

Genetic evaluation of different lactation milk yields in Sahiwal cattle

C.V. Singh*, R. S. Barwal ** and B. Prakash***

*Department of Animal Genetics and Breeding, College of Veterinary & Animal Sciences
G.B. Pant University of Agriculture & Technology, Pantnagar-263145, U. S. Nagar, (Uttarakhand)*

ABSTRACT

The present study was conducted on production records of 927 Sahiwal cows born to 72 sires, spread over a period of 28 years (1978-2007) maintained at Government Livestock Farm, Chakganjaria, Lucknow. The lactation yield from first to fifth lactations was evaluated. The overall least squares means of 1st, 2nd, 3rd, 4th and 5th lactation milk yields were 1468.61±40.98 kg, 1549.55± 32.07 kg, 1667.07± 34.32 kg, 1682.86 ±35.40 kg and 1601.39±36.59 kg, respectively. The period of calving had significant influence on all the lactation milk yields. Season effects were significant on 3rd, 4th and 5th lactation milk yields while non significant effects on 1st and 2nd lactation milk yield were observed. The heritability estimates of different lactation milk yields were moderate. The genetic and phenotypic correlations among all the lactation milk yields were observed from low to very high. The mean performance of different lactation milk yields exhibited an increasing trend.

Key Words: - Sahiwal, least squares, heritability, lactation yield.

Present Address:* Professor & Head, ** Assistant Professor, G.B. Pant University of Agriculture & Technology, Pantnagar-263145, U. S. Nagar; ***Principal Scientist, NBAGR, Karnal

INTRODUCTION

The primary objective of animal breeding is to maximize genetic improvement in economically important traits which can be achieved through proper selection and utilization of breeding system. Selection for enhancing milk production in dairy animals has been practiced for several years because of economic importance. The potential for genetic improvement in a trait largely depends upon genetic variation existing in the population of interest. The variability for a particular trait in a population is measured by heritability estimates of traits under given environmental conditions. Variance and covariance are of prime importance to the breeder for estimating the genetic parameters and then utilizing these estimates for selection of animals. Estimates of genetic parameters are needed for the prediction of breeding values and planning of selection strategies for desired genetic advancement. With this object in view, the present investigation was conducted for estimating the genetic and phenotypic parameters of first to fifth lactation milk yield in Sahiwal cattle.

MATERIALS AND METHODS

The data for the present investigation were collected over a period of 28 years (1978 – 2007) from pedigree sheets of 927 Sahiwal cows born to 75 sires, maintained at Government Livestock Farm, Chakganjaria, Lucknow. Only the sires having records on at least 5 daughters were included in the present study. The records of only those animals were considered whose pedigree was known and they completed normal lactation. The lactation records of less than 150 days were considered as abnormal and were not included in the analysis. The total

duration of the present study was divided into 7 equal periods of four years each. Each year was divided into four seasons namely winter (January- March), summer (April – June), rainy (July – September) and autumn (October – December). In order to classify the data for different periods and seasons, year and season of calving was considered for all the traits. The traits considered in the present study were lactation milk yield from first to fifth lactation.

Statistical Analysis: The influence of non genetic factors on different traits were studied by least squares analysis of variance for non orthogonal data using mixed model least squares and maximum likelihood programme described by Harvey (1990). The model for the least squares analysis of variance to estimate the influence of non genetic factors on different first lactation and lifetime traits included the effect of periods, seasons and sires. Prior to estimation of genetic parameters, the data were adjusted for different significant non genetic factors. The data after adjustment for different significant non genetic factors were utilized for estimation of genetic parameters. Paternal half sib correlation method was used to estimate heritability of different traits (Becker, 1975). The standard error of heritability was estimated by the formula given by Swiger et al. (1964). The genetic and phenotypic correlations among different traits were estimated from the analysis of variance/covariance using half sib data as suggested by Becker (1975). The standard error of genetic correlation was estimated according to the formula given by Robertson (1959). The standard error of phenotypic correlation was estimated according to the formula given by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The least squares means for first lactation milk yield, 2nd lactation milk yield, 3rd lactation milk yield, 4th lactation milk yield and 5th lactation milk yield are presented in Table-1. The least Squares means for first, 2nd, 3rd, 4th and 5th lactation milk yields were- 1468.61± 40.98 kg, 1549.55 ± 32.07 kg, 1667.01 ± 34.72 kg, 1682.86± 35.40kg and 1601.39± 36.57 kg,

respectively. These estimates are in close agreement with those reported by Banik (2004), Kumar (2007), Kathiravan et al (2009) and Abbas (2011) for Sahiwal cows. These results indicate that highest lactation milk yield in Sahiwal cows at this farm were observed in 4th lactation and showed increasing trend from 1st to 4th lactation and declined thereafter. The difference between 3rd and 4th lactation was not significant.

