($p < 0.01$). Genetic group had non-significant effect on NSC, GP and PPHP. The effect of sire was significant on BWT ($p < 0.01$), NSC ($p < 0.01$), LP ($p < 0.05$) and LL ($p < 0.05$). The AP, NSC, DMY, LP, LL and SNFP were higher in 1/2 PMC-1/2S cows; BWT and PPHP were higher in 1/4 PMC-3/4S but GP and FP were almost same in both genetic groups. From this study it may be concluded that production and use of 1/2 PMC-1/2S would seem more profitable for commercial milk production in the Bangladesh Milk Producers' Co-operative Union Limited (BMPCUL) area and at the same time emphasis should be given on rigorous sire selection.

(Key Words : Performance, Crossbred, Sahiwal, Cattle)

INTRODUCTION

Cattle plays an important role in the agricultural operations of Bangladesh. But they are late maturing animal with short lactation length having long inter calving period and their milk production is low. They are mainly used for draught purpose and have high disease resistance and able to thrive in a extreme climatic condition. Many attempts have been under taken to improve the productivity of indigenous (local) dairy cattle through crossing with exotic stocks under existing management and feeding systems. But no fruitful improvement have so far been achieved due to indiscriminate breeding policy.

The productive and reproductive performances of cows available in the Pabna milkshed area are better than overall performance of local cows in Bangladesh (Hossain and Routledge, 1982). That's why these cows have been recognized as Pabna Milking Cows (PMC). These PMC cattle is originated from crossing of local cattle with Sahiwal (S), Hariana (Ha) and Red Sindhi (Si) bulls

(Islam and Vaughan, 1980; Udo et al., 1992; Ghosh, 1981). Considering the well adaptability of Sahiwal breed under our tropical situations, the Bangladesh Milk Producers' Co-operative Union Limited (BMPCUL) is carrying out an up-grading or crossbreeding programme using both liquid and frozen semen from Sahiwal bulls for further improvement of PMC in Pabna milkshed area.

The BMPCUL is a self sufficient and profitable milk producing organization. Therefore, it is believed that, exploitation of suitable genetic materials could be one of the most important way of success story behind the BMPCUL. Therefore, present study was conducted to analyse the performances of existing genetic materials used in the Pabna milkshed area.

MATERIALS AND METHODS

The study was conducted at Baghabarighat, greater Pabna, Bangladesh lies between 20° 34' to 22° 38'N latitude and 88° 01' to 92° 41' east longitude.

Animals and data used

The informations on the productive and reproductive

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performances of 136 cows were collected from the record sheets maintained by three Livestock Field Assistant-Insemination (LFAI) at Pabna milkshed area. The records were accumulated from 1987 to 1994. The genetic groups considered were 1/2 PMC-1/2S and 1/4 PMC-3/4S. The genotype of the sires used for artificial insemination was pure Sahiwal.

Traits considered

Both productive and reproductive traits were included in this study. The reproductive characteristics included (1) birth weight (2) age at puberty (3) number of services per conception (4) gestation period and (5) post partum heat period. The productive traits were (1) daily milk yield (2) lactational production (3) lactation length (4) fat percentage and (5) solids-not-fat (SNF) percentage.

Feeding

Feeding system in Pabna milkshed area can be classified into two categories. Such as "bathan" feeding and "stall" feeding. Bathan is a basin like area along the river Boral at greater Pabna district. About 600 hector of land is a unique source of seasonal legume production. From October to May Pabna Milking Cows usually graze on this bathan area. From June to September animals remain completely confined. Stall feeding is maintained in this period and straw is supplied as a basal diet. Concentrate mixtures of rice polish, sesame oil cake, wheat bran and common salt were given two times in a day; morning and afternoon.

Insemination and health care

Both liquid and deep frozen Sahiwal semen were usually used for insemination. Vaccination and medication were ensured in the milkshed area. Treatments for infectious diseases are provided by the BMPCUL free of cost. Anthelmintic drugs are also supplied.

Design of experiment and statistical analysis

The collected data covered two different genotypes and five individual sires of Sahiwal breed. The number of animals per class and sub-class was not equal. It therefore, conformed the characteristics of a non-orthogonal factorial design (Snedecor and Cochran, 1980). To overcome this situation the data were subjected to statistical least-squares analysis using Harvey (1990) Computer Program.

