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Research Article

PREDICTION OF LIFETIME PERFORMANCE TRAITS FROM EARLY LACTATION TRAITS IN HARIANA CATTLE

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ABSTRACT

The data on early lactation traits of Hariana cattle (555) maintained at Germ Plasm Unit, CCSHAU, Hisar; Government Livestock Farm, Hisar; Kuruskehtra Gaushala, Hisar; Gaushala Bhiwani and Gaushala Jind from 1994-2009 were used to predict lifetime performance traits. The traits taken were first lactation traits viz. age at first calving (AFC), first lactation milk yield (FLMY), first lactation length (FLL), first lactation peak yield (FPY), first dry period (FDP), first service period (FSP) and first calving interval (FCI), second lactation traits viz. second lactation milk yield (SLMY), second lactation length (SLL), second dry period (SDP), second service period (SSP) and second calving interval (SCI) and lifetime traits viz. lifetime milk yield (LTMY), herd life (HL) and productive life (PL). A total of 12 independent variables were taken for prediction by incorporating first and second lactation traits. When only first lactation traits were involved for the prediction of LTMY then the equation incorporating AFC and FLMY which explained 28% of variations in LTMY was considered to be optimum for prediction of LTMY. When first and second lactation traits were used for the prediction of LTMY then the equation incorporating FLMY and SLMY was considered optimum, which explained 44% of variation in LTMY. For the prediction of HL from both lactation traits the final equation incorporating four traits (FCI, FPY, SLL and SSP) was considered optimum with an accuracy of prediction of 17% while, the prediction equation incorporating FCI, FPY, SDP and SSP was considered optimum for prediction of PL. However, due to low R^2 value (12%) it was not reliable to make any conclusion. From the present study it may be inferred that first lactation traits are not sufficient enough to predict lifetime performance. Hence, second lactation traits should be taken into account while predicting lifetime performance of Hariana cattle.

Key words: Hariana cattle, early lactation, lifetime, prediction

Hariana is well known dual purpose indigenous breed of Haryana state. This breed possess unique characteristic of hardiness, adaptability, disease resistance and efficiency of conversion of available coarse fodder especially under harsh conditions. Genetic improvement of Hariana cattle through selective breeding, thus is an important aspect for conservation, preservation and propagation of valuable germplasm. The present economic conditions demand that a dairy animal should be profitable and overall profitability of a dairy animal depends mainly on the returns through the milk production during its lifetime than in its first lactation alone. Evaluation of sires for lifetime production traits not only delays selection decisions but also reduces rate of genetic progress. To overcome this, lifetime milk production has to be projected indirectly from some early observable traits (Kakkar *et al*., 2004). Several procedures have been often proposed for prediction of lifetime milk production from early lactation traits; multiple regression analysis technique has been widely used. Keeping in view, the status of knowledge in the Hariana cattle, the present study was undertaken to devise selection criteria for life time performance traits based on early lactation trait.

MATERIALS AND METHODS

The data for the present investigation were collected from the history-cum-pedigree sheets on 555 Hariana cows maintained from 1994-2009 at Germ Plasm Unit, CCSHAU, Hisar; Government Livestock Farm, Hisar; Kurukshetra Gaushala, Hisar; Gaushala Bhiwani and Jind Gaushala. A total of 12 independent variables were taken for this purpose. The traits taken into consideration were first lactation traits viz. age at first calving (AFC), first lactation milk yield (FLMY), first lactation length (FLL), first lactation peak yield (FPY), first dry period (FDP), first service period (FSP) and first calving interval (FCI); second lactation traits viz. second lactation milk yield (SLMY), second lactation length (SLL), second dry period (SDP), second service period (SSP), second calving interval (SCI) and lifetime traits viz. lifetime milk yield (LTMY), herd life (HL) and productive life (PL). Abnormal lactation records due to specific causes like abortion, still birth, repeat breeding and sickness were

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excluded. Multiple regression analysis (MRA) technique as described by Draper and Smith (1987) was used to predict lifetime production from early lactation traits. Stepwise regression procedure was carried out for the prediction of lifetime traits.

RESULTS AND DISCUSSION

Prediction equations for predicting lifetime traits from first lactation traits and first and second lactation traits have been presented in Tables 1 and 2, respectively.

Prediction of Lifetime Milk Yield (LTMY): Stepwise regression procedure was used to predict lifetime milk production from all first and second lactation traits under study. When only first lactation traits were involved for the prediction of LTMY then FLMY entered at the first step which explained 27% of variation (R^2 value) in LTMY. The trait entered at the second step was AFC and both these traits (AFC and FLMY) explained 28% of R^2 value in LTMY and this equation was considered optimum for prediction of LTMY from first lactation traits. Similar pattern was also reported by Singh (2002) and Gandhi *et al.* (2009). Contrary to these results, Dalal *et al.* (2004) and Shinde *et al.* (2010) reported higher R^2 values of 61.00 and 50.91% while predicting LTMY up to third lactation traits in Hariana cattle and Phule Triveni crossbred cattle, respectively.

