



Use of restricted selection index for genetic improvement of buffaloes

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The importance of Murrah among the Indian breeds is clearly evident from the fact that this breed has been used an improver breed for upgrading low milk producing breeds throughout the country as well as other countries of world. Selection is the only tool available for bringing about genetic improvement in this breed. Profitability from dairy animals is a combination of many traits, viz. bodyweight, age at first calving, calving intervals, breeding efficiency, milk production, number of calves produce etc. But multi-trait selection may lead to increase cost of production by delayed maturity and return of income. Therefore, restrictions can be imposed on AFC, WFC and FCI so that the return in terms of milk starts earlier. Chakravarty *et al.* (1988) while studying the complete restricted index selection for the genetic improvement of Indian buffaloes reported that restriction on age at first calving and first service period was most efficient for improving first lactation milk yield.

Therefore, efforts were made to put complete restriction on AFC and WFC in an index and AFC, WFC and FCI in second index with an idea that these 3 traits are economically highly important for estimation of profit for buffaloes.

Records on 1753 buffaloes belonging to 3 genetic groups i.e. Murrah, Graded Murrah and Nili Ravi from 6 military dairy farms located in north India were used for the study. All the animals were maintained under standardised managemental conditions. Variables considered for each buffalo were first lactation traits like AFC (age at first calving in months), WFC (weight at first calving in kg), FLP (first lactation period in days), FCI (first calving interval in days), FLMY (first lactation milk yield in kg), AFLMY (average milk yield per day of first calving interval in kg), PFL (profit in first lactation in ₹) and APFL (average profit per day of first calving interval in ₹).

In order to obtain adequate data sets for statistical analysis, records used in the study were edited as follows:

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Buffalo producing milk for more than 150 days and that, they dried under normal physiological condition were included. Abortions and other pathological causes which affected the first lactation data were not included in the study. The profit characters (PFL and APFL) were calculated as per Kumar *et al.* (2006). The restricted selection index introduced by Kempthorne and Nordskog (1959) was used in the present study to construct the index.

In order to know the most suitable and efficient selection index following criteria's were used:

- The change in aggregate genetic economic gain (ΔH)

$$= \sum A \Delta P_i$$
- Accuracy of selection (r_{TI}) = $\sigma T I / (\sigma T \sigma I)$
- Heritability estimate of index (h^2_I) = $s^2 g / s^2 P = [(b/G b) / (b/P b)]$

where, ΔP_i = expected genetic gain in i^{th} trait due to unit change in index in standard deviation form = $(\sum b_i G_{ij} \sigma I) I$; A, relative economic value of the i^{th} trait included in the index, which was taken as 1.00; b_i = column vector of coefficient of index; G_{ij} , genetic value of the i^{th} trait; σT , standard deviation of the index, $\sqrt{(b/P b)}$; I, intensity of selection (0.497 if 70% of buffaloes to be retained for further breeding in each generation; $\sigma T I$, covariance between index and aggregate genotypic value; σI , standard deviation of aggregate genotypic value = $\sqrt{(b/G b)}$.

Least square means of age at first calving (months) 41.12 ± 0.35 , WFC (kg) 483.588 ± 2.962 , FLP (days) 302.75 ± 2.66 , FCI (day) 471.99 ± 5.74 , FLMY (kg) 1818.4 ± 21.26 , average milk yield per day of first calving interval (kg) 3.95 ± 0.07 , PFL (₹) 1992.02 ± 370.79 , average profit per day of first calving interval (₹) 5.43 ± 0.08 used for selection index in the herd. A total of 2 restricted selection indices were constructed using complete restriction on AFC and WFC in first and AFC, WFC and FCI in second index. Selection indices along with index coefficients (b_i) and expected genetic gain in individual trait in buffaloes are presented in Table 1. The results indicated that expected genetic gain for the traits under restriction were very small ranging from -0.138×10^{-6} to -0.423×10^{-6} in first index and -0.183×10^{-4} to -0.712×10^{-5} in the second index. But the

Table 1. Restricted selection index coefficients along with accuracy, heritability and expected genetic gain in aggregate genotype

Traits	I ₁ (restriction on AFC, WFC)	I ₂ (restriction on AFC, WFC, FCI)
Accuracy of selection	0.151	0.088
Heritability	0.036	0.013
Expected aggregate genetic gain (₹)	89.760	51.57
Index coefficients (b)		
AFC	1.799	4.400
WFC	0.219	0.687
FLP	0.043	0.261
FCI	-2.155	-2.187
FLMY	0.770	0.537
AFLMY	137.510	4.214
PFL	0.012	0.001
APFL	-269.270	-182.583
Dummy (AFC constant)	-44.504	362.698
Dummy (WFC constant)	2.988	-40.475
Dummy (FCI constant)	—	-78.798
Expected genetic gain on the trait		
AFC	-0.138×10 ⁻⁶	-0.283×10 ⁻⁵
WFC	-0.423×10 ⁻⁶	-0.712×10 ⁻⁵
FLP	-0.348	-0.049
FCI	-1.516	-0.183×10 ⁻⁴
FLMY	9.866	1.479
AFLMY	0.026	-0.131×10 ⁻³
PFL	169.523	102.342
APFL	0.037	-0.004

genetic gain in first lactation milk yield (9.866 kg) greatly reduced as compared to standard selection index incorporating all these characters (433.67 kg in I₂₃). First restricted selection index was better over second (r_{TI} 0.151 vs 0.088). Our findings are not similar to the findings Tailor *et al.* (2000) in Surti buffaloes.

The expected aggregate genetic gain was more (₹ 89.76) by first restricted selection index than that of second index (₹ 51.57). The accuracy of selection (r_{TI} = 0.151) heritability were also for use of first index. The present finding did not agree with result of Chakravarty *et al.* (1988) who has suggested that restriction of age and first service period is most efficient for improvement in FLMY, whereas it was in agreement with the results of Ghajbhiya and Tripathi (1991)

who reported that in 412 Murrah buffaloes maintained at NDRI, Karnal, greatest reduction occurred in aggregate genetic gain when restriction was imposed on highly heritable and economically important traits, such as age at first calving. They recommended a restricted selection index combining age at first calving, first lactation length, first dry period first service period and milk yield per day of first calving interval to keep first lactation length constant.

SUMMARY

Records on 1753 buffaloes belonging to 3 genetic groups i.e. Murrah, graded Murrah and Nili Ravi from 6 military dairy farms of north India were used for the present study. Based on expected genetic economic gain it was concluded that the selection index for buffaloes could be -117.64 AFC + 3.21 WFC + 26.60 FLP + 118.50 FCI - 4.88 FLMY - 26180.0 AFLMY + 0.066 PFL + 31782.0 APFL instead of the restricted index of 1.799AFC + 0.219 WFC + 0.043 FLP - 2.155 FCI + 0.77FLMY + 137.51 AFLMY + 0.012 PFL - 269.27 APFL. On the basis of restricted selection index it was suggested that restriction should not be imposed on age and weight at first calving while selecting buffaloes for aggregate genetic gain per generation.

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