REPRODUCTIVE PERFORMANCE OF HOLSTEIN FRIESIAN AND JERSEY CATTLE IN PUNJAB, PAKISTAN

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The data on 575 records of 270 Holstein Friesian and 818 records of 326 Jersey cows maintained in Punjab, Pakistan were analyzed. The cows were grouped into imported Holstein Friesian, imported Jersey, Farm born Holstein Friesian and farm born Jersey cows. Breed group significantly influenced age at first calving, service period and breeding efficiency. While non-significant effect of season of birth was observed on these traits except service period. Effect of lactation number was non-significant service period. The longest age at first calving was observed in cows born during summer season in farm born Holstein Friesian and Jersey cows. Service period of imported Holstein Friesian and Jersey cows was higher than those of farm born Holstein Friesian and Jersey cows. Shortest service period was observed in summer calvers in imported Holstein Friesian and farm born Jersey cows while among imported Jersey and farm born Holstein Friesian cows shortest service period was observed in autumn calvers. Breeding efficiency in Jersey cows was significantly higher than Holstein Friesian cows. Maximum breeding efficiency was observed in farm born (during summer and winter season) Holstein Friesian and Jersey cows.
Keywords: Holstein Friesian, Jersey, age at first calving, service period, breeding efficiency

INTRODUCTION

Livestock contributes about 51% to agriculture and about 11% to GDP. This sector accounts for almost 12.3% of the overall export earnings of the country. The role of livestock in rural economy may be realized from the fact that 30-35 million rural population is engaged in livestock raising. The total milk production is 34 million tonnes (Anonymous, 2007-08). Increasing genetic potential of milch animals through constructive breeding programs coupled with improving environmental conditions and management practices is one of the effective approaches to increase milk production of dairy animals.

The Government of the Punjab imported a herd of purebred Holstein Friesian and Jersey cattle in 1985 from USA and maintained at the Research Institute for Physiology of Animal Reproduction, Pattoki, District Kasur. This area having subtropical climatic conditions (Anonymous, 1988). The performance of dairy animals is affected by many environmental factors besides their genotype. The evaluation of environmental factors affecting productivity of animals is very important for future planning and management.Thus the present study was planned to compare reproductive performance of imported and farmborn Holstein Friesian and Jersey cattle under similar environmental and managemental conditions.

MATERIALS AND METHODS

The data on 575 records of 270 Holstein Friesian (66 imported and 204 farm born) and 818 records of 326 Jersey cows (90 imported and 236 farm born) maintained at the Research Institute for Physiology of Animal Reproduction (RIPAR), Pattoki, District Kasur, Punjab, Pakistan during the period of 1986 through 2001 were used for analyses. The animals were divided into four groups: Imported Holstein Friesian (2) Imported Jersey (3) Farm born Holstein Friesian and (4) Farm born Jersey cows (named as breed groups). Here the farm born animals were the progeny of imported cows that were raised in Pakistan. The year was divided into four seasons: winter (December to February), spring (March to May), summer (June to August) and autumn (September to November).

Age at first calving of each cow was determined from the difference between the date of birth and the date of first calving. The Holstein Friesian and Jersey cows pregnant for second lactation were imported. The first calving records of these cows were not available. So age at calving of imported cows could not be calculated. Observations in all parameters outside plus and minus three standard deviations from mean were excluded. Data set comprising 307 observations on age at first service and age at first calving were analyzed using the following model.

$Y_{ijk} = \mu + BG_i + SOB_j (BG*SOB)_{ij} + \varepsilon_{ijk}$ (Model I)

Where,

Y_{ijk} = Individual observation of any trait

μ = Population mean

BG_i = Breed Group (i = 1,2,3 and 4)

SOB_j = Season of Birth (j = 1,2,3 and 4)

$(BG*SOB)_{ij}$ = Interaction of BG and SOB.

ε_{ijk} = Random error associated with individual observation.

Service period of each cow was determined from the difference between the date of calving and the date of subsequent conception. Data set comprising 927 observations on service period were analyzed using following model.

