

## LIFETIME PRODUCTION PERFORMANCE OF HOLSTEIN FRIESIAN × SAHIWAL CROSSBREDS

M. Z. Chaudhry<sup>1</sup> and M. Shafiq

Livestock Production Research Institute, Bahadurnagar, Okara, Pakistan

### Summary

The performance records of 410 Holstein Friesian crossbred cows belonging to seven genetic groups (F1, 3/4, 1/4, 5/8, 3/8, triple cross and miscellaneous cross) maintained at Livestock Production Research Institute, Bahadurnagar, Okara were analyzed for various parameters of lifetime traits. For the analysis 2 data sets were made. Data set I included all the cows disposed off from the herd which have completed at least one lactation while for data set II performance traits for only first five lactations were considered. The data was analyzed by Mixed Model Least squares and Maximum Likelihood computer programme PC-I version.

The least squares means  $\pm$  standard errors for data set I (Periods are in days and milk yield is in litres) were  $994.5 \pm 15.5$ ,  $1,877.0 \pm 70.9$ ,  $1,651.9 \pm 19.3$ ,  $2,533.7 \pm 36.5$ ,  $3,530.0 \pm 40.5$ ,  $15,785.2 \pm 320.0$ ,  $8.46 \pm 0.19$ ,  $5.66 \pm 0.16$  and  $3.79 \pm 0.08$ , respectively for age at first calving (AFC), 1st lactation milk yield (FLMY), productive life (PL), herd life (HL), total life (TL), lifetime milk yield (LTMY), milk yield per day of productive life (MY/PL), milk yield per day of herd life (MY/HL) and milk yield per day of total life (MY/TL). For data set II these values were  $1,004.2 \pm 21.2$ ,  $2,220.5 \pm 113.1$ ,  $1,429.1 \pm 40.8$ ,  $2,302.1 \pm 73.3$ ,  $3,307.2 \pm 77.3$ ,  $13,189.7 \pm 667.4$ ,  $9.10 \pm 0.34$ ,  $5.66 \pm 0.25$  and  $4.02 \pm 0.18$  in the same order. For data set I the effect of year of first calving was significant for AFC, FLMY, PL, HL, LTMY and MY/PL. The season of 1st calving was significant only for MY/PL. The effect of genetic group was significant for AFC, FLMY, MY/PL and MY/TL while the effect of parity was significant for all the traits. For data set II the effect of year of 1st calving was significant only for AFC, FLMY and PL while the season of 1st calving was significant for FLMY and PL while the effect of genetic groups was significant for MY/HL only. The lifetime production performance is in general close to the various estimates reported in the literature.

(Key Words : Lifetime Production Performance, Crossbred Dairy Cattle, Pakistan)

### Introduction

The primary goal of dairy cattle breeding is to develop more profitable cows. The profitability in dairying depends upon the efficiency of animals to convert animal feeds into milk. The returns over the feed cost move steadily upward with the increase in level of production. The lifetime profitability in a dairy cow is the function of production per lactation, length of productive life, age at first calving, calving interval, input and output prices. The profit from a dairy cow depends on its herd life and lifetime production. The stayability of a cow in the herd is a good index of its overall efficiency. Thus, the profit

from a cow depends directly on its herd life and milk production. The lifetime milk production primarily depends on factors like early growth rate, age at first calving, first lactation milk yield and herd life. The present study was conducted to evaluate various Holstein Friesian  $\times$  Sahiwal grades for lifetime performance and the non-genetic factors affecting the lifetime performance.

### Materials and Methods

The performance records of the Holstein Friesian  $\times$  Sahiwal (HS) crossbred cows maintained by the Livestock Production Research Institute, Bahadurnagar, Okara during 1976 to 1991 were used for this study. Data on 410 cows belonging to seven genetic groups (F1, 3/4, 1/4, 5/8, 3/8, triple crossbred and miscellaneous crossbred) was analyzed for various parameters of lifetime traits. The

<sup>1</sup>Address reprint requests to Dr. M. Z. Chaudhry, Livestock Production Research Institute, Bahadurnagar, Okara, Pakistan.

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traits studied were:

- 1) Age at first calving (AFC);
- 2) First lactation 305 days milk yield (FLMY);
- 3) Productive life (PL); number of days in milk during the lifetime of an individual cow;
- 4) Herd life (HL); period from first calving to disposal from herd;
- 5) Total life (TL) or longevity; period from birth to disposal;
- 6) Lifetime milk yield (LTM); Milk yield during the total life;
- 7) Milk yield per day of productive life (MY/PL);
- 8) Milk yield per day of herd life (MY/HL); and
- 9) Milk yield per day of total life (MY/TL).

