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Genetic and non genetic factors affecting monthly part lactation milk yields in Sahiwal cattle

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In general, sires are evaluated on the basis of first lactation 305-day or less milk yield of their daughters. This results in enhanced generation interval, lower genetic gain per unit of time and fewer numbers of daughters per sire due to smaller herd size. So that instead of recording complete lactation milk yield, one of the alternative options is to record only monthly part-lactation milk yields. These partial milk yields can be used for predicting the lactation milk yield in cows (Singh 2006). Based on predicted milk yield from part lactation records, the animal can be selected for future breeding.

Data on 476 Sahiwal cows maintained at National Dairy Research Institute, Karnal over a period of 51 years (1961–2011) of first lactation were studied, among which 371 animals completed their 305 days lactation length were used for the further study. The individual monthly part lactation records were calculated by adding daily milk yield at an interval of 30 days. The colostrum yield for the first 5 days after calving was not added to calculate the monthly milk yield, and 10 individual monthly part lactation records were calculated by adding daily milk yield at an interval of 30 days from sixth day to 305-day of calving. The records of animals with less than 300 kg of milk production or less than 100 days of lactation length were discarded. To ensure the normal distribution, the outliers were removed and data within the range of mean ± 2SD were only considered for the present study. For genetic studies, sires having 5 or more daughters were only considered. The non-genetic factors considered for the study were season of calving, period of calving and age at first calving. According to year of calving the total duration of the present study was divided into 13 periods of 4 consecutive years duration except the last period which was of 3 years. Each year was divided into 4 seasons namely winter (Decr- Mar), summer (Apr-June), rainy (July-Sep) and autumn (Oct- Nov).

The influence of various non- genetic factors on different monthly part lactation records was studied by least squares analysis of variance for unequal non-orthogonal data (Harvey 1966). Following statistical model was used:

$$Y_{ijk} = \mu + S_i + P_j + b\,(X_{ijk} - \bar{X}) + e_{ijk}$$

where, Y_{ijk}, first lactation milk yield records of k^{th} cow born in i^{th} season and j^{th} period; μ, overall population mean; S_i, fixed effect of i^{th} season; P_j, fixed effect of j^{th} period; b, regression of first lactation milk yield records on age at first calving; $X_{ijk,}$ continuous independent variable (AFC); $\bar{X}$, arithmetic mean of AFC; and $e_{ijk,}$ random error assumed to be normally and independently distributed with mean zero and constant variance i.e. NID (0, σ^2_e).

For estimation of genetic parameters, data were adjusted for different significant non genetic factors like season, period and age at first calving as a covariable. The heritability, genetic and phenotypic correlations of different monthly part lactation records were estimated by analysis of variance or covariance using half sib data (Becker 1975). The statistical significance of correlation was tested by the 't' test as given by Snedecor and Cochran (1967) at (N-2) degrees of freedom.

The overall least squares averages for different individual monthly milk yields for first 10 months and first lactation 305-day or less milk yield are given in Table 1. It was observed that the average individual monthly milk yield was maximum during second month of lactation and thereafter there was a gradual decline in the milk production over the months. Similar finding were reported by Kumar (1990) and Roy *et al.* (2001) as an increase in monthly yields up to second month during first lactation and thereafter milk yield gradually declined till tenth month in Sahiwal and Holstein Friesian cattle, respectively.

The non-genetic factors included in the least squares model for different individual monthly milk yields were season of calving, period of calving and regression on age at first calving.

The least squares analysis of variance revealed that the period of calving had nonsignificant effect on all the monthly milk yields. In general, the average monthly milk yields were lowest for the period 1977–1980 and were

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Table 1. Least squares analysis of variance (mean squares only) for various monthly milk yields and 305-day or less milk yield in Sahiwal cattle

Traits	Season (3)	Period (12)	AFC (1)	Error (354)
1st month	3387.65	2543.75	8949.24	2825.69
2nd month	32648.07**	2070.56	30917.58**	3290.19
3rd month	33148.13**	2141.69	27428.90**	2900.61
4th month	17480.29**	2260.35	36283.93**	2545.79
5th month	11788.31**	1525.44	25248.08**	2217.50
6th month	4271.25	2068.97	24984.78**	1889.76
7th month	6732.84*	1754.76	9849.72	1837.46
8th month	9316.48**	1637.29	5711.09	1743.11
9th month	13472.41**	1427.77	4700.47	1747.54
10th month	9956.77**	2166.95	5032.62	2563.04
FL305DMY	132872.50	93766.35	1720013.89**	160256.48

*5% significant;**1% significant

highest during the period 1981–84.