$Y_{ijkl} = \mu + BG_i + SOC_j + LN_k + (BG*SOC)_{ij} + (BG*LN)_{ik} + \varepsilon_{ijkl}$ (Model II)

Where,

Y_{ijkl} = Individual observation of any trait
μ = Population mean
BG_i = Breed Group (i = 1,2,3 and 4)
SOC_j = Season of Calving (j = 1,2,3 and 4)
LN_k = Lactation Number (k = 1,2,3,4 and 5)
$(BG*SOC)_{ij}$ = Interaction of BG and SOC.
$(BG*LN)_{ik}$ = Interaction of BG and LN.
ε_{ijkl} = Random error associated with individual observation.

The breeding efficiency was calculated from the following formula suggested by Wilcox *et al.* (1957).

$$\text{Breeding efficiency (\%)} = \frac{365 \times (N-1)}{D} \times 100$$

Where

N = total number of parturitions
D = number of days from the first to the last parturition

Season of first calving was considered to estimate the effect of season of calving on breeding efficiency. Data set comprising 240 observations on breeding efficiency were analyzed using model I. Data entry and manipulation was done by using Microsoft Excel®. Data on different parameters having unequal disproportionate sub class frequencies were analyzed by using General Linear Model SPSS ®, 1999. The comparison of the means among significant fixed effects on reproductive traits were done using Duncan's Multiple Range test as modified by Kramer (1957).

RESULTS AND DISCUSSION

Age at First Calving

The analysis of variance (Table 1) indicated that age at first calving significantly (P<0.05) varied among breed groups. Similar findings have been reported by Niazi and Aleem (2003) in Holstein Friesian cows. The findings of Gyawu *et al.* (1988) are not in line with the results of present study. Table 4 shows that the least squares mean age at first calving of farm born Holstein Friesian cows was 952.90±15.14 days which coincides with the findings of Ahmad (1995). The least squares mean age at first calving of farm born Jersey cows was 888.53±15.97 days, which is in line with those reported by Govindaiah *et al.* (1998).

Table 1. Analysis of variance for evaluation of factors affecting age at first calving

Source of variation	Degrees of freedom	F. ratio
SOB	3	0.45^{NS}
BG * SOB	3	0.53^{NS}
Error	299	
Total	306	

BG = Breed Group SOB = Season of Birth
^{NS}=Non-Significant * = Significant

The analysis of variance revealed that age at first calving was not affected significantly (P<0.05) by season of birth (Table 1). Bilal (1996) reported similar results in Holstein Friesian cows while Govindaiah *et al.* (1998) and Sattar *et al.* (2004) also reported similar results in Jersey cows. Present findings are not in line with Katoch *et al.* (1989) in Jersey cows.

The lowest age at first calving (916.30±22.76 days) was observed among farm born Holstein Friesian and farm born Jersey cows born during winter and spring season, respectively. The calves born in winter and spring seasons were heavier than calves born in other seasons. Accelerated growth due to favourable season and heavier birth weight might have resulted in early maturity and lower age at first calving. The age at puberty is affected by many factors such as breed, season, feeding etc. The delayed puberty is also attributed to underfeeding, poor management conditions and external and internal parasites (Khan, 2002).

Service Period

The analysis of variance (Table 2) indicated that service period significantly (P<0.05) varied among breed groups. The findings of Niazi and Aleem (2003) are not in line with the present results. Table 4 shows that service period in imported Holstein Friesian cows (238.36±22.62 days) was longer than the farm born Holstein Friesian cows (235.54±13.85 days), whereas Ahmad (1995) reported that imported Holstein Friesian cows had shorter service period than farm born Holstein Friesian cows. Imported Jersey cows had significantly (P<0.05) longer service period (202.64±11.66 days) than the farm born Jersey cows (162.58±8.49 days).

The analysis of variance revealed that service period was significantly (P<0.05) affected by season of calving (Table 2). Sattar *et al.* (2004, 2005) reported similar results in Holstein Friesian and Jersey cows. On the contrary, the findings of Bilal (1996) in Holstein Friesian cows and those of Methekar *et al.* (1993) in Jersey cows do not agree with the results of present study.