Two data sets were made for analysis. Data set I included all the cows disposed of from the herd which had completed at least one lactation. Lactation records from first to eleventh lactation (the records of twelfth lactation were linked with the eleventh lactations) were available for this analysis. In data set II performance traits for only first five lactations were considered for analysis.

The data was analyzed by Mixed Model Least Squares and Maximum Likelihood computer programme PC-I. Version (Harvey, 1988). The data was analyzed for:

- 1) The effect of year of first calving (1976-1991);
- 2) Season of 1st calving; the year was divided in to three seasons;
  - a) Summer (March to June)
  - b) Rainy (July to October) and
  - c) Winter (November to February)
- 3) Parity (one to eleven) and
- 4) Genetic group (F1, 3/4, 1/4, 5/8, 3/8, triple crossbred and miscellaneous crossbred). The unadjusted means were tested for differences by Duncan's Multiple Range test.

The lactating cows yielding upto three litres of milk were not given any concentrate while the cows yielding more than three litres of milk were given concentrate 1 kg for every three litres of additional milk yield (first calvers were given 2 kg additional concentrate for growth). Milking was made by hand twice daily. Green forage, berseem and oats during winter & sadabahar, maize and cowpeas during summer was provided *ad libitum*.

## Results and Discussion

The least squares means and standard errors for lifetime performance traits for data set I and II are presented in table 1 and 2, respectively.

### 1) Age at first calving (AFC)

The overall least squares means and standard errors of AFC for data set I and II were  $994.5 \pm 15.5$  and  $1,004.2 \pm 21.2$  days, respectively. The effect of year of first calving was significant ( $p < 0.01$ ) for both data sets. The AFC being lowest in the earlier years and highest in the later years. The effect of season of calving and order of parity was non-significant. The effect of genetic group was significant ( $p < 0.01$ ) for data set I but was non-significant for data set II. The AFC was significantly low in F1 and 3/4 crossbreds while it was high in miscellaneous crossbreds.

### 2) First lactation milk yield (FLMY)

The overall least squares means and standard errors of FLMY for data set I and II were  $1,877.0 \pm 70.9$  and  $2,220.5 \pm 113.1$  litres, respectively. The FLMY for data set II being quite high as compared to data set I,

TABLE 1. LEAST SQUARES MEANS AND STANDARD ERRORS FOR LIFETIME PERFORMANCE IN DIFFERENT GENETIC GROUPS OF H. FRIESIAN CROSSBRED COWS BASED ON ALL LACTATIONS

Sr. No.	Particulars	Unit	Least squares means $\pm$ SE	Unadjusted means $\pm$ SD	COV
1	No. of observations		410	410	
2	Age at first calving	days	$994.5 \pm 15.5$	$980.3 \pm 189.3$	19.31
3	First lactation 305 days milk yield	Lit.	$1,877.0 \pm 70.9$	$1,882.5 \pm 752.0$	39.95
4	Productive life	days	$1,651.9 \pm 19.3$	$1,012.2 \pm 767.3$	75.81
5	Herd life	days	$2,533.7 \pm 36.5$	$1,589.5 \pm 1,170.3$	73.63
6	Total life	days	$3,530.0 \pm 40.5$	$2,572.8 \pm 1,122.4$	43.63
7	Life time milk yield	Lit.	$15,785.2 \pm 320.0$	$8,867.5 \pm 8,368.8$	94.38
8	Milk yield per day of productive life	Lit.	$8.46 \pm 0.19$	$7.72 \pm 2.28$	29.53
9	Milk yield per day of herd life	Lit.	$5.66 \pm 0.16$	$4.98 \pm 1.71$	34.34
10	Milk yield per day of total life	Lit.	$3.79 \pm 0.08$	$2.84 \pm 1.69$	59.51

TABLE 2. LEAST SQUARES MEANS AND STANDARD ERRORS FOR LIFETIME PERFORMANCE IN DIFFERENT GENETIC GROUPS OF H. FRIESIAN CROSSBRED COWS BASED ON FIVE LACTATIONS

