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Short Communication

ACCURACY OF GENETIC PREDICTION OF BREEDING VALUE OF LACTATION PRODUCTION OF LIFETIME PERFORMANCE TRAITS FROM EARLY PERFORMANCE TRAITS IN MURRAH BUFFALOES

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ABSTRACT

Data records on early lactation traits in 171 buffaloes sired by 47 sires maintained at Buffalo Research Centre, LUVAS, Hisar were utilised for prediction of breeding values for life time traits. The prediction of genetic value of life time milk yield (LTMY), production life (PL), milk yield per day of productive life (MY/PL), herd life (HL) and milk yield per day of herd life (MY/HL) were obtained. Accuracy of direct selection for LTMY, PL, MY/PL, HL and MY/HL was 0.42, 0.51, 0.33, 0.51 and 0.54, respectively. The index involving independent variables of first lactation early performance traits had an accuracy of 0.40, 0.39, 0.37, 0.19 and 0.37 for LTMY, PL, MY/PL, HL and MY/HL, respectively with a corresponding genetic gain of 561.66 kg, 56.44 days, 0.14 kg/day, 74.54 days and 0.08 kg/day. There is an increase in accuracy of direct selection as compared to accuracy through indirect selection which would be based on earlier records instead of large increment in the generation interval.

Key words: Accuracy, early performance, genetic prediction, lifetime performance, Murrah buffalo

India with 108.70 million buffalo population (BAHS, 2014) has the largest buffalo population in the world, out of which 20% is Murrah breed. The overall productivity of dairy animals depends on their lifetime performance rather than on a single lactation performance. Lifetime performance of the dairy cattle determines the profitability of dairy enterprise. Although lactation records are widely used in assessing the genetic merit of buffaloes but selection of dairy sires is invariably based on the first one or two lactation records in most of the breeding programmes (Kuralkar and Raheja, 1997). It may not be beneficial to select animals for lifetime traits directly as they are expressed later in life leading to increased generation interval. An early genetic prediction of breeding value of lifetime traits based on the values of early performance traits would reduce the generation interval and hence increase the genetic gain per unit of time. The present study was undertaken for the estimation of accuracy and genetic gain for lifetime performance. Only those lactation traits which had high genetic correlations (MY and PY) with lifetime traits were considered for the construction of selection indices and estimation of genetic gain. Genetic improvement of life-time production and longevity by direct or indirect selection requires estimates of genetic parameters of these traits and their relationships with early lactation traits and the knowledge of relationships between lifetime performance traits and early lactation traits is important for prediction of expected correlated response to selection (Jairath *et al*., 1994).

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Data records on early lactation traits in 171 buffaloes sired by 47 sires maintained at Buffalo Research Centre, LUVAS, Hisar were utilised for prediction of breeding values for life time traits. Selection indices were constructed for the estimation of accuracy and genetic gain for lifetime traits. These included life time milk yield (LTMY), production life (PL), milk yield per day of productive life (MY/PL), herd life (HL) and milk yield per day of herd life (MY/HL). Early performance traits considered for index were first lactation milk yield (kg), first peak milk yield (kg/day), first lactation milk yield per day of lactation length (kg/day), first service period (days) and first calving interval (days) (Hazel and Lush, 1943).

Early lactation performance traits were used for genetic prediction of lifetime performance traits using selection index procedure:

$$I=b_1X_1+b_2X_2 + \cdots + b_nX_n,\ b=P^{-1}\,Cov_g,\ r_{IH} = \sigma_I/\sigma_H$$

Where, b, P, $r_{IH,}$ H, σ_I, σ_H and Gcov are index weights, phenotypic covariance matrix between lactation records, accuracy of genetic prediction, breeding value of lifetime performance traits, phenotypic standard deviation of index, genetic standard deviation of lifetime performance, genetic variance and covariance of lactation traits with lifetime traits with lifetime traits and relative net economic values of the traits, respectively.

Table 1
Accuracy of selection and genetic gain from selection using indexes

Dependent variable	Traits in index	Accuracy of selection (rIH)	Genetic gain (ΔG)
LTMY	$\hat{Y}$ =4.35(FSP)+0.37(FCI)-0.70(FLMY)+502.11(FPY)-205.57(FLMY/FLL)	0.40	561.66
PL	=0.911(FSP)-0.32(FCI)+0.04(FLMY)-0.13(FLMY-305)+30.09(FPY)+17.97(FLMY/FLL)	0.39	56.44
MY/PL	= 0.0006(FSP)-0.0001(FCI)-0.0002(FLMY)+0.12(FPY)-0.05(FLMY/FLL)	0.37	0.14
HL	=0.36(FSP)-0.64(FCI)+0.34(FLMY)+)67.87(FPY)-36.47(FLMY/FLL	0.19	74.54
MY/HL	=0.0010(FSP)-0.0002(FCI)+0.0000(FLMY)+0.059(FPY)-0.34(FLMY/FLL)	0.37	0.08

LTMY=lifetime milk yield; PL=productive life; MY/PL=milk yield per day of productive life; HL=herd life; MY/HL=milk yield per day of herd life

Accuracy of direct selection for LTMY was 0.42. The index involving independent variables of first lactation early performance traits viz. FLMY, FPY, FLMY/FLL, FSP and FCI had an accuracy of 0.40 with corresponding genetic gain of 561.66 kg of LTMY (Table 1). In contrary, lower value of genetic gain was reported by Singh *et al.* (2013) in Hariana cows. Accuracy of direct selection for PL was 0.51. The index involving independent variables of first lactation early performance traits viz. FLMY, FPY, FLMY/FLL, FSP and FCI had an accuracy of 0.39 with corresponding genetic gain of 56.44 days in PL. Besides, slightly lower value was obtained by Singh *et al.* (2013) in Hariana cattle. Although, there are significant reports of accuracy of phenotypic prediction of lifetime performance traits from early performance traits in literature reported by many workers (Pander *et al.*, 2001; Sharma *et al.,* 1996) in Murrah buffaloes yet there is scarce report for study of accuracy of genetic prediction of lifetime traits in Indian buffaloes. Accuracy of direct selection for MY/PL was 0.33 (Table 1). The index involving independent variables of first lactation early performance traits viz. FLMY, FPY, FLMY/FLL, FSP and FCI had an accuracy of 0.37 with corresponding genetic gain of 0.14 kg/day for MY/PL. Besides, slightly lower value was obtained by Singh *et al.* (2013) in Hariana cattle. Similarly, accuracy of direct selection for HL was 0.51. While the index involving independent variables of first lactation early performance traits viz. FLMY, FPY, FLMY/FLL, FSP and FCI had an accuracy of 0.19 with corresponding genetic gain of 74.54 days.

Accuracy of direct selection for MY/HL was 0.54. The index involving independent variables of first lactation early performance traits viz. FLMY, FPY, FLMY/FLL, FSP and FCI had an accuracy of 0.37 with corresponding genetic gain of 0.08 kg/day for MY/HL. Singh *et al.* (2013) recorded lower values for accuracy of selection and predicted genetic gain in their studies on Hariana cattle. Considering estimates of heritabilities of FLMY (0.39±0.14) and FPY (0.37±0.13) and longer generation period encountered for selection of lifetime traits, it is advisable to put some emphasis on longevity and lifetime traits in selection of dams of young bulls through indirect selection based on earlier records. Also, it is further recommended to conduct studies on genetic prediction of lifetime performance traits from early performance traits based on larger set of data to derive any meaningful conclusion.

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