Table 2. Analysis of variance for evaluation of factors affecting service period

Source of variation	Degrees of freedom	F. ratio
BG	3	10.05*
SOC	3	3.73*
LN	4	0.68^{NS}
BG * SOC	9	1.91*
BG * LN	8	1.75^{NS}
Error	899	
Total	926	

BG = Breed Group SOC = Season of Calving
LN = Lactation Number ^{NS} =Non-Significant, * = Significant

Table 5 represents that the shortest service period (154.58±36.82 days) was observed in imported Holstein Friesian cows calved during summer season. Duncan's multiple range test revealed that service period of imported Holstein Friesian cows calved in spring season differed significantly (P<0.05) from those of autumn, winter and summer seasons. Service period did not differ among winter and summer calvers but differed significantly form autumn calvers. The shortest service period (194.39±15.72 days) was observed among farm born Holstein Friesian cows calved during autumn season. Service period of cows calved during winter season differed significantly (P<0.05) from that of autumn season, but did not differ significantly from that of spring and summer. The service period among cows calved during spring, summer and autumn season did not differ significantly from each other. The shortest service period (160.26±14.92 days) was observed in imported Jersey cows calved during autumn season. Service period of cows calved during spring season differed significantly (P<0.05) from that of autumn season and did not differ significantly from winter and summer. The service period among cows calved during winter, summer and autumn season did not differ significantly from each other. The shortest service period (151.31±14.29 days) was observed among farm born Jersey cows calved during summer season. Duncan's multiple range test revealed that service period in farm born Jersey cows calved during different seasons showed non-significant difference.

The analysis of variance revealed that service period was non-significantly affected by lactation number (Table 2). These results are in agreement with those of Bagnato and Oltenacu (1994) and Sattar *et al.* (2005) in Holstein Friesian and Sattar *et al.* (2004) in Jersey cows. On the contrary the findings of Ageeb and Hayes (2000) are not in agreement with those of present study in Holstein Friesian cows.

The variation in service period was due to number of services per conception which is affected by reproductive health, accurate heat detection, timely insemination, quality of semen used and the inseminator's skills, while in case of natural service - the efficiency of service bull, advancing parity, days to first insemination, days to conception and number of services per conception (Khan, 2002). In addition to these important factors, other factors, which to a large extent, are beyond the immediate control of management may impact fertility. These factors include milk production of the cow, age of the cow and season of the year (Hillers *et al.*, 1984). The results of the present study revealed that cows calved during spring season had longest service period. These cows had their breeding period during hot months. The tendency of oestrus to be silent and short in hot season makes detection of heat difficult. Heat stress might have resulted in reduced reproductive efficiency (in terms of ovulation, repeat breeding, conception rate etc.). This may be attributed to increased service period. Confining breeding of cows to the months of December, January and February (cooler months of the year) will help improve this trait.The service period in different lactations has been given in Table 6.

Breeding Efficiency

The analysis of variance (Table 3) indicated that breeding efficiency significantly (P<0.05) varied among breed groups. Similar findings have been reported by Ahmad (1995) in Holstein Friesian cows. The least squares mean breeding efficiency of farm born Holstein Friesian cows in this study was 73.12±2.29 % (Table 4). These findings are in agreement with those of Ageeb and Hayes (2000). The least squares mean breeding efficiency of farm born Jersey cows in present study was 87.01±1.73 % (Table 4). Methekar *et al.* (1992) reported similar findings. The analysis of variance revealed that breeding efficiency was not affected significantly (P<0.05) by season of (first) calving (Table 3). Methekar *et al.* (1992) reported similar findings in Jersey cows but Rao and Rao (1996) differed. Present findings are not supported by Ahmad (1995) and Ageeb and Hayes (2000) in Holstein Friesian cows. There was a non-significant (P<0.05) interaction between various breed groups and seasons of calving (Table 5).

