IMPROVEMENT IN ECONOMIC TRAITS OF LOCAL CATTLE THROUGH CROSSBREEDING WITH HOLSTEIN FRIESIAN SEMEN

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ABSTRACT

In this study, data on productive and reproductive records of 200 local and Holstein Friesian crossbred cows were analyzed for three different zones of Bannu division, NWFP. The crossbred cattle were the product of crossbreeding over the last 20 years, usually containing 50 to 75% exotic blood. The mean age at puberty was 74 3 ± 51 days and ranged from 420 to 1110 days. Age at puberty in local cow was 878.7 days, while in Holstein Friesian crossbred cows it was 610.3 days (P<0.01). The cows showed shortest age at puberty in irrigated area, followed by rainfed and hilly areas. The crossbred cows showed shortest age at puberty in rainfed area followed by irrigated and hilly areas. Mean age at first calving was 1106 ± 76.4 days, ranging from 780 to 1490 days. The cattle showed shortest age at first calving in rainfed area, followed by irrigated and hilly areas (P<0.01). Mean for services per conception was 2 ± 0.1, ranging from 1 to 4. The value was 2.0 in local cattle and 2.05 in crossbreds. The number was slightly shorter in the hilly area than the irrigated and rainfed areas. Conception rate in crossbred cows was 15, 61 and 23% with first, second and third insemination, while in local cattle the mean was 14, 70 and 16%. Mean calving interval was 405 ± 29 days, ranging from 325 to 550 days. Calving interval in local cows was 418 days, while in Holstein Friesian crossbreds it was 390 days (P<0.05). The calving interval was longest in the irrigated area followed by rainfed and hilly areas (P<0.05). Mean dry period was 122 ± 5.3 days, ranging from 60 to 370 days. The dry period in local and Holstein Friesian crossbred cattle was 152.6 and 89.3 days, respectively (P<0.01). Average milk production was 6 ± 0.4 liters day, ranging from 3 to 12 liters day. The average milk recorded in local cows was 4.76 liters day and in crossbred cows it was 7.13 liters day (P<0.01). The cows showed highest milk yield in irrigated area, followed by rainfed and hilly areas (P<0.01). Mean lactation length was 293 ± 23.3 days, ranging from 200 to 480 days. The length was 338.3 days in crossbred cattle and 249.8 days in local cattle (P<0.01). The cattle showed highest lactation length in hilly area, followed by rainfed and irrigated areas (P<0.01). Correlation analysis of the data showed that services per conception was not affected by any reproductive trait or milk yield. However, calving interval was correlated positively and significantly with age at puberty and age at first calving, lactation length, dry period and average milk production (r=0.27, 0.23, 0.35, 0.25 and -0.25, respectively; P<0.01).

The findings of this study indicate that the productive potential of local cattle can be increased by using exotic semen of genetically superior sires, through intensive management and with effective disease control program.

Key words: Economic traits, cattle, crossbreeding, Holstein Friesian

INTRODUCTION

In Pakistan, cattle crossbreeding had been a controversial subject for a long time. The views expressed at various official meetings were highly variable. However, the opinion gradually changed in favor of crossbreeding with following reservations (Wahid, 1975):

a. Crossbreeding should be carried out on a limited scale at the Government owned livestock stations under controlled conditions.
b. Only mediocre cows from Sahiwal, Red Sindhi and Tharparkar breeds should be used in the crossbreeding programs.

Gradually, a national policy for cattle breeding was developed (Khan, 1994), which allows selective breeding for the native breeds and up gradation of non-descript cattle through use of Friesian and Jersey semen in the plain irrigated and hilly rain-fed areas, respectively. The policy emphasizes that the level of exotic inheritance should be maintained between 50 and 62.5 percent.

Artificial insemination establishment in North West Frontier Province (NWFP) was reviewed by Qureshi *et al* (1993). Deep freezing of semen started in the province on Ist October, 1982 under an expanded AI project. A total of 164 AI centers have been working in the province. Based on the results of a study (Qureshi *et al*, 2000), it was concluded that productive and reproductive performance was satisfactory in cross-bred cattle under field conditions.

However, very little information is available about the improvement in productive and reproductive traits and their interaction in crossbred cattle after crossbreeding with exotic cattle. Therefore, the present project was planned to study improvement in economic traits of local cattle through crossbreeding with Holstein Friesian semen in district Bannu.

