

*Original Research***Effect of Genetic and Non-Genetic Factors on Production Performance of Sahiwal Cattle**

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Abstract

The present study was conducted on 308 Sahiwal cows sired by 38 bulls spared over a period of 32 years (1981- 2012), maintained at instructional dairy farm and AICRP on cattle -Sahiwal (field unit) at G.B.P.U.A. & T., Pantnagar Uttarakhand and Chak Ganjaria Government Cattle Farm Lucknow, Uttar Pradesh. The overall least- square means for first lactation milk yield (FLMY), 305 days first lactation milk yield (305 FLMY), first lactation length (FLL), first peak yield (FPY), and days attain to first peak yield (DAFPY) were as 1927.50 ± 36.68 kg, 1965.05 ± 27.30 kg, 290.42 ± 5.57 days, 11.15 ± 0.39 kg and 41.78 ± 2.97 days, respectively. Highly significant effect ($P < 0.01$) of sire was observed in all the traits, while season was found to influence the first lactation milk yield and 305 days first lactation milk yield at 5% level of significance. The period of calving significantly ($P < 0.05$) influenced first peak yield while it was non-significantly influencing FLL, FLMY, 305d- FLMY and DAFPY.

Key words: Genetic and Non-Genetic Factors, Lactation Traits, Least-Square Means, Sahiwal**How to cite:** Kumar, D., Singh, C., Kumar, D., Kumar, S., Shahi, B., & Khadda, B. (2020). Effect of Genetic and Non-genetic Factors on Production Performance of Sahiwal Cattle. International Journal of Livestock Research, 10(2), 61-66. doi: 10.5455/ijlr.20190727104522**Introduction**

Livestock is an important and integral part of agriculture sector and plays an important role in the national economy and in the socio-economic development of the country. Cattle are the most important livestock in India and play a vital role in agriculture related economy. Among them Sahiwal is considered as the best milch dairy breed of the country and is well adapted to the tropical and sub-tropical conditions of Indian sub-continent. The Sahiwal breed is being utilized widely for improvement of local stock or for initial crossbreeding of indigenous stock with European breeds in many warm humid countries of the world because of its well-known resistance to tropical diseases, endurance to hot climate of tropics, low cost of maintenance and higher milk constituents. The primary objective of the animal breeder is to maximize

genetic improvement in economically important traits which can be achieved through proper selection and breeding system. The genetic composition of a population can be studied by considering the relative importance of hereditary and environmental factors affecting the performance of an individual in the population. The genetic parameters estimates are helpful in determining the best method of selection, to predict the direct and correlated response to selection and in choosing a breeding policy to be adopted for future as well as in the estimate of genetic gain. Milk production of a cow is a function of its genotype and environment under which the animal is brought up and maintained at a given time and age. The selection of the superior animals with maximum accuracy is of utmost importance for any breed improvement programme where performances of first lactation traits are of utmost importance. In present Investigation an attempt was made to evaluate the production performance of Sahiwal cows maintained at multi-locational herds and to estimate their genetic parameters.

Materials and Methods

The data for present investigation on 308 Sahiwal cows were collected from pedigree cum history sheets of three herds namely Instructional Dairy Farm (IDF) of Govind Ballabh Pant University of Agriculture and Technology Pantnagar (Uttarakhand), Chak Ganjaria Government Cattle Farm Lucknow (Uttar Pradesh), and animal maintained under All India Coordinated Research Project (AICRP) on Cattle Sahiwal under field condition nearby area of Pantnagar (Uttarakhand). The data set were spread over a period 32 years (1981-2012), at a class interval of 8 years and only first lactation records were considered for investigation. Each year was further delineated into three seasons namely rainy (July- October), winter (November-February) and summer (March-June). The first lactation traits under investigation were first lactation milk yield (FLMY), 305 days first lactation milk yield (305 FLMY), first lactation length (FLL), first peak yield (FPY), and days attain to first peak yield (DAFPY). The effect of various genetic and non-genetic factors on different traits were further analyzed using mixed model least-squares and maximum likelihood computer program (LSMLMW PC-1 version) for fitting constant to overcome the difficulty of disproportionate sub class frequencies and non-orthogonal of data designed by Harvey (1990). The difference between means was tested for significance by Duncan's multiple range test by Kramer (1957). Paternal half – sib correlation method was used to estimate heritability as described by Hazel & Terril (1945). The standard error of heritability was estimated by using the formula as given by Swiger *et al.* (1964).