The statistical least-squares procedure was used to analyse the fixed main effects of genetic group and sire on various traits. For all traits the following linear model was found to be best fitted (Highest R^2 value).

$$Y_{ijk} = \mu + G_i + S_j + e_{ijk}$$

Where, Y_{ijk} is the k th record on a parameter of cow in the i th genetic group and j th sire,

μ is the overall population mean,

G_i is the effect of i th genetic group,

S_j is the effect of j th sire and

e_{ijk} is the random error term associated with each observation ($0, \sigma^2$).

RESULTS AND DISCUSSIONS

Birth weight (BWT)

The average BWTs of 1/2 PMC-1/2S and 1/4 PMC-3/4S were 21.43 ± 0.75 and 23.19 ± 0.36 kg respectively (table 3). BWTs was significantly different ($p < 0.05$) between two genetic groups (table 2) which was similar to the findings of Nahar et al. (1989). Nahar et al. (1992) recorded a lower BWTs of 1/2L-1/2S calves (17.6 ± 0.3 kg) than that of 1/2 PMC-1/2S calves (21.43 ± 0.75 kg). The average calf BWTs of both genotypes studied was higher than pure PMC calves described by Udo et al. (1990) as 15.6 ± 0.4 kg and by Hossain and Routledge (1982) as 16.37 ± 2.20 kg. The effect of individual sire on BWTs was also significantly different ($p < 0.01$).

Table 1. Summary of the data used and traits analysed

Traits	Genetic Groups		
	1/2 PMC- 1/2S	1/4 PMC- 3/4S	Total
Birth Weight (kg)	15	46	61
Age at puberty (month)	54	46	100
No. of services per conception (no.)	51	46	97
Gestation period (day)	39	46	85
Post Partum heat period (month)	16	31	47
Daily Milk yield (kg)	54	46	100
Lactational production (kg)	15	45	60
Lactation length (day)	15	45	60
Fat percentage (%)	14	46	60
SNF percentage (%)	14	46	60

Age at puberty (AP)

The AP was higher in 1/2PMC-1/2S (38.53 ± 2.17 months) and lower in 1/4PMC-3/4S (31.12 ± 2.01 months). In the present study AP was significantly differed by the genetic group (table 2). It was similar to

Table 2. Summary of the analysis showing the effect of genetic group and sire group on various traits

Trait	Genetic group	Sire group
Birth Weight (kg)	*	**
Age at puberty (month)	**	NS
No. of services per conception (no.)	NS (p < 0.06)	**
Gestation period (day)	NS	NS
Average post partum heat period (month)	NS	NS
Daily milk yield (kg)	**	NS (p < 0.07)
Lactational production (kg)	***	*
Lactation length (day)	*	*
Average Fat percentage (%)	*	NS
Average SNF percentage (%)	**	NS

NS = Non-significant (p > 0.05), *p < 0.05, **p < 0.01, ***p < 0.001.

the findings of Majid et al. (1995). However, Chaudhry et al. (1994) found a non-significant effect of genetic group on AP. Majid et al. (1995) found highest AP in Sahiwal Cows (37.45 ± 0.88 months) and lowest in Friesian cows

(21.99 months). On the other hand Rahman et al. (1987) found a highest AP in Sahiwal cows (49.21 ± 1.48 months) in compared to local cows (42.77 months) and Sindhi cows (51.03 months). Sire group had a non-significant effect on AP.

Number of services per conception (NSC)

For a successful pregnancy, number of services required for 1/2PMC-1/2S and 1/4PMC-3/4S cows were 1.45 ± 0.12 and 1.23 ± 0.10 respectively (table 3). NSC was not significantly differed by genetic group (table 2), which is consistent with the findings of Sultana (1995) and Khan (1990). Number of services per conception was significantly differed by the quantity of milk yield (Younis et al. 1967). Khan (1990) reported 1.57 NSC for Pabna Milking Cows. Highest NSC was recorded in Sahiwal cows among different genotypes by Majid et al. (1995) as 1.90 ± 0.12 and also by Chaudhry et al. (1994) as 4.5.

Gestation period (GP)

Little difference in GP was observed between genotypes. This result was similar to the findings of Majid et al. (1995); Rahman et al. (1993); Hossain and Routledge (1982).