Table 3. Analysis of variance for evaluation of factors affecting breeding efficiency

Source of variation	Degrees of freedom	F. ratio
BG	1	23.46*
SOC	3	0.24^{NS}
BG * SOC	3	0.37^{NS}
Error	232	
Total	239	

BG = Breed Group, SOC = Season of Calving
LN = Lactation Number, * = Significant

Table 4. Least square means of reproductive traits

Traits	Holstein friesian		Jersey	
	Imported	Farm born	Imported	Farm born
Age at First Calving (Days)	-	952.90±15.14 (157)	-	888.53±15.97 (150)
Service Period (Days)	238.36±22.62 a (73)	235.54±13.85 a (299)	202.64±11.66 a (191)	162.58±8.49 b (364)
Breeding Efficiency (%)	-	73.12±2.29 (111)	-	87.01±1.73 (129)

Figures given in parenthesis indicate number of observations

Table 5. Least squares means of reproductive traits in different breed groups in different seasons of calving

Traits		Winter	Spring	Summer	Autumn
Age at first calving (days)	IH	-	-	-	-
	FBH	916.30±22.76	966.84±35.26	969.72±25.72	958.72±35.26
	IJ	-	-	-	-
	FBJ	890.74±23.99	884.26±27.20	892.18±28.60	886.93±44.08
Service period (days)	IH	185.06±26.56 [c]	369.40±72.99 [a]	154.58±36.82 [c]	244.37±28.15 [b]
	FBH	269.10±18.92 [a]	244.12±29.08 [ab]	234.52±18.39 [ab]	194.39±15.72 [b]
	IJ	207.88±21.83 [ab]	234.06±32.42 [a]	208.31±21.09 [ab]	160.26±14.92 [b]
	FBJ	158.10±14.90 [a]	189.45±18.05 [a]	151.31±14.29 [a]	151.44±14.48 [a]
Breeding efficiency (%)	IH	-	-	-	-
	FBH	71.74±3.47	71.29±7.36	75.16±3.29	74.29±2.60
	IJ	-	-	-	-
	FBJ	89.71±3.04	83.28±4.65	86.77±2.75	88.25±3.00

Note: Means in a row with different superscripts are significantly (P<0.05) different.
IH= Imported Holstein Friesian, FBH= Farm born Holstein Friesian, IJ= Imported Jersey, FBJ= Farm born Jersey

Table 6. Least squares means of reproductive traits in different breed groups during different lactations

Traits		L1	L2	L3	L4	L5
Service period (days)	IH	-	-	216.45±28.16	225.36±36.89	273.25±34.34
	FBH	256.98±12.29	225.52±15.68	242.08±20.85	225.40±35.33	227.67±45.29
	IJ	-	-	254.35±18.95	182.98±19.73	170.56±17.22
	FBJ	171.07±12.06	180.68±14.32	151.56±17.87	156.65±24.63	152.91±22.16

Note: Means in a row with different superscripts are significantly (P<0.05) different.
IH= Imported Holstein Friesian, FBH= Farm born Holstein Friesian, IJ= Imported Jersey, FBJ= Farm born Jersey , L= Lactation

This study revealed that the breeding efficiency of cows was low; about 25% of the farm born Holstein Friesian and 13% farm born Jersey cows were unable to give calf each year owing to the effect of high ambient temperature, which is the main cause of reproductive failure. Ageeb and Hayes (2000) concluded that the reproductive problems occurred and general breeding efficiency was low for temperate cattle maintained in the tropics. As the heritability and repeatability estimates of reproductive measures are low therefore proper feeding, management and amelioration of the climate will improve this trait. Some other factors affecting breeding efficiency are: fertilization rate, number of services per conception, conception rate, calving rate, service period and calving interval. Improved management in all these factors would be helpful.

Seasonal depression in the breeding efficiency is attributed to the effect of high temperature which affects many factors related to breeding efficiency. Modification of the environment (cooling/provision of shade/air conditioning) would alleviate the adverse effects. Feeding management and breeding of cows in cooler months of the year will help improve this trait.

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