EFFECT OF GENETIC AND NON-GENETIC FACTORS ON LACTATION YIELD IN *MALVI* COWS

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ABSTRACT

The data for the present investigation pertained to 1647 observations of lactation yield (LY) on *Malvi* cows maintained at Govt. Cattle Breeding Farm, Agar, District Shajapur (M.P.), covering a period of 48 years from 1962 to 2009. The least squares analysis of variance revealed the mean LY in these cows to be 854.90±33.52 kg and the trait was significantly affected by sire ($P< 0.01$), period ($P< 0.01$), parity ($P< 0.01$) and inbreeding ($P< 0.05$). Heritability estimates for LY was obtained as 0.16±0.13. It was inferred that inbreeding had deteriorating effect on the lactation yield and hence to improve the lactation yield in this herd, avoidance of inbreeding along with ameliorative managerial practices should be adopted.

KEYWORDS : *Malvi* cows, inbreeding, lactation yield, heritability.

INTRODUCTION

The milk yield is the basic and most important trait on which economy of dairying is based. In order to have an effective selection procedure for building up the high yielding herd an investigation is necessary on the factors affecting the milk yield. In India, most of the herds of cattle are small in size and in small population maintained for long time inbreeding is inevitable. Therefore, there is a need to study the incidence and degree of inbreeding at organized farms and its impact on lactation yield. Hence, the present study was undertaken to study the genetic variation present and to examine the effects of inbreeding and some other factors on this trait in *Malvi* cows.

MATERIALS AND METHODS

The data for the present investigation pertained to 1647 observations of lactation yield (LY) on 409 *Malvi* cows maintained at Govt. Cattle Breeding Farm, Agar, District Shajapur (M.P.), spanning a period of 48 years (1962 to 2009). Inbreeding coefficient for each animal was calculated using path coefficient method (Wright, 1922). It was observed that all the inbred animals under study had an inbreeding coefficient of 0.25 as they were all produced by sire-daughter mating. Therefore, on the basis of level of inbreeding animals were classified into two groups only viz., non-inbred (IL_1) and inbred (IL_2). The entire period of 48 years was divided into eight periods of six years each and each year was divided into four seasons, viz., spring (February – March), summer (April – June), rainy (July - September) and winter (October – January). To study the effect of genetic and non-genetic factors on lactation yield the data were analyzed by least squares technique of fitting constants using "Mixed Model Least Square and Maximum Likelihood Computer Programme PC-2" (Harvey, 1990) employing the statistical model which included the effects of sire, period of calving, season of calving, parity and level of inbreeding. Heritability estimate of lactation yield was obtained by paternal half sib correlation method. Duncan's Multiple Range Test (DMRT) was applied to compare the least squares means.

RESULTS AND DISCUSSION

Out of 409 animals, 45 were found to be inbred giving 11.00% incidence of inbreeding in the herd. The inbreeding coefficient of each inbred cow came out to be 0.25. The higher coefficient of inbreeding (0.25) of all the inbred animals is due to the limited number of sires. Out of 12 sires, three sires were used continuously for 4 to 7 years, thus enhancing 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 NDRI Karnal herd, *Sahiwal* has the maximum percentage of inbreds (82%), followed by 36% for *Karan Swiss* and 20% for *Karan Fries* (Saha *et al.*, 2001).

The least squares mean for lactation yield was found to be 854.90±33.53 kg (Table 1). However, Chaturvedi (1991) reported higher mean lactation yield in this breed. The least squares analysis (Table 2) revealed that sire had significant (p<0.01) effect on lactation yield. The significant effect

Table 1. Least squares means and standard errors for lactation yield in *Malvi* cattle