Table 3. Least-squares Means ± SE for productive and reproductive performance traits in animals of two genetic groups in the pabna milkshed aread

Traits	Genetic group	
	1/2 PMC-1/2 S	1/4 PMC-3/4 S
Birth Weight (kg)	21.43 ^a ± 0.75	23.19 ^b ± 0.36
Age at puberty (month)	38.53 ^a ± 2.17	31.12 ^b ± 2.01
No. of services per conception (no.)	1.45 ^a ± 0.12	1.23 ^a ± 0.10
Gestation period (day)	282.35 ^a ± 1.51	282.94 ^a ± 1.29
Post Partum heat period (month)	4.33 ^a ± 0.72	3.38 ^a ± 0.55
Lactational production (kg)	2,018.15 ^a ± 183.80	1,235.19 ^b ± 120.05
Lactation length (day)	216.88 ^a ± 17.90	170.98 ^b ± 11.69
Daily Milk yield (kg)	8.37 ^a ± 0.31	7.49 ^b ± 0.28
Fat percentage (%)	5.10 ^a ± 0.07	5.15 ^b ± 0.04
SNF percentage (%)	7.94 ^a ± 0.10	7.63 ^b ± 0.07

Mean with uncommon superscripts differ significantly (p < 0.05).

Post partum heat period (PPHP)

The longer average PPHP was observed in 1/2PMC-1/2S cows (4.33 ± 0.72 months) while nearly same was for 1/4PMC-3/4S cows (3.38 ± 0.55 months) and the difference was not significant. Majid et al. (1995) also found a non-significant effect of genetic group on PPHP. However, Nahar et al. (1992) found a significantly

different effect of genetic group on PPHP. In the present study a longer PPHP was due to improper heat detection, reproductive disorders and/or improper nutrition.

Daily milk yield (DMY)

The DMY of 1/2PMC-1/2S and 1/4PMC-3/4S cows (8.37 ± 0.31 and 7.49 ± 0.28 kg respectively) were

significantly different ($p < 0.01$). The significant effect of genetic group on DMY is consistent with the findings of Chaudhry et al. (1994); Bhuiyan et al. (1992); Nahar et al. (1978); Rahman et al. (1987); Husain and Mostafa (1985); Panda and Sadhu (1983). Ali (1984) found highest DMY in Pabna Milking Cows (2.50 kg) over local cows. Hossain and Routledge (1982) also found the highest average DMY of Pabna Milking Cows (2.81 kg) over local cows (0.89 kg).

The average DMY of Sahiwal cows reported by Bhuiyan et al. (1992); Ahmed and Islam (1987); Husain

and Mostafa (1985) were 3.98, 3.60 and 3.96 kg respectively. In the present study DMY of $S \times PMC$ were higher than either pure Pabna Milking Cows or Sahiwal cows indicating that positive heterosis might have occurred. This trait was not significantly differed by sire which indicates that the sires had little effect on their daughters milk production as expected in a commercial dairy operation like BMPCUL. DMY was also influenced by nutrition supplied to the cows, number of lactation and milking pattern.

Table 4. Mean comparison showing the individual sire differences for the significantly differed traits

Trait	Effect of									
	sire 1		sire 2		sire 3		sire 4		sire 5	
Birth weight (kg)	23.50 ^a ± 0.74		23.77 ^{ab} ± 0.54		22.91 ^{ab} ± 0.51		23.19 ^{ab} ± 0.61		18.22 ^{bc} ± 1.28	
No. of services per conception (no.)	1.14 ^a ± 0.14		1.56 ^b ± 0.08		1.10 ^a ± 0.12		1.28 ^a ± 0.16		1.61 ^b ± 0.20	
Lactational production (kg)	1,562.99 ^a ± 172.99		2,031.98 ^b ± 240.93		1,320.00 ^a ± 240.73		1,662.91 ^{ab} ± 241.28		1,591.48 ^a ± 427.02	
Lactation Length (day)	197.90 ^a ± 16.84		233.46 ^{ac} ± 12.01		158.83 ^b ± 23.43		185.52 ^{abd} ± 23.48		193.95 ^{ab} ± 111.58	

Means with uncommon superscripts differ significantly ($p < 0.05$).

