Haryana Vet. (Dec., 2017) **56 (2),** 121-124 **Research Article**

RELATIONSHIP OF SIRE'S EVALUATION FOR DIFFERENT PRODUCTION TRAITS AND DAUGHTER PREGNANCY RATE 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 of this University over a period of 24 years from 1991 to 2014. The data were analyzed to estimate the breeding values of sires for production traits and daughter pregnancy rate (DPR) using Least squares (LS) method, Best linear unbiased prediction (BLUP) procedure and Restricted maximum likelihood REML method using WOMBAT software. Production traits studied were first lactation milk yield (FLMY), first lactation length (FLL), first lactation peak yield (FPY) and first dry period (FDP). The model used for estimation of breeding values of sires contained sire group, period of calving, season of calving and milk yield group as fixed effect and animal/sire as random effect while age at first calving was taken as covariate. The product moment correlations between sires' EBVs for FLMY with those of FPY and FLL were high and significant i.e. 0.85 and 0.65 by Least Squares, 0.85 and 0.62 by BLUP and 0.85 and 0.62 by REML (WOMBAT) method, respectively. FLMY, FPY and FLL had negative rank correlations with those of DPR42, DPR63 and DPR84. BLUP showed high product moment and rank correlations with other two methods and was judged as the best method. Sires were ranked on the basis of EBVs of FLMY by BLUP method and compared with their corresponding ranks based on EBVs of FPY. It was found that out of top five sires for FLMY, four managed to remain in the list of top five sires for FPY as well. This showed that there is almost no change in the ranking of top sires for both traits. So, preliminary selection of animals can be done on the basis of FPY.

Key words: Breeding value, crossbred cattle, daughter pregnancy rate, rank correlation

The success of dairy industry is much dependent on the superiority of animals. Sire is known as half the herd and prime importance should be given to quality of sires which are used for breeding purpose. The effectiveness of sire evaluation is the backbone of any breed improvement programme because for the overall genetic improvement of a trait the contribution of sire path is higher than the dam path (Banik and Gandhi, 2006). Selection of superior sires with maximum accuracy at an early stage and multiplication of their germplasm is one of the most important aspects of any progeny-testing programme for bringing about further genetic improvement in the herd. The genetic evaluation procedures have progressed a long way from the simple daughter average sire index method to animal models to improve accuracy of sire evaluation. Various methods are available for evaluating sires, however, their comparison is important to know which method is superior for our breeding programme. Therefore, the objective of the present investigation was to evaluate the efficiency of crossbred sires by using Least squares (LS) method, Best linear unbiased prediction (BLUP) procedure and REML (WOMBAT) method.

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MATERIALS AND METHODS

The 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 were utilised for the present study. The production traits under study were first lactation milk yield (FLMY), first lactation length (FLL), first lactation peak yield (FPY) and first dry period (FDP) and reproduction traits under study were various daughter pregnancy rates (DPR42, DPR63 and DPR84). Abnormal lactation records due to specific causes like abortion and sickness were excluded from the study. The entire duration of 24 years from 1991 to 2014 was divided into 8 periods each having three years 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 September), autumn (October to November) and winter (December to March) on the basis of fluctuations in atmospheric temperature and relative humidity.

Estimation of Waiting Period and Daughter Pregnancy Rate: Waiting period (WP) is the initial phase of lactation during which no insemination occurs. WP = (DOFAI – DOFC) where, DOFAI=date of first AI after first calving and DOFC= date of first calving.

Daughter pregnancy rate measures how quickly cows become pregnant again after calving. It is defined as the percentage of non-pregnant cows that become pregnant during each 21 days period, because each estrus cycle represents one chance for an animal to become pregnant. DPRs were estimated as suggested by USDA (2003).

DPR=21/(First Service Period–Voluntary Waiting Period+11); DPR42, DPR63 and DPR84 were estimated for waiting period of 42, 63 and 84 days, respectively.

The breeding values of sires were estimated by Least squares (LS), Best linear unbiased prediction (BLUP) procedure and REML method using animal model (Meyer, 2007) with sire group, period of calving, season of calving, milk yield group as fixed effects and animal/sire as random effects. For the estimation of sires breeding values more than three progenies per sire were included. The product moment and rank correlations among sire's estimated breeding values for DPR and production traits were calculated according to Steel and Torrie (1980). All three methods i.e. Least squares, BLUP and REML were compared by calculating the product moment and rank correlations between the estimated breeding values of sires for FLMY, FPY, DPR42, DPR63 and DPR84.