When first and second lactation traits were used for the prediction of LTMY then the trait entered at the first step was SLMY for which the accuracy of prediction was 44%. When FLMY entered at the second step then there was an increase of 4% in R^2 value. Thereafter no other traits contributed significantly in the R^2 value for prediction of LTMY. So, the equation incorporating FLMY and SLMY was considered optimum for prediction of LTMY from both lactation traits, which is in close agreement with Singh (2002). However, Bhattachariya and Gandhi (2005) reported lower R^2 value (37%) while predicting LTMY from first and second lactation traits in Karan Fries cattle. On the contrary, Dalal *et al*. (2004) and Shinde *et al.* (2010) reported higher R^2 values as 91.25 and 74.28%, respectively. From these results it can be concluded that first lactation traits alone are not sufficient enough to predict LTMY because of low R^2 value and the inclusion of second lactation milk yield is also important. An equation incorporating FLMY and SLMY was considered to be the best for the prediction of LTMY.

Prediction of Herd Life: When first lactation traits were used for prediction of HL, then the traits entered at the first, second, third and fourth step were FSP, FLL, FPY and AFC. All these four traits explained 13% of variation (R^2 value) in HL. After that no other traits contributed significantly in the accuracy of prediction for HL. So, the equation incorporating these four traits (AFC, FLL, FSP and FPY) was considered optimum for prediction of HL from first lactation traits. When first and second lactation traits both were taken to predict HL then the traits entered at first, second, third and fourth step were SSP, FCI, SLL and FPY, respectively. The accuracy of prediction by SSP alone was 11% while it increased by 3, 1 and 2% due to addition of FCI, SLL and FPY, respectively in the previous equation. The

Table 1
Prediction equations for predicting lifetime traits from first lactation traits

Step No.	Prediction Equation	R^2 (%)
Lifetime milk yield		
1.	Y=1086.03+2.47 FLMY	27
2.	Y=1731.31-0.39AFC+2.47FLMY	28
Herd life		
1.	Y=952.40+1.95FSP	9
2.	Y=778.51+0.74FLL+1.88FSP	10
3.	Y=935.36+1.10FLL+1.74 FSP -45.20FPY	12
4.	Y=1186.70-0.15AFC+1.23FLL+1.61FSP -46.17FPY	13
Productive life		
1.	Y=880.06+1.79FSP	9
2.	Y=1137.01-0.11AFC-0.85FDP+2.46FSP	11
3.	Y= 923.41-0.74 FDP+2.45 FSP	10
4.	Y=1325.76-0.12AFC-1.08FDP+2.59FSP -0.31.52FPY	12

AFC=Age at first calving; FLMY=First lactation milk yield; FLL=First lactation length; FPY=First lactation peak yield; FDP=First dry period; FSP=First service period

Table 2
Prediction equations for predicting lifetime traits from first and second lactation traits

Step no.	Prediction equation	R^2 (%)
Lifetime milk yield		
1.	Y=966.69+2.51SLMY	44
2.	Y=530.00+1.03FLMY+2.01SLMY	48
Herd life		
1.	Y=1214.69+1.51SSP	11
2.	Y=822.91+0.93FCI+1.24SSP	14
3	Y=607.85+1.04FCI+0.72SLL+1.09SSP	15
4.	Y=738.03+1.03FCI-41.20FPY+1.05SLL+1.02SSP	17
Productive life		
1	Y=1107.86+1.41SSP	9
2.	Y=733.08+0.89FCI+1.14SSP	12
3.	Y=723.69+1.04FCI-0.97SDP+1.90SSP	15
4.	Y=889.69+1.04FCI-30.57FPY-1.19SDP+2.06SSP	16

FCI=First calving interval; FLMY=First lactation milk yield; FPY=First lactation peak yield; SLMY=Second lactation milk yield; SDP=Second dry period; SLL=Second lactation length; SSP=Second service period

final equation after incorporating these four traits (FCI, FPY, SLL and SSP) was considered optimum with an accuracy of prediction of 17%. The low R^2 value obtained in the present study was similar to the findings of Singh (2002). Contrary to this Dalal (1998) and Gahlot (2003) reported high R^2 values (40.30 and 67.00%, respectively) while predicting HL.

Prediction of Productive Life: While, predicting PL from first lactation traits the first trait which explained maximum variation (9%) in PL was FSP. Then at the second step FDP and FSP were entered in the prediction equation and these traits explained 10% of variation in PL. At the third step AFC, FDP and FSP were entered in the equation and these traits explained 11% of variation in PL. When FPY was also taken in the previous prediction equation then all these four traits (AFC, FDP, FSP and FPY) explained 12% of variation. When second lactation traits were taken into consideration along with first lactation traits to predict PL, there was an increase of 4% in R^2 value. HEnce, the prediction equation incorporating FCI, FPY, SDP and SSP was considered to be optimum for prediction of PL but due to low R^2 value, it was not reliable to make any conclusion. Singh (2002) also reported low R^2 value while predicting PL from first and second lactation traits in Hariana cattle.

The prediction equation incorporating first two lactation traits resulted in an increase in R^2 value of 20% over the equation using only first lactation traits for prediction of lifetime milk yield. The prediction equation incorporating FLMY and SLMY which explained 48% of variation in LTMY was considered optimum for prediction of LTMY. From these results it can be concluded that first lactation traits alone are not sufficient enough to predict LTMY because of low R^2 value. Hence, for the prediction of LTMY inclusion of second lactation milk yield is also important, however, herd life and productive life cannot be predicted accurately with these traits. Other traits need to be taken into account for developing equation with high R^2 value. In general, the prediction equations developed under present study have very low R^2 value for making any conclusion.

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