Table 1. Least squares means for lactation milk yield from first to fifth lactations

Factor	No. of Observations.	Lactation milk yield				
		1st	2 nd	3 rd	4 th	5 th
Overall Mean	927	1468.61± 40.98	1549.55± 2.07	1667.01± 4.72	1682.86± 35.40	1601.39± 36.59
S ₁ (Winter)	340	1468.60± 40.50	1548.45± 42.00	1676.22± 45.46	1707.02± 46.35	1644.50± 47.91
S ₂ (Summer)	209	1414.14 ± 47.32	1525.16 ± 48.99	1592.65 ± 53.03	1588.05 ± 54.07	1507.89 ± 55.89
S ₃ (Rainy)	173	1456.26 ± 48.90	1531.46 ± 50.11	1606.95 ± 54.22	1591.68 ± 55.31	1581.48 ± 57.17
S ₄ (Autumn)	205	1460.63 ± 45.60	1593.11 ± 47.24	1752.21 ± 51.14	1844.70 ± 52.14	1671.66 ± 53.89
P ₁ (1978 – 1982)	107	1348.64 ± 136.49	1488.86 ± 141.31	1275.01 ± 152.97	1397.69 ± 155.96	1157.35 ± 161.21
P ₂ (1983 – 1986)	121	1459.48 ± 106.15	1586.58 ± 109.90	1584.58 ± 118.97	1422.74 ± 121.29	1476.33 ± 125.38
P ₃ (1987 – 1991)	230	1366.06 ± 96.32	1392.38 ± 99.72	1477.61 ± 107.95	1392.96 ± 110.06	1642.77 ± 113.77
P ₄ (1992 – 1995)	150	1505.87 ± 95.40	1453.85 ± 98.77	1558.65 ± 106.00	1636.07 ± 109.00	1767.07 ± 112.67
P ₅ (1996 – 1999)	106	1340.23 ± 84.34	1394.98 ± 87.32	1739.79 ± 94.53	1741.27 ± 96.37	1709.72 ± 99.62
P ₆ (2000 – 2003)	76	1613.97 ± 102.82	1649.71 ± 106.00	1872.11 ± 115.24	1901.52 ± 117.49	1623.79 ± 121.44
P ₇ (2004 – 2007)	137	1515.12 ± 145.70	1880.46 ± 150.85	2090.68 ± 163.29	2287.76 ± 166.48	1832.66 ± 172.08

Effect of period: The period of calving significantly influenced 2nd, 3rd, 4th and 5th lactation milk yields. However, no consistent trend was observed with fluctuations being detected over the period of calving. The fluctuations in these traits could be due to differences in managerial practices followed during different periods of time. The cows calving in 7th period produced highest milk yield during 2nd, 3rd, 4th and 5th lactations but for first

lactation milk yield it was observed in 6th period. The lowest milk yield was observed in first and third period for 1st and 2nd lactations while for 3rd, 4th and 5th lactation it was in 1st period. These estimates showed increase in milk yield in different lactations due to better feeding and management practices at the farm. The present results were in close agreement with the result of Kumar (2007), Kathiravan et al (2009) and Abbas (2011).

Effect of season: The effect of season of calving on 3rd, 4th and 5th lactation milk yields was significant but non-significant on 1st and 2nd lactation milk yields. These estimates are in close agreement with the reports of Mohanty (2001), Kumar (2007), Kathiravan et al (2009) and Abbas (2011).

The cows that calved in different season for 1st lactation had no significant difference in mean values while cows that calved in season-4 (autumn) had significantly higher lactation milk yield during 2nd, 3rd, 4th and 5th lactations in comparison to the cows which calved in the other three seasons. Season-2 (summer) calvers produced lowest milk yield in all lactations. This may be Table 2. Heritability estimates (on the diagonal), genetic correlations (above the diagonal) and phenotypic correlations (below diagonal) among different lactation