RESULTS AND DISCUSSION

The estimated breeding values (EBVs) obtained by Least squares method for various first lactation traits ranged from 1439.01 to 3091.29 kg for FLMY, 236.34 to 395.22 days for FLL, 7.56 to 14.02 kg for FPY, 60.13 to 172.56 for FDP, 0.055 to 0.902 for DPR42, 0.021 to 0.721 for DPR63, 0.039 to 0.835 for DPR84, respectively. The corresponding EBVs obtained by BLUP method ranged from 1965.04 to 2481.44 kg for FLMY, 292.28 to 337.45 days for FLL, 9.57 to 12.18 kg for FPY, 84.74 to 130.72 for FDP, 0.218 to 0.473 for DPR42, 0.197 to 0.656 for DPR63, 0.250 to 0.506 for DPR84, respectively. Similarly, EBVs of sires obtained by REML method ranged from 2170.79 to 2470.12 kg for FLMY, 302.56 to 333.74 days for FLL, 9.31 to 12.37 kg for FPY, 84.38 to 130.02 for FDP, 0.256 to 0.407 for DPR42, 0.308 to 0.368 for DPR63, 0.21 to 0.67 for DPR84, respectively. The product moment and rank correlations between sire's EBVs for various DPR and production traits were obtained by different methods and are presented in Tables 1, 2 and 3.

Product Moment Correlation: The present study revealed that the product moment correlations between sires EBVs for FLMY with those of FPY and FLL were high and positive (0.85 and 0.65 by Least squares, 0.85 and 0.62 by BLUP and 0.85 and 0.62 by REML method, respectively). These results were in agreement with the observation of Dalal *et al.* (1999), Gaur (2003), Rameshchander *et al*. (2004) and Kumar (2015). High product moment correlation between FLMY and FPY indicated that FPY can be taken as criteria for early selection of animal. Product moment correlations among sire's estimated breeding values for FLMY, FLL and FDP reported in the present study were similar in magnitude and direction as reported by Dalal *et al.* (1999) and Kumar (2006) in Hariana and by Kumar (2015) in crossbred cattle.

The product-moment correlation between various DPR and FLMY ranged from -0.16 to -0.01 by Least squares,-0.08 to -0.002 by BLUP method and -0.13 to 0.08 by REML (WOMBAT) method. The product-moment correlation between various DPR and FPY ranged from -0.48 to 0.08 by Least squares, -0.31 to 0.07 by BLUP method and -0.33 to 0.02 by REML method. The product-

Table 1
Rank (above diagonal) and product moment (below diagonal) correlation among production traits and DPR by Least squares method

	FLMY	FPY	FLL	FDP	DPR42	DPR63	DPR84
FLMY	-	0.76**	0.62**	0.16	-0.05	-0.23	-0.08
FPY	0.85**	-	0.27	0.11	-0.41**	-0.48**	0.02
FLL	0.65**	0.35*	-	0.16	0.12	-0.07	-0.28
FDP	-0.16	-0.11	0.11	-	0.56**	0.52**	0.21
DPR42	-0.16	-0.48**	0.01	-0.49**	-	0.66**	0.35*
DPR63	-0.01	-0.35*	0.01	-0.56**	0.57**	-	0.39*
DPR84	-0.05	0.08	-0.31*	-0.19	0.41**	0.46**	-

*P<0.05, **P<0.01

Table 2
Rank (above diagonal) and product moment (below diagonal) correlation among production traits and DPR by BLUP method

	FLMY	FPY	FLL	FDP	DPR42	DPR63	PR84
FLMY	-	0.81**	0.61**	0.12	0.03	-0.21	-0.04
FPY	0.85**	-	0.27	0.16	-0.26	-0.39**	0.04
FLL	0.62**	0.30*	-	0.14	0.18	-0.07	-0.23
FDP	-0.13	-0.17	-0.05	-	0.69**	0.50**	0.20
DPR42	-0.002	-0.31*	0.11	-0.64**	-	0.58**	0.33*
DPR63	-0.08	-0.34*	-0.08	-0.51**	0.54**	-	0.41**
DPR84	-0.06	0.07	-0.27	-0.16	0.28	0.48**	-

*P<0.05, **P<0.01

moment correlation between various DPR and FLL ranged from -0.31 to 0.01 by Least squares,-0.27 to 0.11 by BLUP method and -0.30 to 0.10 by REML method. Product-moment correlation between various DPR and FDP ranged from -0.56 to -0.19 by Least squares,-0.64 to -0.16 by BLUP method and -0.70 to -0.10 by REML method. These negative product moment correlations of DPR with FLMY, FPY and FLL indicated that these are antagonistic traits. So, due weightage should be given to both kind of traits (production and reproduction traits) in the selection criteria.

