

Expected genetic gain in total lactation milk yield under single and multiple record selection in Sahiwal cows

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Sahiwal is a prestigious Indian dairy breed, well known for its high milk producing ability under harsh climatic conditions and capable of tick resistance and heat tolerance. Due to its unique character and also decline in its number from 4 000 in 1992 (Singh 1996) to 3 000 in 1994 (Nivsarkar et al. 2000), it needs conservation and improvement as a pure breed. It is one of the milch breeds chosen for upgrading of local non-descript cattle because of its high genetic merit. The present study was undertaken to find out the optimum number of lactation records to be considered for selection of Sahiwal cows to maximize the genetic gain.

Lactation records (756) of 412 Sahiwal cows, maintained in 2 organized herds from Chhattisgarh state of India, generated from 1992 to 2008 were analyzed for the present study. Care and management of the cows during the period under study were almost similar.

The heritability of lactation yield on the basis of first to third parity separately as well as average of first 2 and first 3 lactation records was estimated by paternal halfsib correlation method as per Henderson's method-3 (Henderson 1953) using computer programme developed by Harvet (1990). Only those sires having at least 3 progenies were included for the estimation of heritability.

Expected genetic gain per generation and per year, on the basis of single and multiple records, were calculated as per Falconer (1981).

$DG = h^2 \times i \times sp$.

where, DG, Expected genetic gain; h^2 , heritability; i , intensity of selection; and sp , phenotypic standard deviation. For estimation of annual genetic gain per year the above mentioned formula was divided by the generation interval.

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The value of intensity of selection (i) was taken as 0.5 assuming 70% of total cows to be retained. Generation interval (GI) on the basis of first lactation records was taken as average age of cows at second calving. Similarly GI on the basis of second lactation records and on the basis of third lactation records was calculated as average age at third calving and average age at fourth calving respectively.

Heritability estimates of total lactation yield for first, second and third lactation separately, were 0.539 ± 0.22 , 0.336 ± 0.22 and 0.323 ± 0.27 , respectively. Heritability for total lactation yield was also estimated taking average of first 2 and first 3 lactation yields and accordingly, the estimates were 0.373 ± 0.25 and 0.625 ± 0.39 . Sethi *et al.* (2001) also reported heritability as 0.38 in Sahiwal cows for first lactation yield while Gandhi and Gurnani (1995) reported the heritability for second and third lactation milk yield as 0.22 and 0.27 respectively. Heritability for first 3 lactations was 0.66 as reported by Sethi *et al.* (2001). Thus, the findings of heritability estimates are in the range of earlier reports by different workers. Medium heritability estimates observed in the present study are indicative of existence of fairly good amount of additive genetic variance in Sahiwal herds maintained in Chhattisgarh. It was also observed that heritability estimate was more in average of first three records rather than average of first 2 records.

Table 1. Expected genetic gain per generation and per year based on polled (Farm-1 and Farm -2) data assuming 70% of animals to be retained i.e. $i = 0.50$

Criteria for selection	Generation interval (year)	Phenotypic standard deviation (σ_p) (kg)	Genetic gain per generation (kg)	Genetic gain per year (kg)
After first lactation	4.97	371.31	100.06	20.17
After second lactation	6.27	385.80	71.95	11.60
After third lactation	7.5	391.90	122.46	16.33

The phenotypic standard deviation for total lactation yield for first lactation, average of first 2 lactation records and average of first 3 lactation records were 371.31 kg, 385.80 kg and 391.90 kg, respectively, whereas corresponding values for generation interval (GI) were 4.97 years, 6.27 years and 7.50 years respectively (Table 1). Expected genetic gain per generation after taking first, first two and first three lactations were 100.06 kg, 71.95 kg and 122.46 kg, respectively, while corresponding values for annual genetic gain were 20.17 kg, 11.60 kg and 16.33 kg respectively (Table 1). The values were in close agreement with Singh (1996) in Sahiwal cow. Comparatively higher values were obtained by Chhikara *et al.* (1989) for second and third lactation in Sahiwal cows. However, genetic gain obtained in this study was higher than the reports of Pundir and Raheja (1995). The genetic gain per generation was increased (Table 1) from first lactation to third lactation but annual genetic gain decreased. The reason is that generation interval increased along parity. From the result it may be concluded that selection based on first lactation records will yield more annual genetic gain than selection based on multiple records.

SUMMARY

Lactation records (756) of 246 Sahiwal cows, maintained in 2 organized farms located in Chhattisgarh state were analysed to estimate the expected genetic gain in single and multiple lactation milk yields assuming 70% cows were retained. The estimates of heritability for first, second and third lactations were 0.539 ± 0.22 , 0.336 ± 0.22 and 0.323 ± 0.27 respectively, while heritability estimates for average of first 2 and first 3 lactations were, 0.373 ± 0.25 and 0.625 ± 0.39 respectively. The expected genetic gain per generation, taking first lactation, average of first 2 lactations and average of first 3 lactation records, were 100.06 kg, 71.95 kg and

122.46 kg, respectively, while the corresponding annual genetic gains were 20.17 kg, 11.60 kg and 16.33 kg, respectively. Thus, it was concluded that selection based on first lactation record will bring more annual genetic gain than selection based on multiple records.

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