USE OF TEST DAY YIELDS FOR GENETIC EVALUATION OF SIRES IN HARIANA CATTLE

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INTRODUCTION

An early and accurate appraisal is essential for the maximum genetic progress. Systematic evaluation of bulls needs complete records of their daughters at least for first lactation. The complete records, generally, are not available due to economic constraints, transfer of herds, selling and death of animals. Large expense involved in recording of milk yield data is also a limiting factor for complete recording in rural areas. However, part records or records at some interval may be utilized to evaluate the sires which would increase the rate of genetic progress and would reduce generation interval, cost of recording and maintaining dairy animals with low breeding potentials. Generally, in most of the countries, selection of sire is based on complete lactation yields, which are predicted from individual test day milk records taken at monthly intervals (Pander *et al.,* 1992). Therefore, the objective of this study was to predict the breeding value of sires for first lactation milk yield on the basis of estimated breeding values of test day milk records.

MATERIALS AND METHODS

First lactation milk records of 518 daughters of 23 Hariana bulls calving between 1976-96 obtained from Government Livestock Farm, Hisar, were used to predict the breeding values of sires for first lactation milk yield from the estimated breeding value (EBV's) of sires for test day milk records (TD). First test day milk yield (TD_1) in kg was recorded on 15^{th} day after calving. Next test day milk records were taken at 30 days interval. Breeding values of sires for test day milk records and first lactation milk yield were estimated by best linear unbiased prediction (BLUP) procedure described by Henderson (1973). Multiple regression (MRA) and principal component analysis (PCA) techniques were used to predict the breeding value of sires for first lactation milk yield (FLMY). Standardized principal component scores were derived by using PCA technique described by Jobson (1992). A total of 10 test day milk records (TD_1 to TD_{10}) were taken for this purpose.

RESULTS AND DISCUSSION

Multiple regression analysis. A total of 10 independent variables were taken for this purpose. These were the estimated breeding values of sires for test day milk records from TD_1 to TD_{10}. All possible combinations were made for first six test day milk records (TD_1 to TD_6). A total of 69 regression equations were developed for predicting the breeding value of first lactation milk yield. The best prediction equations with one, two, three, four, five, six and ten variables are given in table 1. The coefficient of determination (R^2) was the maximum (90.28%) for TD_3 among all ten-prediction equations having only one variable. Singh and Yadav (1996) obtained similar value of R^2 (90.00), while predicting FLMY from third month milk yield. When two

variables were taken at a time in different combinations, the accuracy of prediction was the maximum (93.38%) by combining TD_1 with TD_2. Joshi *et al.,* (1996) reported lower R^2 value (66.43%) by combining TD_1 with TD_2. R^2 value was the maximum (94.655) for three variable prediction equations. There was an increase of only 0.20 per cent in R^2 value by addition of TD_3 in the best three variables prediction equation. When first six test days were entered in the prediction equation they explained about 94.87 per cent of variation in FLMY.

Examination of the prediction equations and their R^2 values indicated that the prediction equation incorporating 10 variables provides an increase in R^2 value of only 3.95 per cent over the equation containing six variables, it should be rejected. Similarly, prediction equations having 6, 5, 4 and 3 variables should also be rejected, since they also provide an increase of 1.73, 1.49, 1.47 and 1.27 per cent in R^2 value over the best equation containing two variables. However, TD_1 and TD_2 combination showed an increase in R^2 value of about 3.10 per cent over the best equation containing a single variable. Hence, the TD_1 and TD_2 combination, which provide a reasonably simple and economical model with high R^2 value, was found the best equation for predicting the breeding value of sires for FLMY. The high R^2 value obtained in the present study was in agreement to those reported by Joshi *et al.,* (1996) in Hariana cattle and Singh and Yadav (1996) in crossbred cattle.

Table 1. Prediction equations for predicting the breeding values of first lactation milk yield from the estimated breeding values of test day milk records.

S. No	Prediction equation	R^2 value (%)
1	$\hat{Y} = 3.08 + 293.27\ X_3$	90.28
2	$\hat{Y} = 7.47 - 136.50\ X_1 + 446.75\ X_2$	93.38
3.	$\hat{Y} = 22.39 - 107.85\ X_1 + 369.14\ X_2 + 65.49\ X_5$	94.65
4.	$\hat{Y} = 20.26 - 82.38\ X_1 + 279.56\ X_2 + 61.37\ X_3 + 66.79\ X_5$	94.85
5.	$\hat{Y} = 19.56 - 83.42\ X_1 + 274.32\ X_2 + 63.80\ X_3 - 13.74\ X_4 + 82.21\ X_5$	94.87
6.	$\hat{Y} = 28.76 + 74\ 38\ X_2 + 153.06\ X_3 - 19.41\ X_4 + 82.90\ X_5 + 13.75\ X_6 + 43.46\ X_7$	95.11
7.	$\hat{Y} = 15.85 - 315.72\ X_1 + 328.93\ X_2 + 13.42\ X_3 - 121.39\ X_4 + 217.83\ X_5 + 224.04\ X_6 - 540.20\ X_7 + 440.53\ X_8 + 6.37\ X_9 - 93.39\ X_{10}$	99.06

Where, $\hat{Y}$ is the predicted BV of first lactation milk yield (kg) and X_1, X_2, X_3……X_{10} are estimated breeding values of 1, 2, 3,….. 10^{th} test day milk record, respectively.

Principal component analysis. Standardized principal components were derived from simple product moment correlation matrix between the estimated breeding values of sires for test day milk records. The eigenvalues obtained in the analysis showed that out of the ten estimated principal components (PC), four principal components explained 95.58 per cent of total variation in the data. The eigen values of these first four principal components were obtained as 6.98, 1.51. 0.44 and 0.32 from first to fourth principal components, respectively. When these four standardized principal components were used for the prediction of breeding value of sires for FLMY through MRA, they explained 95 per cent of variation in FLMY, which was higher than MRA. The prediction equation is given below :

$$\hat{Y} = 27.06 + 921.5\ Z_1 + 1773.9\ Z_2 + 405.3\ Z_3 - 140.3\ Z_4$$

Where,

$\hat{Y}$ = is the breeding value of sires for first lactation milk yield

Z_1, Z_2, Z_3, Z_4, are the standardized principal components.

CONCLUSION

From these results, it can be concluded that breeding values of early test day milk record (TD_1 and TD_2) can be used for evaluation of sires for first lactation milk yield. This will help in reducing generation interval. It can also be concluded that PCA technique should be preferred over MRA to predict breeding value of FLMY as it removes the dependency among independent variables and hence decreases bias in accuracy of prediction.

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