Results and Discussion

The overall least squares means for first lactation milk yield (FLMY), 305 days first lactation milk yield (305 FLMY), first lactation length (FLL), first peak yield (FPY), and days attain to first peak yield (DAFPY) were as 1927.50±36.68 kg, 1965.05±27.30 kg, 290.42±5.57 days, 11.15±0.39 kg and 41.78±2.97

days, respectively (Table 1). The results are in agreement with results reported by Sreedhar (2011), Manoj *et al.* (2012) and Dongre *et al.* (2013) in Sahiwal cattle.

The effect of farm was highly significant ($P < 0.01$) on first lactation milk yield (FLMY), 305 days first lactation milk yield (305 FLMY), and first peak yield (FPY). These results are in close agreement with finding of Chawla and Mishra (1982) in Sahiwal cattle. Cows at reared under field condition and IDF Nagla had highest first lactation milk yield and 305 days first lactation milk yield with their mean value 2248.48 ± 80.42 kg; 2261.67 ± 59.85 kg and 2103.82 ± 37.16 kg; 2147.17 ± 27.66 kg, respectively. Whereas Cows at Chank Ganjaria farm Lucknow had lowest 1430.19 ± 60.85 kg and 1486.31 ± 45.29 kg, respectively. The cows at field condition had longest first lactation length (FLL) of 295.96 ± 12.23 days, whereas, cows at Lucknow farm had shortest first lactation length (FLL) of 286.71 ± 9.25 . The higher level of milk production in first lactation at field and IDF farm may be due to better managerial and breeding practices coupled with superior germplasm.

The effect of season of calving was non-significant of first lactation length (FLL) whereas, it was highly significant ($P < 0.01$) on FLMY and 305 FLMY. Cows calving during winter season had more first lactation milk yield (1998.26 ± 46.22 kg) and 305 FLMY (2011.51 ± 34.40) whereas; summer calvers had less FLMY (1867.17 ± 43.83 kg) and 305 FLMY (1914.67 ± 32.62). The winter calvers had minimum energy loss due to low temperature humidity and persistently stay in milk for longer duration. Whereas, early dry up of summer calvers due to hot climatic conditions and high humidity. The non-significant effect of season of calving on first lactation length were in close agreement with findings of Singh *et al.* (2005), Manoj *et al.* (2012) and Narwaria *et al.* (2015) However, Bhoj (2012), Rahman and Khan (2012), Dongre *et al.* (2013) and Narwaria *et al.* (2015) found significant effect of season of calving on on FLMY and 305 FLMY in Sahiwal cattle.

Period of calving had highly significant ($P < 0.01$) effect on FPY which was in close agreement with findings of Dhaka *et al.* (2002) and Dhawan *et al.* (2016) in Sahiwal cattle. Whereas, rest of all production trait *i.e.* first lactation milk yield (FLMY), 305 days first lactation milk yield (305 FLMY), first lactation length (FLL) and days attain to first peak yield (DAFPY), the effect period was found to be non-significant which was comparable with Singh *et al.* (2006) and Manoj *et al.* (2012). Cows calving during period 1997-2004 had highest least squares means for FLMY and 305 FLMY with their value being 1963.08 ± 92.59 and 2046.77 ± 68.91 kg, respectively; whereas, during period 1989-1996 the estimate of least squares means, were lowest being 1889.89 ± 83.71 and 1905.9 ± 62.34 kg, respectively.