MATERIALS AND METHODS

Data regarding productive and reproductive records of 100 local and 100 Holstein Friesian crossbred cows were analyzed in three different zones of Bannu division, NWFP, namely: Zone-I, Bannu (Irrigated plain area); Zone-II, Lakki Marwat (rain-fed area) and Zone-III, North Waziristan (hilly area). In irrigated plain area, green fodder was available throughout the year, while in rain fed area wheat straw was available. In hilly area the animals were put on grazing.

Data regarding various reproductive and other parameters were taken from the history sheets of the animals. Incomplete records and milk yield less than 180 days were excluded from the data. Age at puberty was calculated in days from the date of birth of a female to the date of first observed heat. Age at first calving was calculated in days from the date of birth of a heifer till its date of first calving. Conception rate (%) and services per conception were worked out. The period in days between two consecutive calvings was considered as calving interval. Abnormally long interval due to abortion etc. were excluded from the analysis. The interval between date of drying and subsequent normal parturition was considered as dry period. The overall average milk yield and lactation length were calculated in local and Holstein Friesian crossbred cows as described already (Knobil and Neill, 1994). Differences in the age at puberty, calving interval, dry period, average milk production and lactation length were worked out among the breeds. Effect of zones (irrigated, hilly and rainfed) on various parameters was also analyzed using analysis of variance through General Linear Model procedures, using a computer package. The results were compared by Duncan Multiple Range Test to determine difference amongst various groups. Relationships among various traits were determined through correlation analysis (Steel and Torrie, 1982).

RESULTS AND DISCUSSION

Age at puberty

Data analysis of 100 Holstein Friesian crossbred and 100 local non-descript cows revealed that the overall mean age at puberty was 743 ± 51 days, the range was 420 to 1110 days (Table 1). The overall mean age at puberty in local cows was 878.7 days, while in Holstein Friesian crossbred cows it was 610.3 days, the difference being significant ($P<0.01$, Table 4).

The cows showed shortest age at puberty in irrigated area, followed by rainfed and hilly areas (730.6, 730.8 and 770.6 days, respectively, Table 3). The Holstein Friesian crossbred cows showed shortest age at puberty in rainfed area, followed by irrigated and hilly areas (600, 615, 616 days). This may be due to better management of crossbred cows in rainfed area. The crossbred cattle get more improvement in their genetic potentical which need special attention for management of their health and production.

The age at puberty found in the present investigation is not in line with the findings of some earlier workers. Tahir *et al* (1983) found that the age at maturity in Sahiwal, Holstein Friesian x Sahiwal and Jersey x Sahiwal averaged 1020 ± 11.00, 525 ± 25.00 and 413 ± 612.00 days, respectively. Rahman *et al* (1987) found that age at maturity in Jersey x local and Red Sindhi was 956.7 ± 39.11 and 1531.68 ± 39.41 days, respectively. The value for the age at puberty in this study is close to the findings of Chetty *et al* (1986), who found that the age at maturity in Jersey crossbred cows was 604.06 ± 16.16 days.

Age at first calving

The overall mean age at first calving was 1106 ± 76.4 days, the range was 780 to 1490 days (Table 1). The cattle showed shortest age at first calving in rainfed area, followed by irrigated and hilly areas (1089, 1096 and 1137 days, respectively), the difference being highly significant ($P<0.01$). The Holstein Friesian crossbred cattle showed shortest age at first calving in irrigated area, followed by hilly and rainfed areas (966, 971 and 974 days, respectively).

The age at first calving found in the present study is not in line with Chopra *et al* (1980), who found that the age at first calving in Holstein Friesian, Brown Swiss and Jersey halfbreds was 930 ± 15.00, 1013 ± 24.00 and 867 ± 19.00 days, respectively. Haq (1992) found that age at first calving in Holstein Friesian and Jersey cows was 787.38 ± 61.00 and 771.48 ± 7.88 days, respectively. Th age at first calving found in this

investigation is close to the findings of Rafique (1997), who found it in Holstein Friesian cows to be 978 ± 17.39 days.

Services per conception

The overall mean services per conception was 2 ± 0.1 in the experimental animals and the values ranged from 1 to 4 (Table 1). The overall mean conception rate recorded in Holstein Friesian crossbred cows was 15, 61 and 23% with first, second and third insemination while in local bred cattle the overall mean found was 14, 70 and 16% with first, second and third insemination, respectively.

The overall mean services per conception in local bred cattle was 2, while in Holstein Friesian crossbred cows it was 2.05. The number of services per conception was slightly shorter in the hilly area than the irrigated and rainfed areas. However, the difference was non-significant.

