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Relationship between Sire Evaluation for First Lactation Milk Yield and Reproduction Traits in Crossbred Cattle

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ABSTRACT

The present study was carried out on first lactation records of 276 crossbred cows sired by 49 sires maintained in the Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana over a period of 24 years (1991 to 2014). Breeding values of sires for first lactation milk yield (FLMY) and various reproduction traits viz., age at first calving (AFC), first service period (FSP), first calving interval (FCI) and waiting period (WP) were estimated using best linear unbiased prediction (BLUP) procedure, least squares method (LS), and restricted maximum likelihood (REML) method using WOMBAT software. Sire group, period of calving, season of calving and milk yield group were taken as fixed effect and animal/sire as random effect. The product moment and spearman rank correlations between sires EBVs for FLMY with those of all reproduction traits were either very low or negative by all three methods whereas the product moment correlations between sires EBVs for FSP with those of FCI and WP were high and positive (0.973 and 0.535 by BLUP method, 0.971 and 0.572 by least squares method and 0.973 and 0.51 by REML method, respectively). These negative and negligible product moment correlations of sires EBVs for FLMY with reproduction traits indicated that these are antagonistic traits. So, due weightage should be given to both production and reproduction traits in the selection criteria.

Key words: *Breeding Value, Crossbred Cattle, Rank correlation.*

INTRODUCTION

Superiority of animals forms the basis of success of dairy industry. The contribution of sire path is higher than the dam path for overall genetic improvement of a trait, therefore the effectiveness of sire evaluation is the backbone of any breed improvement programme[2]. So, the aim of an animal breeder is to select the genetically superior bulls so that genetic improvement in both productive as well as reproductive performances of the herd can be done[9]. Furthermore, the success of the program is quite dependent on how early and accurately young bulls are evaluated for breeding value.

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First lactation performance has been the standard of evaluation for most genetic studies with dairy cattle as these records are available sooner on more number on cows and are less susceptible to error[7]. Simultaneous attention to reproductive traits along with milk production is desirable to bring about overall improvement in the index value of a sire, therefore, multi trait criteria of sire evaluation using any advanced statistical technique would be expected to enhance the accuracy of selection of the sire[12]. Various methods are available for evaluating sires and the present investigation was carried out to evaluate the efficiency of crossbred sires by three different methods viz., Best linear unbiased prediction (BLUP) procedure, Least squares method (LS) and REML (WOMBAT) method.

MATERIALS AND METHODS

Data for the present investigation were collected from first lactation records of 276 crossbred cows sired by 49 sires maintained in the Department of Animal Genetics and Breeding, LUVAS, Hisar over the period of 24 years from 1991 to 2014. The production traits under study was first lactation milk yield (FLMY) and reproduction traits under study were age at first calving (AFC), first service period (FSP), first calving interval (FCI) and waiting period (WP). Abnormal lactation records due to specific causes like abortion and sickness were excluded. The entire duration of 24 years was divided into 8 periods of equal duration. Year to year variation within the period was assumed to be non-significant. Each year was divided into four seasons viz. summer (April to June), rainy (July to Sept.), autumn (Oct. to Nov.) and winter (Dec. to March) on the basis of fluctuations in atmospheric temperature and relative humidity.

The breeding values of sires were estimated by best linear unbiased prediction (BLUP) procedure, least squares (LS) and REML method using animal model[13] with sire group, period of calving, season of calving, milk yield group as fixed effects and animal/sire as random effect. The product moment and spearman rank correlations among sire's estimated breeding values for FLMY and reproduction traits were calculated according to Steel and Torrie[15].

RESULTS AND DISCUSSION

The breeding value of sires for various first lactation traits were estimated by different methods and their range is presented in Table 1.

Table 1: Range of Estimated breeding values of sires for various first lactation traits by different methods

Traits	Estimated breeding values of sires (Range)		
	BLUP method	**LS method**	**REML (WOMBAT) method**
FLMY	1965.04-2481.44 kg	1439.01 to 3091.29 kg	2170.79 to 2470.12 kg
FSP	116.53 to 171.54 days	62.78 to 242.32 days	106.80 to 176.41 days
FCI	384.82 to 453.56 days	345.08 to 499.43 days	380.40 to 463.25 days
AFC	1123.61 to 1327.36 days	957.53 to 1433.20 days	980.25 to 1446.85 days
WP	75.81 to 118.59 days	57.85 to 146.36 days	92.21 to 100.67 days

Breeding values obtained by Least squares method for FLMY, FSP, FCI and AFC in present study were lower than those obtained by Bajetha *et al.*[1] for the above traits by least squares method in crossbred cattle. Breeding values obtained by BLUP method for FLMY, FSP, and AFC in present study were higher and estimated breeding values (EBVs) for FCI were lower than those obtained by Gaur[8] by BLUP method in Frieswal cattle. EBVs of sires by REML (WOMBAT) for FLMY ranged from 2170.79 to 2470.12 kg, which were lower than those reported by Lodhi *et al.*[12]. EBVs of sires for FLMY, FSP and FCI were comparable with those reported by Divya[6] and Dash *et al.*[5]. Breeding values of sires obtained for AFC, FSP and FCI in present study were lower and EBVs for FLMY were higher than those obtained by Singh and Singh[14] by different methods.