Sr. No.	Particulars	Unit	Least squares means $\pm$ SE	Unadjusted means $\pm$ SE	COV
1	No. of observations		136	136	
2	Age at first calving	days	1,004.2 $\pm$ 21.2	922.4 $\pm$ 190.3	18.95
3	First lactation 305 days milk yield	Lit.	2,220.5 $\pm$ 113.1	2,325.2 $\pm$ 629.5	27.07
4	Productive life	days	1,429.1 $\pm$ 40.8	1,490.7 $\pm$ 233.3	15.65
5	Herd life	days	2,302.1 $\pm$ 73.3	2,281.4 $\pm$ 388.0	17.01
6	Total life	days	3,307.2 $\pm$ 77.3	3,201.7 $\pm$ 397.6	12.42
7	Life time milk yield	Lit.	13,189.7 $\pm$ 667.4	13,911.9 $\pm$ 3,555.3	25.56
8	Milk yield per day of productive life	Lit.	9.10 $\pm$ 0.34	9.43 $\pm$ 1.77	18.77
9	Milk yield per day of herd life	Lit.	5.66 $\pm$ 0.25	6.20 $\pm$ 1.32	21.29
10	Milk yield per day of total life	Lit.	4.02 $\pm$ 0.18	4.41 $\pm$ 0.97	22.00

indicating that the low producer cows were disposed off in their earlier lactations. The effect of parity was highly significant ( $p < 0.01$ ), the milk yield was lowest for first parity and highest for 9th parity, with a tendency to decline in later parities. The effect of year of calving was significant at  $p < 0.01$  and  $p < 0.05$  for data set I and II, respectively. The first lactation milk yield was high during the early years and low during the later years; indicating that the management was better in the early years. The effect of calving season was non-significant for data set I but was significant ( $p < 0.05$ ) for data set II, milk yield was higher in summer calvers; the difference between winter and rainy season calvers was non-significant. The effect of genetic group was significant ( $p < 0.05$ ) for data set I but it was non-significant for data set II. The milk yield was lowest in 1/4 crossbreds and highest in F1 crossbreds.

### 3) Productive life (PL)

The overall least squares means and standard errors for PL was  $1,651.9 \pm 19.3$  and  $1,429.1 \pm 40.8$  days for data set I and II, respectively. The effect of year of calving was significant ( $p < 0.01$ ) for both data sets, being higher in earlier years and lower in later years. The effect of calving season was significant ( $p < 0.05$ ) for data set II only; PL was longer in summer calvers while the difference between rainy and winter calvers was non-significant. The effect of parity was significant ( $p < 0.01$ ), the PL significantly increased according to the parity order. The effect of genetic group was non-significant for both data sets.

The overall least squares means and standard errors for parity number was  $2.618 \pm 0.144$ ; while the unadjusted mean  $\pm$  SE was  $3.598 \pm 0.123$ . The effect of genetic

group on parity was significant ( $p < 0.05$ ); the F1 HS crossbreds had higher parity than all other genetic groups; while the parity in 3/4 HS crossbreds was also higher than rest of the genetic groups except 5/8 HS crossbreds.

### 4) Herd life (HL)

The overall least squares means and standard errors for HL was  $2,533.7 \pm 36.5$  and  $2,302.1 \pm 73.3$  days for data set I and II, respectively. The effect of year of calving was significant ( $p < 0.01$ ) for data set I only. The herd life was significantly longer for year 1976 and 1977 than all other years; difference between the year 1976 and 1977 was non-significant for both data sets. The effect of parity was statistically significant ( $p < 0.01$ ). The herd life significantly increased with the parity order; however, the difference between parity eighth and ninth and between parity tenth and eleventh was non-significant. The difference due to genetic groups was non-significant for both data sets.

### 5) Total life (TL)

The overall least squares means and standard errors for total life (longevity) was  $3,530.0 \pm 40.5$  and  $3,307.2 \pm 77.3$  days for data set I and II, respectively. The effect of calving year and calving season was non-significant for both data sets. The effect of parity was significant ( $p < 0.01$ ); TL significantly increased according to the parity order. However, the difference between eighth and ninth parity and between tenth and eleventh parity was non-significant. The effects of genetic group was non-significant for both data sets.

### 6) Lifetime milk yield (LTMV)

The overall least squares means and standard errors for

LTMY was  $15,785.2 \pm 320.0$  and  $13,189.7 \pm 667.4$  litres for data set I and II, respectively. The effect of calving year was significant ( $p < 0.05$ ) for data set I only; it was highest in the early years and was lowest in the later years. The effect of calving season was non-significant for both data sets. The effect of parity was significant ( $p < 0.01$ ); it significantly increased according to the parity order, however, the difference amongst ninth, tenth and eleventh parity was non-significant. The effect of genetic group was non-significant.