The findings of the present study for number of services per conception was not in line with the finding of Singh and Mishra (1980), who found that in Holstein, Jersey and Jersey x Hariana cows the number of services per conception averaged 4.2 ± 1.07, 3.3 ± 0.17 and 1.7 ± 0.17, respectively. Staempfli *et al.* (1984) found that services per conception in Jersey x non descript (exotic level ranging from 30 to 75%) crossbreds was 2.2 ± 1.4.

The services per conception recorded in the present study is close to the findings of Dash and Mishra (1980), who found that the least squares means for number of services per conception were 2.01 ± 0.07, 1.99 ± 0.11 and 2.04 ± 0.19 for first, second and third conception in Brown Swiss, Jersey and Tharparkar cows. Goodchild *et al.* (1984) found 2.1 ± 1.5 services per conception in Sahiwal x Bos taurus crossbreds.

The conception rates found by a number of research workers in different breeds of cattle are not in line with the conception rate found in this study. Kaushik (1979) reported that in the Friesian, Brown Swiss and Jersery halfbreds with Hariana, the overall conception rate at first insemination was 41.11%, while the overall conception rate was 36.62%. Jaiswal *et al.* (1979) reported that the overall conception rate of Hariana cows was 33.66% while in ½ Friesian x Hariana, ½ Brown Swiss x Hariana and ½ Jersey x Hariana, values were 50.9, 51.9 and 51.8%, respectively.

The conception rate may be controlled by better management, blanaced diret, viability of spermatozoa, proper storage, handling and processing of the semen, proper time of insemination, detection of heat with the use of teasers and rectal palpation etc. The differences in the number of services per conception might be due to semen quality, handling, processing of semen during artificial insemination and time of insemination.

Calving interval

The overall mean calving interval was 405 ± 29 days, the range was 325 to 550 days (Table 1). Average calving interval in local cows was 418 days, while in Holstein Friesian crossbreds it was 390 days, the difference being significant ($P<0.01$). The cattle showed longest calving interval in the irrigated area, followed by rainfed and hilly areas (411.8, 402.9, 397.9 days, respectively, $P<0.05$, Table 3).

The present investigation of calving interval is close to the finding of Mishra *et al.* (1989) and not in line with the findings of Dash and Mishra (1980) and Rafique (1997). Singh and Mishra (1980) found that in Holstein, Jersey and Hariana cows the calving interval averaged 551.9 ± 44.63, 532.0 ± 44.63 and 523.7 ± 29.52 days, respectively. The variation in calving interval appears to be largely due to managemental practices and nutritional deficiencies.

Dry period

The overall mean dry period was 122 ± 5.3 days, the range was 60 to 370 days (Table 1). The dry periods in local and Holstein Friesian crossbred cattle were 152.6 and 89.3 days, respectively, the difference being highly significant ($P<0.01$). The Holstein Friesian crossbred cattle showed shortest dry period in hilly area, followed by rainfed and irrigated areas i.e. 78.5, 86.3 and 103.0 days, respectively. The local cattle showed shortest dry period in irrigated area i.e. 52 days. The dry period in rainfed and hilly areas was the same i.e. 153 days.

The dry period observed in this study was in line with the findings of Raheja and Bhat (1982), who found that the dry period in Friesian x Hariana, Friesian x Sahiwal and Friesian x Tharparkar cows averaged 115.5 ± 8.2, 126.3 ± 11.2 and 97.3 ± 9.8 days, respectively. The dry period observed in the present study was not in line with findings of Nagaracenkar and Rao (1982), who evaluated the performance among contemporary halfbred Tharparkar crosses with

Friesian, Brown Swiss and Jersey bulls and observed that overall average dry period was 61.59 ± 1.51 days.

The dry period is mainly controlled by managemental factors. Appropriate management can reduce the dry period to the ideal of around 60 to 90 days, so as to make the crossbreds more economical.

Average milk production and lactation length

The overall mean recorded for milk production was 6 ± 0.4 liters day (1875 ± 149.12 liters lactation), ranging from 3 to 12 liters day (Table 1). The average milk recorded in local cows was 4.76 liters day and in Holstein Friesian crossbred cows it was 7.13 liters day, the difference being significant (P<0.01). The cows showed highest milk yield in irrigated areas followed by rainfed and hilly areas (6.42, 5.93 and 5.50 liters per day, respectively, P<0.01).