The product moment correlation between EBVs of sires for daughter pregnancy rates (DPR42, DPR63 and DPR84) were low to high ranging from 0.41 to 0.57 by Least squares method, 0.28 to 0.54 by BLUP method and 0.02 to 0.45 by REML method.

Rank Correlation: Sires were ranked on the basis of EBVs for various production and reproduction traits. The EBVs of sires for FLMY had high rank correlation with that of FPY (0.76 by Least squares, 0.81 by BLUP and 0.84 by REML). The EBVs of sires for FLMY had high rank correlations with that of FLL (0.61 by Least squares, 0.62 by BLUP and 0.60 by REML method) as well. Rank correlations between EBVs of sires for FDP and other production traits were found to be low and non-significant. High rank correlations of EBVs of sires for FLMY with that of FLL and FPY were supported by findings of Dalal *et al.* (1999) in Hariana, Gaur (2003) in Frieswal cattle, Rameshchander *et al*. (2004) in Sahiwal and Kumar (2015) in crossbred cattle.

Rank correlations between FLMY and daughter pregnancy rates were either low or negligible by all three methods. Patil (2011) also observed inverse (antagonistic) relationship between milk production and fertility performance of Murrah buffalo. The rank correlations between the EBVs for production traits and DPR also presented the similar picture as that of product moment correlation.

Comparison of Sire Evaluation Methods: Sires were ranked on the basis of EBVs for different traits (FLMY, FPY, DPR42, DPR63 and DPR84). The effectiveness of different sire evaluation methods was compared using product moment correlation and Spearman's rank correlation.

Table 3
Rank (above diagonal) and product moment (below diagonal) correlation among production traits and DPR by REML method

	FLMY	FPY	FLL	FDP	DPR42	DPR63	DPR84
FLMY	-	0.84**	0.60**	0.09	0.10	-0.28	-0.08
FPY	0.85**	-	0.30*	0.17	-0.11	-0.34*	0.01
FLL	0.62**	0.30*	-	0.09	0.18	-0.21	-0.22
FDP	-0.12	-0.25	-0.02	-	0.74**	0.33*	0.20
DPR42	0.08	-0.08	0.10	-0.70**	-	0.23	0.10
DPR63	-0.15	-0.33*	-0.14	-0.28**	0.19	-	0.35*
DPR84	-0.13	0.02	-0.30*	-0.10	0.02	0.45**	-

*P<0.05, **P<0.01

Table 4
Product moment and rank correlations between methods LS, BLUP and REML based on EBVs for FLMY, FPY and daughter pregnancy rate

TRAIT	LS/BLUP		LS/REML		REML/BLUP	
	Product moment	Rank	Product moment	Rank	Product moment	Rank
FLMY	0.962**	0.954**	0.923**	0.928**	0.987**	0.990**
FPY	0.967**	0.964**	0.953**	0.942**	0.989**	0.983**
DPR42	0.959**	0.962**	0.887**	0.883**	0.964**	0.941**
DPR63	0.973**	0.978**	0.869**	0.877**	0.912**	0.905**
DPR84	0.975**	0.960**	0.906**	0.871**	0.964**	0.945**

**P<0.01

Product moment and rank correlations were obtained by taking two methods together at a time out of three sire evaluation methods used in the study. High product moment and rank correlations between different methods, for EBVs of different traits (FLMY, FPY, DPR42, DPR63 and DPR84) were observed (Table 4). This showed that all methods are not significantly different. But, comparatively BLUP method is best because it showed high product moment and rank correlations with other two methods i.e. LS and REML. Lodhi *et al.* (2016) also reported BLUP method as best method for estimating breeding values in crossbred cattle. However, Raheja (1992) and Singh and Singh (2016) reported that LS method was more stable than the BLUP method. While, Gaur *et al.* (2001) suggested that either of the methods (LS or BLUP) could be used for the selection of sires for breeding purpose in crossbred cattle.

Sires were ranked on the basis of EBVs of FLMY by BLUP method and compared with their corresponding ranks based on EBVs of FPY. It was found that out of top five sires for FLMY, four managed to remain in list of top five sires for FPY as well. This showed that there is almost no change in the ranking of top sires for both traits. A critical appraisal of high product moment and rank correlations among FLMY and FPY indicated that preliminary selection of animals should be on the basis of FPY and antagonistic correlation among DPR and production traits indicated that due weightage should be given to fertility traits (DPR) in the selection criteria.

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