Lactational production (LP)

Total LP in 1/2PMC-1/2S and 1/4PMC-3/4S were 2,018.15 ± 183.80 and 1,235.19 ± 120.05 kg respectively (table 3) which were higher than pure Pabna Milking Cows (803 kg) as reported by Hossain and Routledge (1982). LP was significantly different ($p < 0.001$) between two genetic groups (table 2) which is consistent with the findings of Nahar et al. (1989) and Chaudhry et al. (1994). The LP of pure Sahiwal cows were 1,912 and 1,123.20 kg as described by Tahir et al. (1989); Ahmed and Islam (1987) respectively. Nahar et al. (1992) found the LP of SXL (F_1) was 890 kg which was much lower than $S \times PMC$. This indicates that the performances of PMC is better than local cows.

Lactation length (LL)

In the present study LL was longer in 1/2PMC-1/2S cows (216.88 ± 17.90 days) and shorter was in 1/4PMC-3/4S cows (170.98 ± 11.69 days) (table 3). LL was significantly different ($p < 0.05$) between two genetic groups (table 2). Similar results were obtained by Bhuiyan and Sultana (1994); Nahar et al. (1989); Maarof et al. (1989) and Sharma et al. (1982). The LL of pure Sahiwal

cows was reported by Sultana (1995); Chaudhry et al. (1994); Rahman et al. (1987); Ahmed and Islam (1987) as 293, 262, 356 and 312 days respectively. Hossain and Routledge (1982) observed a LL of 286 days in Pabna Milking Cows.

Fat percentage (FP)

Milk from 1/4PMC-3/4S contained higher FP (5.15 ± 0.04) than 1/2PMC-1/2S cows (5.10 ± 0.07%) and this difference was statistically significant ($p < 0.05$). However, Chaudhry et al. (1994) reported a non-significant effect of genetic group on this trait. This dissimilarity could be due to variation in sampling, different quality of feed supplied and different stages of lactation.

SNF percentage (SNFP)

The higher SNF content was found in the milk from 1/2PMC-1/2S cows (7.94 ± 0.10%) and lower from 1/4PMC-3/4S cows (7.63 ± 0.07%) and this difference was statistically significant ($p < 0.01$). The SNF content of milk from Sahiwal cows was 8.3% (Chaudhry et al., 1994). The SNF content of milk could be influenced by

the genetic factors although quality of feed, stages of lactation and season may affect this trait.

CONCLUSION

In the present study it is observed that the performances of Sahiwal crosses with Pabna Milking Cows are higher than the performances of Sahiwal crosses with local. The reproductive performances are better in 1/4PMC-3/4S than 1/2PMC-1/2S and the productive performances are better in 1/2PMC-1/2S than 1/4PMC-3/4S except fat percentage.

From the standpoint of the present analysis though reproductive performances are better in 75% Sahiwal than 50% Sahiwal but for most reproductive traits it is statistically non-significant ($p < 0.05$). Therefore, production and use of 1/2PMC-1/2S by Bangladesh Milk Producers' Co-operative Union Limited (BMPCUL) would seem more profitable for commercial Milk production. And for this, selection based on 1/2PMC-1/2S animals should be continued to improve their genetic potential further. Moreover, significant sire to sire variations for most of the important traits (except milk yield) indicate that much opportunity lies with the rigorous sire selection before using them in the BMPCUL area.

