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Cumulative milk yield for genetic evaluation of Surti sires

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The complete records, essential for systematic evaluation of bulls, generally are not available due to transfer of animals from herds, selling and death of animals. However, part records may be useful to evaluate sires, if relationship between sires breeding value for first lactation milk and part yields is high. Very little information is available to evaluate sires on part yields. Therefore, the present study was undertaken to evaluate the sires on cumulative milk yield and also to estimate the genetic parameters.

First lactation records (1976–2004) of 554 farm bred, Surti buffaloes, sired by 51 bulls maintained at Net-work Project on Buffaloes, Livestock Research Station, Vallabhnagar, Udaipur (Rajasthan) were utilized. The first lactation milk yield up to 5 month was portioned into 4 groups of cumulative part yield of first 60, 90, 120 and 150 days. The first lactation milk yield: Total (TMY) and 305 days or less (305 FLMY) was also used for the study.

The genetic parameters were estimated by mixed model least-squares and maximum likelihood computer programme PC-1 designed by Harvey (1987). The year and season of calving (fixed effect) and sire (random effect) were considered as the factors affecting part lactation milk yield. Heritability and genetic correlations were computed through paternal half-sib correlation method while the standard error of these parameters was computed after Swiger *et al.* (1964) and Robertson (1959) respectively. The phenotypic correlations were calculated using conventional statistical procedure (Snedecor and Cochran 1966).

The breeding values of sires for part lactation records and 305FLMY were estimated by Regressed least-squares method (RLS). The product moment and rank correlation among sires breeding value of part lactation and complete lactation were calculated according to Steel and Torrie (1980).

Very little variation exists in cumulative milk yield as indicated from coefficient of variation, which ranged from 21.80 to 23.05%. The cumulative monthly milk yield was significantly affected by period and season of calving. The variations with respect of sire was significant on cumulative milk yield from CMY_{60} to CMY_{150}. The heritability estimates for cumulative milk yield from CMY_{60} to CMY_{150} were significantly high and varied within a narrow range (Table 2).

Although the milk yield up to 5 months was taken in the present study but the heritability estimates showed increasing trends from after CMY_{60} to CMY_{120} and thereafter declined slightly indicating that earlier months have more additive genetic variance than later months of lactation. Evidently, the later month of lactation was influenced more by temporary environment and stage of subsequent pregnancy might have also influenced this part of lactation.

The heritability estimates of all the segments of cumulative monthly milk yields were slightly higher as compared to first

Table 1. Mean, standard deviation, standard error and coefficient of variation of cumulative monthly milk yield

Traits	Means (kg)	SD	SE	C V (%)
CMY_{60}	314.89	68.63	2.92	21.80
CMY_{90}	477.95	106.87	4.54	22.36
CMY_{120}	607.36	137.67	5.85	22.67
CMY_{150}	717.50	165.40	7.03	23.05

Table 2. Estimates of heritability (diagonal) phenotypic (above diagonal) and genetic correlations (below diagonal) among cumulative milk yield

Traits	CMY_{60}	CMY_{90}	CMY_{120}	CMY_{150}
CMY_{60}	0.526 ±0.154	0.942 ±0.014**	0.860 ±0.022**	0.792 ±0.025**
CMY_{90}	0.994 ±0.010	0.548 ±0.156	0.959 ±0.012**	0.903 ±0.018**
CMY_{120}	0.986 ±0.024	0.996 ±0.007	0.585 ±0.160	0.979 ±0.008**
CMY_{150}	0.946 ±0.044	0.972 ±0.021	0.990 ±0.006	0.555 ±0.157

** P<0.01.

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Table 3. Estimates of genetic (r_g) and phenotypic correlations (r_p) of cumulative monthly milk yield with first lactation milk yield

Cumulative milk yield	First lactation milk yield			
	TMY		305 FLMY	
	r_g	r_p	r_g	r_p
CMY_{60}	0.628 ±0.16	0.483 ±0.037**	0.717 ±0.14	0.544 ±0.036**
CMY_{90}	0.736 ±0.12	0.573 ±0.035**	0.813 ±0.11	0.642 ±0.033**
CMY_{120}	0.786 ±0.10	0.667 ±0.032**	0.860 ±0.08	0.736 ±0.028**
CMY_{150}	0.843 ±0.08	0.741 ±0.028**	0.909 ±0.06	0.808 ±0.025**