Heritability estimates for first to tenth individual monthly milk yields and FL-305 DMY were 0.25 ± 0.15, 0.26 ± 0.15, 0.13 ± 0.14, NE, NE, 0.07 ± 0.13, NE, 0.09 ± 0.13, 0.09 ± 0.13 0.17 ± 0.14 and 0.17 ± 0.14 respectively. The heritability estimates for fourth, fifth, and seventh months were non-estimable and for all other months the estimates were low and statistically nonsignificant with higher standard error.

The heritability estimate was highest for second and third months milk yield. In general, the heritability estimates obtained in the present study were low and not significant having higher standard error. Similar to the present findings the highest heritability estimate for second month milk yield was also reported by Singh *et al.* (1988) and Gaur and Raja (2010) in Sahiwal cattle.

The genetic correlation amongst various monthly part lactation milk yields ranged from 0.43 ± 0.71 1st with 6th to 0.99 ± 0.08 1st with 2nd. Some of the genetic correlations amongst monthly part lactation milk yield records were not estimable. The phenotypic correlations among various monthly part lactation milk yields ranged from 0.36 ± 0.05 3rd with 10th to 0.92 ± 0.02 7th with 8th respectively.

SUMMARY

In the present study, effect of genetic and phenotypic parameters on monthly part lactations milk yield records of first lactation were investigated in Sahiwal cows. Milk yield records (476) of Sahiwal cows maintained at National Dairy Research Institute (NDRI) Karnal over a period of 51 years (1961–2011) were taken and among which 371 animals completed their 305 days lactation length were used for the further study. These cows were daughters of 34 sires having 5 or more progeny per sire. The data were classified according to season and period of calving. The present investigation revealed that the overall least squares population means of FL305DMY was 2189.16 ± 47.60 kg. The overall least squares averages for different individual monthly part lactation milk yields from 1st to 10th months were 201.36 ± 6.96, 257.63 ± 7.55, 250.63 ± 6.03, 247.40 ± 4.49, 234.47 ± 4.19, 222.38 ± 4.42, 204.96 ± 3.82, 202.55 ± 4.42, 188.88 ± 4.42 and 156.71 ± 6.04 kg, respectively. It was revealed that period had no significant effect on FL305-DMY and monthly part lactation milk yield records, while season had highly significant effect on most of the monthly part lactation milk yields. The heritability estimate of individual monthly milk yields ranged from 0.07 ± 0.13 (6th) to 0.25 ± 0.15 (1st) and that of FL-305 DMY was 0.17 ± 0.14. The genetic and phenotypic correlations of various monthly part lactation milk yields with FL305DMY were positive, higher and statistically highly significant in Sahiwal cows.

REFERENCES

Becker W A. 1975. *Manual of Quantitative Genetics*. 3rd edn. Publication Program in Genetics, Washington State University, Washington, USA.

Gaur G K and Raheja K L. 1996. Genetic evaluation of Sahiwal sires based on milk yield of their daughters at earliest stage of lactation. *Indian Journal of Veterinary Research* **5**: 7–13.

Harvey W R. 1966. *Least Squares Analysis of Data with Unequal Sub-Class Numbers*. Agricultural Research Services, United State Department of Agriculture, USA.

Kathiravan P, Sachdeva G K, Gandhi R S, Raja T V, Singh P K and Singh A. 2009. Genetic evaluation of first lactation and reproduction traits in Sahiwal cattle. *Journal of Livestock Biodiversity* **1**: 51–55.

Kumar S. 1990. 'Genetic studies on part lactations for sire evaluation in Sahiwal cattle.' M. Sc. Thesis, NDRI, (Deemed University), Karnal, India.

Monalisa D, Gandhi R S, Raja T V, Avtar Singh and Sachdeva G K. 2010. Influence of certain non-genetic factors on test day milk records in Sahiwal cattle. *Indian Journal of. Dairy Science* **63:** 504–06.

Raja T V. 2010. 'Part lactation records for Sahiwal sire evaluation.' Ph.D. Thesis, NDRI, Karnal, India.

Roy T C, Mahanta P K, Deka D, and Das B. 2001. Effects of season, period and age at first calving on the part lactation milk yields in Holstein-Friesian cattle of Meghalaya. *Indian Journal of Animal Health* **40**: 163–67.

Singh M, Chaudhary R P, Singh R V and Singh C V. 1988. A genetic study of part lactation production on Sahiwal cows. *Indian Journal of Animal Sciences* **58:** 860–61.

Singh S. 2006. 'Genetic evaluation of Karan Fries sires on the basis of part lactation milk yields.' M. Sc. Thesis, NDRI, (Deemed University), Karnal, India.

Snedecor G W and Cochran W G. 1967. *Statistical Methods*. Oxford & IBH Publ. Co., New Delhi, India.