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HERITABILITY ESTIMATES OF SOME MEASURES OF MILK PRODUCTION IN SAHIWAL CATTLE

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Data on 918 Sahiwal cows, the progeny of 35 sires, were used to estimate heritabilities of some measures of milk yield by the method of paternal half-sib correlation. The first lactation 305-day milk yield (FLMY), milk yield per day of first calving interval (MYFCI) and milk yield per day of age at second calving (MYASC) averaged 1603.29 ± 12.32, 3.87 ± 0.04 and 1.01 ± 0.01 kg, respectively. Heritability estimates for FLMY, MYFCI and MYASC were 0.11 ± 0.07, -0.01 ± 0.04 and 0.10 ± 0.07, respectively. These estimates indicated that FLMY is a better indicator of cow's transmitting ability than MYFCI or MYASC and be preferably used in the selection of young cows.

INTRODUCTION

The young dairy cows are usually selected on the basis of their first lactation 305-day milk yield with a little attention to traits such as age at first calving and calving interval. A combination of two or more of these traits could be used as a criterion in selecting cows to improve milk production if the estimates of heritability for the combined parameters are higher than lactation milk yield alone. The milk yield per day of first calving interval combines the first lactation milk yield and the first calving interval, whereas milk yield per day of age at second calving reflects the three parameters jointly. The estimates of heritability for milk yield per day of first calving interval and milk yield per day of age at second calving were 0.28 ± 0.02 and 0.37 ± 0.02, respectively in Holstein Friesian x Sahiwal crossbreds (Deshpande and Bonde, 1981). These estimates warranted effective use of milk yield per day of first calving interval and milk yield per day of age at second calving in selection of young cows and in estimating genetic improvement in milk yield. The present study was aimed at estimating the heritability of these three parameters, namely first lactation 305-day milk yield, milk yield per day of first calving interval and milk yield per day of age at second calving in a purebred herd of Sahiwal cattle. The estimates would be helpful in ascertaining the best criterion of selecting young cows for simultaneous genetic improvement in milk yield and reproductive traits.

MATERIALS AND METHODS

Data on pedigree and lactation records of 918 Sahiwal cows, the progeny of 35 sires, maintained at the Livestock Production Research Institute, Bahadurnagar, Okara, from 1964 to 1986 were used for the

estimation of heritability of first lactation 305–day milk yield (FLMY), milk yield per day of first calving interval (MYFCI) and milk yield per day of age at second calving (MYASC). The normal and complete records of the cows were only included in the analyses. First lactation records of less than 800 kg milk yield or 180 days of lactation length were excluded from the study. Sires having less than 5 daughters were also excluded from the analyses. The records on the three measures were deviated from the respective year–season means to remove the possible effects of these factors.

The paternal half–sib analysis was carried out according to the computational procedures described by Becker (1984). The standard errors of heritability estimates were calculated according to the formula developed by Swiger *et al.* (1964).

RESULTS AND DISCUSSION

The mean values of various measures of milk production computed from the data on Sahiwal cows have been summarised in Table 1. The heritability estimates of each measure have been described in the following paragraphs:

First lactation 305–day milk yield: The first lactation 305–day milk yield based on 918 records averaged 1603.29 ± 12.32 kg with a coefficient of variation of 23.28%. The heritability estimate calculated from 847 half–sibs was 0.11 ± 0.07 (Table 2).

Although the heritability estimate for FLMY was low, yet it was in close agreement with those reported by Prasad and Prasad (1972) who reported the heritability estimates ranging from 0.05 to 0.12 for the trait under study in different breeds of dairy cattle. However, several other workers have reported moderate to very high estimates of heritability in various breeds of dairy cattle for first lactation milk yield. The heritability estimates ranging from 0.2 to 0.3 have been reported by Shah and Zafar (1986) in

Table 1. Mean values of various measures of milk production

Measures of milk production	No. of records	Mean ± S.E.	Range	C.V. (%)
First lactation 305–day milk yield (kg)	918	1603.29 ± 12.32	801 – 3318	23.28
Milk yield/day of first calving interval (kg)	872	3.87 ± 0.04	1.24 – 8.51	27.32
Milk yield/day of age at second calving (kg)	872	1.01 ± 0.01	0.38 – 2.22	27.22

Table 2. Analysis of variance of first lactation 305–day milk yield, milk yield per day of first calving interval and milk yield per day of age at second calving for heritability estimation

Measures of milk yield	Sources of variation	d.f.	Mean squares	Expected mean squares
1. First lactation 305–day milk yield (kg)	Between sires	34	215107.80	$\sigma^2_W + 23.50\,\sigma^2_S$
	Within sires	812	130057.50	σ^2_W
2. Milk yield per day of first calving interval (kg)	Between sires	33	0.8983	$\sigma^2_W + 22.98\,\sigma^2_S$
	Within sires	773	0.9288	σ^2_W
3. Milk yield per day of age at second calving (kg)	Between sires	33	0.0924	$\sigma^2_W + 22.98\,\sigma^2_S$
	Within sires	773	0.0573	σ^2_W

Sahiwal breed of cattle.

Chand and Narain (1984) reported heritability estimate of 0.42 ± 0.27 based on the data of 198 cows. Khanna and Bhat (1971 reported the heritability of FLMY as 0.51 ± 0.21 in Sahiwal cattle from the data of 400 cows which was the highest estimate for FLMY in this breed as observed from the available literature. A low heritability estimate for FLMY in the herd under refernece indicates that larger proportion of the phenotypic variation is due to environment and the progress through selection with in the herd will be slow. This estimate also suggests that there is a great scope for improving productivity through better feeding and management.

Milk yield per day of first calving interval: The MYFCI based on 872 records averaged 3.87 ± 0.04 kg (Table 1). The data on 807 half–sibs from 34 sires were available for the estimation of heritability calculated by paternal half–sib correlation technique.

The heritability estimate, not different from zero as obtained in the present study, was similar to that reported by Hingane (1982) by the method of paternal half–sib correlation from the data of 1142 Hariana cows kept at a Government Livestock Farm in India. However, he reported a moderate estimate of heritability (0.39) from the data of a progeny testing programme for this breed.

The lowest heritability estimates as obtained in the present study indicated that expression of milk yield per day of first calving interval is not a good indicator of genetic variability and hence can not be effectively utilized in the selection programmes.

Milk yield per day of age at second calving: The MYASC averaged 1.01 ± 0.01 kg with a coefficient of variation of 27.22% (Table 1). The analysis of data of 807 half–sibs of 34 sires gave the heritability of MYASC as 0.10 ± 0.07 (TAble 2). The heritability estimate for this trait was much lower than the estimate reported by Deshpande and Bonde (1983) who analysed the data on first lactation milk yield of 1346 Holstein x Sahiwal cows of 8 grades from < 1/8 to 7/8–Holstein Friesian inheritance and reported heritability of milk yield per day of age at second calving as 0.37 ± 0.22.

The heritability estimate for milk yield expressed as milk yield per day of age at second calving is not different from that reported for first lactation milk yield, hence the effectiveness of selection based on milk yield per day of age at second calving will not be different from selection based on first lactation milk yield only.

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