** ($P < 0.01$).

lactation milk yield (0.509±0.152) and 305 days FLMY (0.412±0.140). This indicated that additive genetic variability in cumulative monthly milk yields was high enough or almost equal to first lactation milk yield, to warrant selection of the animals based on any segments of cumulative monthly milk yield of first lactation, would be expected to be as effective as selection on the basis of first lactation milk yield (TMY and 305FLMY).

The genetic and phenotypic association among all the segments of cumulative milk yield were positive and high, indicating poleotropic effect of genes. All the genetic and phenotypic correlations of TMY and 305FLMY with cumulative milk yield were also positive, and significantly high (P<0.01) (Table 3). The genetic and phenotypic correlation coefficients of TMY and 305 FLMY with cumulative milk yield were found to increase gradually from CMY60 to CMY150. High genetic association of cumulative milk yield and TMY and 305 FLMY indicates that genes influencing the cumulative milk yields of these months and TMY and 305 FLMY were same. The results also indicated that cumulative milk yield would be expected to be as effective as selection on the basis of TMY and 305FLMY.

The relative efficiency of selection on the basis of cumulative yield upto 60, 90, 120 and 150 days of first lactation were 0.638, 0.763, 0.843 and 0.880 over TMY and 0.809, 0.937, 1.025 and 1.054 over 305FLMY respectively. For early and effective selection, the cumulative milk yield upto 60 and 90 days would be as accurate as selection on the basis of first lactation milk yield i.e. TMY and 305 FLMY.

The average breeding value estimated by regressed least-squares method was 1161.43 kg. All 15 sires (29.4%) had breeding value more than average breeding value, while 36 sires (70.6%) were below the average breeding value. The sire No. 34 stood first having breeding value of 1750.91 kg which was 50.75% higher than overall average breeding value. On the other hand, sire No. 9 ranked at lowest place, which had breeding value 39.93% lower than the average breeding value. The differences of highest and lowest breeding value were 1053.2 kg. The number of sires having breeding value 20, 15, 10 and 5% above overall breeding value was 7 (13.73%), 2 (3.92%), 3 (5.88%) and 3 (5.88%) respectively. The product moment correlation coefficients between breeding value of sires for 305FLMY and part lactation milk yield (CMY_{60} and CMY_{90}) were 0.627 and 0.607 respectively. The corresponding rank correlations were 0.881 and 0.913.

The rank correlations between estimated breeding value based on 305 FLMY and part lactation milk yield (CMY_{60} and CMY_{90}) were less than one. This indicated that ranking would change and therefore, to bring genetic improvement, sire should be evaluated for first lactation milk yield of their daughters. The major objection for evaluation of sires, based on first lactation milk yield, has increased generation interval and thereby slowing down genetic progress. Sire evaluation is generally aimed at selecting first few top ranking sires. From the results, it is concluded that initial selection of sires may be done on the basis either of part lactation milk yields (CMY_{60} and CMY_{90}) and finally on the basis of first lactation milk yield where complete records are available.

SUMMARY

The coefficient of variation of cumulative milk yield ranged from 21.80 to 23.05%. The heritability estimates for cumulative milk yield from CMY_{60} to CMY_{150} were high, significant and varied within a narrow range. The genetic and phenotypic associations among all the segments of cumulative milk yield were positive and high. All the genetic and phenotypic correlations of TMY and 305FLMY with all segments of cumulative milk yields were also positive and highly significant. The product moment correlation coefficient between breeding value of sires for 305FLMY and cumulative milk yield CMY_{60} and CMY_{90} were 0.627 and 0.607 respectively. The results of rank and product moment correlation coefficients indicated that initial selection of sires may be done on the basis of either CMY_{60} and CMY_{90} and finally on the basis of first lactation milk yield, where complete records are available.

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