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EFFECT OF INBREEDING AND SOME OTHER FACTORS ON AGE AT FIRST CALVING IN GIR COWS

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ABSTRACT

Effects of Inbreeding, sire, period and season on age at first calving (AFC) and its phenotypic and genetic association with other reproductive traits viz., first service period (FSP) and first calving interval (FCI) were studied on 191 *Gir* cows maintained at the Kasturba Gandhi National Memorial Trust Dairy Farm, Kasturbagram, Indore (M.P.). The AFC in these cows averaged 1787.46±36.11 days and was significantly ($p<0.01$) affected by inbreeding. The effects due to sire, period and season were non- significant. The heritability estimate of AFC was low (0.09±0.12) with large standard error. The phenotypic correlations of AFC with FSP and FCI were both positive and significant ($p<0.01$). It was concluded that inbreeding had deteriorating effect on the age at first calving and hence to improve the age at first calving in this herd avoidance of inbreeding along with ameliorative managerial practices should be adopted.

Key Words : Age at first calving, inbreeding, *Gir*

The early age at first calving is a desirable character because it reduces the cost of raising the heifers from birth to maturity which in turn increases the margin of profit by increasing the life time production of dairy animal. The reduction in age at first calving also reduces generation interval which in turn makes the progeny testing of bulls more feasible proposition in the country. Most of the cattle herds in our country are small in size. In small herds inbreeding becomes inevitable. There appears scanty information on effect of inbreeding on age at first calving in *Gir* cows. This led to conduct the present study.

MATERIALS AND METHODS

The data utilized for the present investigation pertained to 191 observations of age at first calving (AFC) on *Gir* cows maintained at the Kasturba Gandhi National Memorial Trust Dairy Farm, Kasturbagram, Indore (M.P.) covering a period of 36 years (1974 to 2009). The inbreeding coefficient for each animal was calculated using path coefficient method. Since only source of inbreeding in the herd during the period under study was found to be daughter x sire matings, each inbred

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animal was having an inbreeding coefficient of 0.25. Therefore on the basis of level of inbreeding the animals could be classified into two groups only viz., non-inbred (IL_1) and inbred (IL_2). The entire duration of 36 years was delineated into six periods of six years each to overcome the differences in managemental practices while year was divided into four seasons viz., spring (February – March), summer (April – June), rainy (July – September) and winter (October – January) depending upon the climatic conditions prevailing in the region. To study the effect of genetic and non-genetic factors the data were analyzed by least squares technique of fitting constants using "Mixed Model Least Squares and Maximum Likelihood Computer Programme PC-2"[4]employing the following statistical model statistical model which included the effects of sire, period of birth, season of birth and the level of inbreeding. Heritability estimate of AFCs and its genetic and phenotypic correlations with other reproductive traits were obtained by paternal half sib correlation method[5]

RESULTS AND DISCUSSION

Out of 191 cows, 38 were found to be inbred leading to 19.89 % incidence of inbreeding in the herd. The inbreeding coefficient of each inbred cow came out to be 0.25. The average inbreeding level of entire herd was 0.0497±0.0072. The higher coefficient of inbreeding (0.25) of all the inbred animals is due to the limited number of sires, as only 14 sires were used during the period of 36 years. Moreover, three sires were used continuously for 5 to 7 years in the herd which had further increased chances of daughter x sire mating. Varied incidences of inbreeding have been reported in various breeds and herds by different workers in India and abroad. In *Sahiwal* herds maintained at NDRI Karnal, Hissar, Meerut and Lucknow the incidence of inbreeding have been reported to be 82%, 22.08%, 72.3% and 35.62%, respectively[13]. In *Karan Swiss* and *Karan Fries* cattle the incidence of inbreeding was found to be 21.0 and 36.2 percent, respectively[12].

The overall least squares mean for age at first calving in the herd was found to be 1787.46±36.11 days (Table 1). The average age at first calving in this breed has been reported to be as low as 1320 to 1521 days[3,14 & 10] and as high as 1844 days[8]. The higher age at first calving in this study might have been due to poor management and inbreeding in the herd. However, large herd to herd variation for this trait indicates a scope for genetic improvement i.e. decline in age at first calving by introduction of genes from the herds with lower age at first calving.

Table 1. Least squares means and standard errors for age at first calving.