#### 7) Milk yield per day of productive life (MY/PL)

The overall least squares means and standard errors for MY/PL was  $8.46 \pm 0.19$  and  $9.10 \pm 0.34$  litres for data set I and II, respectively. The effect of year of calving was significant ( $p < 0.01$ ) for data set I only. The yield in the early years was best and in general was poorer in the later years. The effect of calving season was also significant ( $p < 0.05$ ). MY/PL was higher in the winter calvers; the difference between rainy and summer calvers was non-significant.

#### 8) Milk yield per day of herd life (MY/HL)

The overall least squares means and standard errors for MY/HL was  $5.66 \pm 0.16$  and  $5.66 \pm 0.25$  litres for data set I and II, respectively. The means in both the data sets are the same. The effect of year of calving and season of calving was non-significant for both data sets. The effect of parity was significant ( $p < 0.01$ ); MY/HL in general increased with the parity order. The effect of genetic group was non-significant for data set I but was significant ( $p < 0.01$ ) for data set II; MY/HL was higher in F1, while the difference between other genetic groups was non-significant.

#### 9) Milk yield per day of total life (MY/TL)

The overall least squares means and standard errors for MY/TL was  $3.79 \pm 0.08$  and  $4.02 \pm 0.18$  litres for data set I and II, respectively. The effect of calving year and calving season was non-significant for both data sets. The effect of parity was significant ( $p < 0.01$ ); in general it increased with the parity order. The effect of genetic group was significant ( $p < 0.05$ ) for data set I only. The F1 were at the top followed by 3/4 crossbreds; the difference between all other genetic groups was non-significant.

The lifetime performance of the crossbreds in the present study is better than reported by Singh and Tomar (1988) who reported that the lifetime milk yield in Karan Fries (H. Friesian  $\times$  Sahiwal/Tharparkar) was  $9,538.5 \pm 294.4$  kg during a productive life of  $1,002.5 \pm 35.4$  days

in an average of  $3.58 \pm 0.11$  lactations. Prasad et al. (1987) have also reported poor performance of the crossbreds. They reported that the lifetime milk yield was  $8,377.72 \pm 118.55$  kg in a productive life of  $1,210.08 \pm 21.68$  days while the age at 1st calving was  $1,124.89 \pm 18.46$  days; however, the first lactation milk yield was reported to be  $2,909.25 \pm 72.38$  kg which is much higher than recorded in the present study. Similarly the lifetime yield in various genetic groups of H. Friesian and Jersey crossbreds and pure local breeds reported by Prasad and Manglik (1987) is lower; the lifetime yield ranged from 9,976.19 to 13,332.79 kg. The lifetime performance for Tharparkar cows reported by Basu et al. (1983) and by Gupta and Gurnani (1984); for sahiwal cows reported by Bhatia (1980) and for Red Sindhi cows reported by Malhotra and Singh (1980) is low as compared with the present estimates which indicates that the production performance of crossbred cattle is far superior than the local dairy breeds.

The lifetime performance of different genetic groups (1/2, 3/8, 1/4, 5/8 and 7/8) of H. Friesian  $\times$  Sahiwal crossbreds based on six lactations reported by Jadhav et al. (1991) is better than obtained in this study. They reported that the lifetime milk yield was  $19,727.28 \pm 260.72$  kg during  $1,850.47 \pm 12.08$  days of productive life and  $2,434.16 \pm 17.01$  days of herd life. They further reported that the 1/2 HS crossbreds performed better for all the traits of lifetime performance; the 1/2 HS crossbreds remained in herd for longer time, had higher total milk yield and milk yield per day of herd life. Osman and Russell (1974) has also stated significant effect of grade for lifetime production based on first three lactations; they observed that the 1/2 and 5/8 grades performed better than other grades.

The milk yield per day of life reported by Sadana and Basu (1982) for pure Holstein Friesian and Brown Swiss maintained at Karnal (India) were  $5.9 \pm 0.21$ , and  $4.4 \pm 0.20$  kg, respectively being better than our study while in Jersey it was lower ( $2.7 \pm 0.12$  kg). The per day yield for herd life in Jersey  $\times$  Sahiwal crossbreds as reported by Singh et al. (1988) is also better than the present findings.

The variation in the performance of crossbred cows of the present study can be attributed to the variation in the management levels of different studies. In addition the genetic variation in the genetic potential of the exotic semen used for the crossbred progeny can also affect the lifetime performance of the progeny.

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