	1 st LMY	2 nd LMY	3 rd LMY	4 th LMY	5 th LMY
1 st LMY	<u>0.28 ± 0.09</u>	0.30 ± 0.32	0.297 ± 0.26	0.47 ± 0.20	0.05 ± 0.30
2 nd LMY	0.46	<u>0.11 ± 0.08</u>	0.41 ± 0.35	0.82 ± 0.28	0.13 ± 0.41
3 rd LMY	0.35	0.35	<u>0.21 ± 0.09</u>	0.78 ± 0.18	0.40 ± 0.28
4 th LMY	0.30	0.32	0.36	<u>0.37 ± 0.10</u>	0.19 ± 0.26
5 th LMY	0.23	0.19	0.34	0.41	<u>0.20 ± 0.09</u>

The heritability estimates for 1st to 5th lactation milk yield in the present study ranged from very low to moderate. Since lactation milk yield is a lowly heritable trait, the variation in h² estimates for lactation milk yield was due to environmental factors. Therefore, these traits can be improved through proper management and feeding practices at this farm.

The genetic correlations of first lactation milk yield with 2nd, 3rd and 4th lactation were positive and medium but with 5th lactation milk yield was positive and very low. The genetic correlations of 2nd lactation with 3rd lactation were positive and high but with 5th lactation milk yield was positive and very low. The genetic correlations of 3rd lactation with 4th and 5th lactation were highly positive. The genetic correlation between 4th and 5th lactation milk yield was positive but very low. These findings are in close agreement with those of Mohanty (2001), Banik (2004), Kumar (2007), Kathiravan (2009) and Abbas (2011) in Sahiwal cattle.

The phenotypic correlations of first lactation milk with 2nd, 3rd, 4th and 5th lactation milk yields were positive and medium. The phenotypic correlations of 2nd lactation milk yield with 3rd, 4th and 5th lactation milk yield were positive and medium. The 3rd lactation milk yield had positive and medium phenotypic correlations with 4th and 5th lactation milk yield. The phenotypic correlation between 4th lactation and 5th lactation was observed positive and medium. These results are in close agreement with the reports of Mohanty (2001), Kumar (2007), Kathiravan (2009) and Abbas (2011).

On the basis of this study, it may be suggested that selection based on first lactation milk yield would be expected to improve the milk yield in subsequent lactations, since very little opportunity exists for selection of cows for lifetime traits.

due to the fact that cows calving in autumn season received cultivated and preserved fodder during autumn season, causing higher yield than the cows that calved in other seasons when availability of cultivated and preserved fodder was inadequate.

Heritability: The heritability estimates, genetic and phenotypic correlations among 1st to 5th lactation milk yields are presented in table-2. The heritability estimates for 1st, 2nd, 3rd, 4th and 5th lactation milk yields were 0.28± 0.09, 0.11± 0.08, 0.21± 0.09, 0.37± 0.10 and 0.20± 0.09 respectively. These estimates are in close agreement with the findings of Banik (2004), Kumar (2007), Kathiravan (2009) and Abbas (2001).

REFERENCES

- Abbas Sikandar 2011. A genetic study on first lactation and lifetime traits and evaluation of sires by different methods in Sahiwal cattle. M.V.Sc. Thesis, G.B.P.U.A. & T., Pantnagar, U.S. Nagar, Uttarakhand.
- Banik S. 2004. Sire evaluation in Sahiwal cattle. PhD Thesis, NDRI Deemed University, Karnal.
- Becker WA. 1975. Manual of quantitative genetics. 3rd edition. Pub. Program in Genetics, Washington State University, Washington, USA.
- Harvey WR. 1990. User guide for LSMLMW and MIXMDL package. Mixed model least squares and maximum likelihood computer programme. PC-2 Version. Mimeograph, Columbia, Ohio, USA.
- Kathiravan P, Sachdeva GK, Gandhi RS, Raja TV, Singh PK and Singh AK. 2009. Genetic evaluation of first lactation production and reproduction traits in Sahiwal cattle. *Journal of livestock Biodiversity* 1 (2): 51-55.
- Kumar A. 2007. Genetic evaluation of stayability in Sahiwal cattle. Ph.D Thesis, NDRI, Deemed University, Karnal, India
- Mohanty JS. 2001. Principle component analysis. A multi trait selection criterion in Sahiwal cattle. M.Sc. Thesis, NDRI Deemed University, Karnal.
- Panse VG and Sukhatme PV. 1967. Statistical methods for Agricultural workers, ICAR, Krishi Bhawan, New Delhi.
- Robertson A. 1959. The sampling variance of the genetic correlation coefficient. *Biometrics*. 15 (3) 469-485.
- Swiger LA, Harvey WR, Everson DO and Gregory KE. 1964. The variance of intra-class correlation involving groups with one observation. *Biometrics*. 20: 818.