REFERENCES

- Ahmed, Z. and T. S. Islam. 1987. Cattle breeding programme through artificial insemination in Bangladesh. A. I. Extension project Report CCBS. Dhaka, Bangladesh.
- Ali, M. 1994. Evaluation of Livestock Resources and Performance of Indigenous lactating cows on rice straw-based ration in Bangladesh. Ad Ph. D. Thesis. Faculty of Graduate School, University of the Philippine at los Banos, Philippines.
- Bhuiyan, A. K. F. H. and R. Sultana. 1994. Analysis of performance of exotic cattle and their crosses in Bangladesh. Proceedings of the 5th World congress on genetic applied to livestock production. 20:355-358.
- Bhuiyan, A. K. F. H., M. A. Matin and M. O. Faruque. 1992. Performance of purebred and crossbred dairy cattle in Bangladesh. Proceedings of the 6th AAAP Animal Science congress. Ahat, Bangkok. 8:182.
- Chaudhry, M. Z., M. J. Tahir and M. Rafique. 1994. Production performance and milk producing efficiency in different filial groups of H. Friesian \times Sahiwal half-breds. Asian-Australasian J. of Anim. Sci. 7(3):383-387.
- Ghosh, J. C. 1981. The history of the milking cows of the bathan areas of Pabna district In: maximum livestock from minimum land. Proceedings of a seminar at BAU Mymensingh.
- Harvey, W. R. 1990. Mixed Model least-squares and maximum likelihood computer program. PS-2 version, mimeograph, Ohio State University, Ohio, USA.
- Hossain, M. A. and S. F. Routledge. 1982. Performance of crossbred and local cattle under village condition in Pabna district of Bangladesh. Proceeding of "Maximum Livestock from Minimum Land" Seminar, pp. 161-167.
- Hussain, S. S. and K. G. Mostafa. 1985. Reproductive potentialities of local and crossbred animals under farm and village condition. Livestock Adviser, X:15-19.
- Islam, M. N. and A. M. Vaughan. 1980. A comparison of two local and two FriesianXLocal cows in early second lactation on the Reshombari bathan in Pabna district. Bangladesh cattle development project. Technical paper no. 21.
- Khan, A. A. 1990. A comparative study on the reproductive efficiency of native and crossbred cows. M. S. Thesis, BAU Mymensingh.
- Maarof, M. M., L. M. Al-ani and S. T. Raseed. 1987. Performance of Jenubi cattle. Indian J. of Anim. Sci. 57(7):719-727.
- Majid, M. A., T. N. Nahar, A. I. Talukder and M. A. Rahman. 1995. Reproductive performances of pure breeds, F₁, F₂ and F₃ cows raised in Savar Dairy Farm. Bang. J. of Livestock Res.
- Nahar, T. N., K. G. Mostafa and M. R. Amin. 1989. A comparative study on the Performance of F₁ Crossbred cows. Bang. J. of Anim. Sci. 18(1-2):55-62.
- Nahar, T. N., M. Islam and M. A. Hasnath. 1992. A comparative study on the performance of F₁ crossbred cows under rural conditions. Asian-Australasian J. of Anim. Sci. 5(3):435-438.
- Panda, P. B. and D. P. Sadhu. 1983. Some genetic and non-genetic factors affecting milk production in crossbreds of Holstein and Jersey with Hariana and Deshi Bengal cows. Indian Vet. J. 60(2):99-106.
- Rahman, M. F., N. Ahmed and A. R. Ahmed. 1987. A comparative study on some productive and reproductive performances of Dairy Cows at Savar Dairy and Cattle Improvement Farm. Bang. Vet. J. 21(1-10):55-61.
- Rahman, M. F., M. S. Islam, M. A. Hossain, M. A. M. Prodhan and A. Rahman. 1993. Reproductive patterns of different breeds of cows in Bangladesh. Bang. J. of Livestock Res. 1(1):19-24.
- Sharma, J. M., M. M. Dhingra and B. S. Gurung. 1982. Note on the genetic and non-genetic factors affecting some production traits in crossbred (Friesian \times Sahiwal) cattle. Indian. J. of Anim. Sci. 52(1):42-45.
- Snedecor, G. W. and W. G. Cochran. 1980. Statistical Methods. 7th edition. The Iowa State University press. Ames. USA.
- Sultana, R. 1995. Quantitative analysis of reproductive performance of purebred and their crosses in the Savar Dairy Farm. M. Sc. Thesis. Deptt. of Animal Breeding and Genetics. BAU. Mymensingh.
- Tahir, M., M. R. Qureshi and W. Ahmed. 1989. Some of the environmental factors influencing milk yield in Sahiwal cows. Pakistan Vet. J. 9(4):173-175.
- Udo, H. M. J., C. Hermans and F. Dawood, 1990. Comparison

- of two cattle production systems in Pabna district Bangladesh. *Tropical Animal Health Production*. 22:247-259.
- Udo, H. M. J., J. Mejeje, F. Dawood and A. A. Diskhuizen. 1992. The benefits of cattle in mixed farm systems in Pabna, Bangladesh. *Asian-Australasian J. of Anim. Sci.* 5(3):495-503.
- Younis, A. A., A. Naga, S. Kotby and A. A. Salman. 1976. A survey of some reproductive traits in a Friesian herd kept under Kuwait Condition. *Indian J. of Anim. Sci.* 46:567-579.