Product moment correlation:

The product moment correlation between sire's EBVs for FLMY and various reproduction traits were obtained by different methods and are presented in Table 2, 3 and 4. The present study revealed that the product moment correlations between sires EBVs for FLMY with those of all reproduction traits were either very low or negative by all three methods. Lodhi *et al.*[11] also reported low product moment correlation between sires EBVs for FLMY with FSP and FCI by BLUP and REML method in crossbred cattle; however, Chander *et al.*[3] reported very high and negative product moment correlation between sires EBVs for these traits in Sahiwal cattle.

Table 2: Rank (above diagonal) and product moment (below diagonal) correlation among FLMY and reproduction traits by BLUP method

	FLMY	FSP	FCI	AFC	WP
FLMY	-	-0.096	-0.031	0.048	-0.006
FSP	0.052	-	0.974**	0.029	0.531**
FCI	0.014	0.973**	-	0.048	0.562**
AFC	-0.045	0.062	0.078	-	0.157
WP	0.014	0.535**	0.555**	0.169	-

***P<0.05, **P<0.01**

These negative and negligible product moment correlations of sires EBVs for FLMY with FSP, FCI, AFC and WP indicated that these are antagonistic traits. So, due weightage should be given to both production and reproduction traits in the selection criteria. The EBVs of sires for AFC had negligible product moment correlations with all other traits by all three methods. The product moment correlations between sires EBVs for FSP with those of FCI and WP were high and positive (0.973 and 0.535 by BLUP method, 0.971 and 0.572 by least squares method and 0.973 and 0.51 by REML method, respectively). High product moment correlations of sires EBVs for FSP with FCI were supported by the findings of Dalal *et al.*[4] in Hariana cattle, Chander *et al.*[3] in Sahiwal cattle, Kumar[10] in Frieswal cattle and Lodhi *et al.*[11] in crossbred cattle. High product moment correlation among these traits could be expected because of the close link between these traits.

Table 3: Rank (above diagonal) and product moment (below diagonal) correlation among FLMY and reproduction traits by least squares method

	FLMY	FSP	FCI	AFC	WP
FLMY	-	-0.176	-0.116	0.021	-0.103
FSP	0.096	-	0.978**	0.069	0.58**
FCI	0.101	0.971**	-	0.075	0.595**
AFC	-0.004	0.106	0.099	-	0.028
WP	0.134	0.572**	0.593**	0.081	-

***P<0.05, **P<0.01**

Rank correlation: Sires were ranked on the basis of EBVs for first lactation milk yield and other reproduction traits. The spearman rank correlations between sire's EBVs for FLMY and various reproduction traits were obtained by different methods and are presented in Table 2, 3 and 4.

Table 4: Rank (above diagonal) and product moment (below diagonal) correlation among FLMY and reproduction traits by REML (WOMBAT) method

	FLMY	FSP	FCI	AFC	WP
FLMY	-	-0.104	-0.034	0.005	0.033
FSP	0.058	-	0.972**	-0.055	0.559**
FCI	0.015	0.973**	-	-0.016	0.593**
AFC	-0.021	-0.028	-0.006	-	0.111
WP	-0.007	0.51**	0.531**	0.118	-

***P<0.05, **P<0.01**

The rank correlations between the EBVs for FLMY and reproduction traits also presented the similar picture as that of product moment correlation i.e. the EBVs of sires for FLMY had negative or negligible rank correlation with FSP, FCI, WP and AFC. Rank correlation of EBVs of sires for FSP with that of FCI and WP were very high and positive (0.974 and 0.531 by BLUP method, 0.978 and 0.58 by Least squares method and 0.972 and 0.559 by REML method, respectively). Dalal *et al.*[4] reported negative rank correlations between EBVs of sires for FLMY with FSP, FCI and AFC. Rank correlations between EBVs of sires for AFC and other first lactation traits were found to be

low and non-significant. High rank correlations of EBVs of sires for FSP with that of FCI were supported by findings of Dalal *et al.*[4] in Hariana, Chander *et al.*[3] in Sahiwal and Kumar[10] in crossbred cattle.

CONCLUSION

The negative and negligible product moment and spearman rank correlations of sires EBVs for FLMY with other first lactation reproduction traits indicated that these traits are antagonistic in nature and due weightage should be given to both kind of traits (production and reproduction traits) in the selection criteria for bringing overall genetic improvement in the herd.

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