Effect	No. of observations	Mean±S.E. (days)
μ	191	1787.46±36.11
Sire		
S_1	23	1872.23±71.71
S_2	13	1842.49±82.21
S_3	9	1886.96±97.76
S_4	36	1849.51±62.05
S_5	37	1798.12±61.44
S_6	9	1645.02±95.44
S_7	9	1841.17±98.01
S_8	10	1859.26±93.34
S_9	11	1771.74±98.46
S_{10}	10	1746.46±94.57
S_{11}	5	1590.40±178.67
S_{12}	9	1704.23±165.50
S_{13}	5	1917.20±184.22
S_{14}	5	1699.71±160.05
Period		
P_1 (1974-1979)	39	1751.15±83.11
P_2 (1980-1985)	32	1773.78±83.17
P_3 (1986-1991)	34	1837.98±82.16
P_4 (1992-1997)	28	1758.69±78.15
P_5 (1998-2003)	33	1801.78±71.75
P_6 (2004-2009)	25	1841.45±118.70
Season		
S_1 (spring)	59	1822.04±46.17
S_2 (summer)	37	1786.65±58.22
S_3 (rainy)	31	1768.01±56.12
S_4 (winter)	64	1773.15±44.07
Inbreeding		
IL_1 (non-inbred)	153	1702.29±32.10[a]
IL_2 (inbred)	38	1872.64±55.88[b]

a, b: Least squares means bearing different superscripts differ significantly from each other

Table 2. Least squares analysis of variance for age at first calving.

Source of variation	d.f.	S.S.	M.S.	F
Sire	13	774012.48	59539.42	0.902
Period	5	183859.12	36771.82	0.557
Season	3	86700.29	28900.09	0.438
Inbreeding	1	620492.18	620492.18	9.397 **
Error	168	11092724.46	66028.12	-

** Significant (P< 0.01)

Analysis of variance revealed non-significant effect of sire on age at first calving while significant effect of sire on this trait was reported in *Gir*[3]and in *Malvi*[11]. In this study, period also had non significant bearing on AFC. Similar findings were also reported in *Red Sindhi* and *Jersey* crosses[9] while significant effect of period on this trait was found in *Gir*[1& 10] and in *Malvi*[11]. Although there are no significant differences amongst least squares means of periods, comparatively higher average age at first calving during period 3, 5 and 6 might be due to the presence of inbred animals as inbred animals were mainly born during period 3 to 6. Besides differences in the managerial practices, climatic conditions and other environmental factors operating in different periods might be responsible for adversely affecting and increasing the age at first calving in the herd over the periods. Although the heifers born in rainy season had the lowest (1768±56.12 days) and those born in spring the highest (1822.04±46.17 days) age at first calving (Table 1), the least square analysis revealed the effect of season to be non-significant. Similar findings have also been reported by in *Gir*[1], and in *Malvi* [11]cows . However, significant effect of season on this trait was found in *Gir*[10].

Significant effect of inbreeding on age at first calving as observed in the present study is in agreement with the findings in *Gir*[8], *Sahiwal*[7], *Irish Holstein Friesian*[6], *Malvi*[11] and *Nicarguan Reyna Creole*[2] breed of cattle. Comparison of average at first calving in inbred and non-inbred groups (Table 1) revealed that age at first calving was significantly longer in inbred (1872.64±55.88 days) as compared to non-inbred (1702.29±32.10 days) cows. Significantly longer age at first calving in inbred females as compared to non-inbred females corroborate the generally accepted view that reproductive traits are adversely affected by inbreeding due to loss of heterozygosity as these traits are mainly governed by non-additive gene action.

Heritability and phenotypic and genetic correlations: The low heritability estimate of AFC (0.09±0.12) found in the present study is in congruence in *Gir*[3&1] cows. The lower heritability of the trait gives the indication that non-additive gene action and environmental factors play a major role in the expression of the trait and therefore, improvement in this trait can be affected by ameliorating the managerial practices and other environmental conditions.

The significant (P<0.01) positive phenotypic correlations of age at first calving with first service period (0.16±0.06) and first calving interval (0.19±0.05) found in the present study are in agreement with the findings in *Gir*[1] cattle. Thus it can be inferred that reduction in age at first calving would simultaneously lead to decrease in service period and calving interval a desirable association in farm practice. The genetic correlation of age at first calving with first service period and first calving interval were also positive but non significant which is in agreement with the findings in Red Sindhi[9]. However, positive and significant genetic association between these traits breed have been reported[1].

CONCLUSION

From the above observations it could be concluded that inbreeding has deteriorating effect on the age at first calving and hence it should be avoided. The sires should be replaced after every two years so that sire-daughter mating could be averted. Out crossing along with ameliorative managerial practices will lead to reduction in AFC and the herd will attain optimum reproductive efficiency.

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