The overall mean lactation length was 293 ± 23.3 days, ranging from 200 to 480 days (Table 1). The lactation length recorded in Holstein Friesian crossbred cattle was 338.3 days, while in local bred cattle it was 249.8 days, the difference was significant (P<0.01). The cattle showed highest lactation length in hilly area, followed by rainfed and irrigated areas i.e. 304.2 299.7 and 278.6 days, respectively (P<0.01).

Table 1: Mean, maximum and minimum values of different economic traits of crossbred and local cattle in Bannu Region (n=200)

Parameters	Overall parameters Mean ± S.E	Maximum	Minimum	Crossbred Mean	Local Mean
Age at puberty (day)	743 ± 50.6	1110	420	610.3	878.7
Age at first calving (days)	1106 ± 76.4	1490	780	970	1243
Services per conception (No.)	2.0 ± 23.3	4.0	1.0	2.05	2.0
Lactation length (days)	6 ± 0.4	480	200	339	249
Average milk production (liter/day)	405 ± 29	12	3	7.13	4.76
Calving interval (days)	122 ± 5.3	550	325	390	418
Dry period (days)		370	60	89.3	152.3

Table 2: Relationship of reproductive performance with various parameters in cattle pearson correlation co-efficient)

Parameters	Age at puberty	Age at Ist calving	Lactation length	Av milk production	Dry period
Services/Conception	0.01 NS	0.03 NS	0.006 NS	-0.04 NS	-0.07 NS
Calving Interval	0.27 **	0.23**	0.35**	-0.25**	0.25**

NS = Non Significant
** = Highly Significant (P<0.01)**

Table 3: Effects of zone on reproduction and milk production in cattle

Parameters	Irrigated area	Rainfed area	Hilly area	P value
Reproduction				
Age at puberty (days)	730.6	730.8	770.6	**
Age at Ist calving (days)	1096	1089	1137	**
Services per conception (No.)	2.08	2.08	1.9	N.S.
Calving Interval (days)	411.8	402.9	397.9	*
Production				
Lactation length (days)	278.6	299.7	304.2	**
Av.milk production (liter/day)	6.42	5.93	5.5	**
Dry period (days)	127.5	119.5	115.7	*

N.S. = Non significant
** = Significant (P<0.05)**
** = Highly significant (P<0.01)**

Table 4: Improvement in economic traits of local cows due to cross breeding with Holstein Friesian

Parameters	Breed of cattle		Difference (F value)
	Local x Holstein Friesian (HF blood = 50 to 75%)	Local	
Age at puberty (days)	610.3	878.7	268.4**
Calving interval (days)	390	418	28*
Dry period (days)	89.3	152.6	61.3**
Average milk production (liter/day)	7.13	4.76	2.37**
Lactation length (days)	339	249	90**

** = Significant (P<0.05)**
** = Highly Significant (P<0.01)**

The milk yield noted in the present study is not in line with the findings of Perez *et al.* (1985), who analyzed data in Chile on 2600 lactations of 1540 Holstein Friesian cows and reported that total lactation yield and lactation length averaged 5259 ± 1513 Kg and 324 ± 64 days, respectively. Khattab and Ashmawy (1988) observed that 305 days milk yield averaged 3045 ± 271 Kg. Haq (1992) reported that lactation yield in Holstein Friesian and Jersey cows averaged 4114.40 ± 115.96 and 3150.48 ± 46.18 liters for 305 days, respectively.

The milk yield recorded in the present study is in line with the findings of Das *et al.* (1988), who analyzed the 1st lactation record of 179 Jersey cows in Assam (India) and reported that the milk yield averaged 1923 ± 48.91 Kg. Sekerden and Ozkutuk (1990) calculated an average milk yield of 2553 Kg and lactation length of 299 days for 143 Jersey cows imported into Turkey. In a later study (Qureshi *et al.* 2000) the average lactation length of crossbred cows was 503.0 ± 6.36 days, ranging from 30 to 1441 days and the mean milk yield was 10.1 ± 0.14 Kg per day, ranging from 1.0 to 18.0 Kg per day.

Interaction among various traits

Correlation analysis of the data showed that services per conception was not affected by any of the reproductive traits or milk yield. However, calving interval was correlated positively and significantly with age at puberty, age at first calving, lactation length, dry period and negatively with average milk production (r=0.27, 0.23, 0.35, 0.25 and -0.25, respectively; $P<0.01$).

Conclusion

The findings of this study indicate that Holstein Friesian crossbred cows showed better productive and reproductive performance than the local cattle. The productive potential of local cattle can be increased by using exotic semen of genetically superior sires, through intensive management and with effective disease control program.

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