Effect	No. of observations	Mean ± S.E. (kg)	Effect	No. of observations	Mean ± S.E. (kg)
Overall mean (μ)	1647	854.90±33.52	**Season**		
Sire			Spring	234	860.43±37.58
S_1	286	1134.39±35.12^{d}	Summer	258	861.69±37.80
S_2	114	996.05±35.21^{c}	Rainy	348	851.16±35.36
S_3	200	924.69±28.43^{b}	Winter	807	846.30±33.68
S_4	273	870.87±29.62^{b}	**Parity**		
S_5	29	777.42±59.43^{ab}	Pt_1	327	785.57±26.91^{a}
S_6	47	827.09±52.88^{b}	Pt_2	269	825.37±30.49^{ab}
S_7	182	704.32±43.54^{a}	Pt_3	234	850.91±33.31^{bc}
S_8	76	821.50±48.90^{b}	Pt_4	201	856.79±35.35^{bc}
S_9	356	820.67±50.68^{b}	Pt_5	171	910.82±38.14^{c}
S_{10}	64	812.68±72.96^{b}	Pt_6	146	863.90±41.00^{bc}
S_{11}	12	816.57±103.88^{b}	Pt_7	116	900.94±44.00^{bc}
S_{12}	8	752.52±119.26^{ab}	Pt_8	85	890.55±48.02^{bc}
Period			Pt_9	58	824.93±54.19^{ab}
P_1	17	651.13±100.16^{a}	Pt_{10}	40	839.17±61.41^{bc}
P_2	135	923.63±71.35^{c}	**Level of inbreeding**		
P_3	254	1009.71±56.23^{d}	IL_1	1511	884.31±27.45^{b}
P_4	260	895.37±45.50^{c}	IL_2	136	825.48±43.21^{a}
P_5	252	897.30±36.07^{c}			
P_6	293	799.55±27.75^{b}			
P_7	274	761.91±29.93^{ab}			
P_8	162	900.56±34.67^{c}			

of sire on lactation yield has also been reported by Pathak (1977) in *Gir* and Sharma *et al.* (1987) in *Sahiwal* cows. The study revealed the period of calving to be a significant factor (p<0.01) to affect the lactation yield, a finding similar to that reported by Chaturvedi (1991) in *Malvi* and Bhadauria *et al.* (2003) in *Gir* breed. Although the DMR test did not reveal a definite trend, the lactation yield steadily increased significantly from the lowest in period 1 to highest in period 3; subsequently declined significantly through period 7 and then increased significantly during period 8 (Table 1). These significant differences in mean lactation yield during different periods might be attributed to differential management, availability of feeds and fodder and due to variation among sires. The effect of season on lactation yield was found to be non-significant which is in agreement with the findings of Chaturvedi (1991) in *Malvi* cows. The parity had highly significant (P< 0.01) effect on lactation yield (Table 2). Lactation yield was highest for parity five (910.82±38.14 kg) and lowest for parity one (785.57±26.91 kg). Lowest lactation yield in primipara indicates that the cows have not yet attained complete maturity and are still in growing phase. This finding is corroboratory to the findings of Chturvedi (1991) in *Malvi*, Tomar *et al.* (1994) in *Nimari* and Bhadauria *et al.* (2003) in *Gir* cows.

Table 2. Least squares analysis of variance for lactation yield in Malvi cattle

Source of variation	d.f.	S.S.	M.S.	F
Sire	11	4486725.75	407884.16	5.407**
Period of calving	7	5168786.15	738398.02	9.788**
Season of calving	3	62352.42	20784.14	0.276
Parity	9	1974904.84	219433.87	2.909**
Inbreeding	1	349593.15	349593.15	4.634*
Error	1615	121833455.94	75438.67	-

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

The effect of inbreeding on lactation yield was found to be significant (P<0.05). The inbred cows recorded significantly lower lactation yield as compared to non-inbred cows (Table1). There appears no report on the effect of inbreeding on lactation yield in Malvi cattle. However, our findings are in agreement with the findings of Odedra *et al.* (1979) and Rajoriya (2009) in *Gir*; Kumar and Narain (1977) and Khanna *et al.* (1979) in Sahiwal breed of cattle and Malhado *et al.* (2013) in *Murrah* buffalo.

Heritability estimate : The heritability estimate obtained for lactation yield was found to be low (0.16±0.13) and not significantly different from zero. Estimates of similar magnitude have also been reported by Bhadauria *et al*.(2003) in *Gir* and Ekka *et al.* (2014) in Kankrej cattle. The low estimate of heritability indicated that in this herd lactation yield was mainly governed by non-additive gene action with larger environmental influences. Thus, the improvement in this trait could be brought about by improved feeding and managerial practices. The continuous selection pressure applied in this herd for improvement of lactation yield might have more or less fixed the genes responsible for expression of this character exhausting additive genetic variance for this trait resulting into low estimate of heritability.

From the results of this study it could be concluded that while formulating and implementing selection and breeding strategies to bring about genetic improvement in lactation yield in this herd data should be adjusted for non-genetic effects viz., period of calving and parity of the cow. Further, in view of adverse affect of inbreeding on lactation yield inbreeding should be avoided by replacing the sire every one or two years.

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