Table 1: Least-squares means and their standard error for various production traits in Sahiwal cattle

Source of Variation	No of obs.	FLMY (Kg)	305 FLMY (Kg)	FLL (Days)	FPY (Kg)	DAFPY (Days)
Overall mean	308	1927.50±36.68	1965.05±27.30	290.42±5.57	11.15±.39	41.78±2.97
Season		**	**	NS	NS	NS
Summer	109	1867.17 ^a ±43.83	1914.67 ^a ±32.62	286.41±6.66	10.90±.40	42.72±3.03
Rainy	86	1917.06 ^a ±49.52	1968.97 ^a ±36.85	289.22±7.5	11.42±.44	40.07±3.39
Winter	113	1998.26 ^b ±46.22	2011.51 ^b ±34.40	295.64±7.03	11.14±.45	42.55±3.43
Period		NS	NS	NS	*	NS
1981 to 1988	191	1949.97±51.86	1916.22±38.60	307.11±7.8	10.56 ^a ±.49	42.49±3.77
1989 to 1996	20	1889.89±83.71	1905.90±62.34	292.49±12.74	9.85 ^a ±.47	45.03±3.55
1997 to 2004	17	1963.08±92.59	2046.77±68.91	281.58±14.08	11.36 ^b ±.54	39.46±4.11
2005 to 2012	80	1907.05±47.24	1991.33±35.16	280.51±7.18	12.85 ^b ±.42	40.13±3.17
Farm		*	*	NS	*	NS
LKO	169	1430.19 ^b ±60.85	1486.31 ^c ±45.29	286.71±9.25	-	-
IDF	106	2103.82 ^a ±37.16	2147.17 ^b ±27.66	288.59±5.65	11.86 ^a ±.16	45.12±1.25
Field	33	2248.48 ^a ±80.42	2261.67 ^a ±59.85	295.96±12.23	9.90 ^b ±.34	44.31±2.62

Estimates with different superscripts differ significantly. F statistic of corresponding effects as ** = highly significant ($P < 0.01$), * = Significant ($P < 0.05$), NS = Non-significant. AFC- Age at first calving, FLMY- First lactation milk yield, 305 FLMY- 305 Days first lactation milk yield, FPY- First peak yield, DAPY- Days attain to peak yield, FLL- First lactation length, FSP - First service period, FDP- First dry period, FCI- First calving interval

The heritability estimates were 0.25±0.07, 0.37±0.12, 0.25±0.09, 0.16±0.03 and 0.19±0.04 for FLMY, 305-dFLMY, FLL, FPY and DAFPY, respectively (Table 2). The heritability estimates for FLMY, 305-d FLMY and FLL was moderate to high whereas, the heritability estimates for FPY and DAFPY were observed to be low. The similar reports were also reported by Singh *et al.* (1999), Kannan (2002) and Narwaria *et al.* (2015). Moderate estimate of heritability indicated that the traits had low genetic base and most of the variation in lactation traits were due to environmental factors and thus there is a wider scope of their improvement by subjecting the animals to better environment.

Table 2: Estimates of heritability with their standard error for various production traits in Sahiwal cattle

S. No.	Traits	Heritability ($h^2 \pm S.E.$)
1	First Lactation Milk Yield (FLMY)	0.25±0.07
2	305-days First Lactation Milk Yield (305d- FLMY)	0.37±0.12
3	First Lactation Length (FLL)	0.25±0.11
4	First Peak Yield (FPY)	0.16±0.03
5	Days attain to First Peak Yield (DAFPY)	0.19±0.04

AFC- Age at first calving, FLMY- First lactation milk yield, 305 FLMY- 305 Days first lactation milk yield, FPY- First peak yield, DAPY- Days attain to peak yield, FLL- First lactation length, FSP - First service period, FDP- First dry period, FCI- First calving interval

Conclusion

Low to moderate heritability among production traits indicated that the presence of genetic variance and the selection can be applied to improve these traits to some extent along with following good managerial practices. Optimum genetic potential for production traits in dairy cattle may be exploited by following proper feeding, management practices and adopting strict diseases control measure throughout the year and season. The significant effect of non-genetic factors like season, period and farm may be attributed to the non-uniform feeding system and management practices followed in different farms during the study period.

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