Relationship between sire's estimated breeding values for production traits and ranking of sires in Sahiwal cattle

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ABSTRACT

The present investigation was undertaken on 1367 first lactation records of Sahiwal cattle maintained at GLF, Chak Ganjaria, Lucknow over a period of 71 years (1944-2014). The study was conducted for estimation of breeding value of sires for different first lactation traits using daughter's average, least-squares and best linear unbiased prediction methods. Efficiency of different methods was estimated by rank correlation and product moment correlation. The rank correlation coefficients and product moment coefficient between the sires evaluated by various methods were very highly significant (P<0.01) for first lactation milk yield, first lactation length and age at first calving. The comparison of different method of sire evaluation for first lactation traits showed that all the methods are equally efficient to rank the sires for these traits.

Key Words: BLUP, Rank correlation, Lactation trait, Sahiwal

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INTRODUCTION

The effectiveness of sire evaluation is the backbone of any breed improvement programme. This investigation was planned to evaluate Sahiwal sires as its performance is remarkable in hot climate and has been recognized worldwide as one of the best milch breed (Ilatsia et al., 2011). Various sire evaluation methods viz. daughter's average, least-squares analysis and best linear unbiased prediction (BLUP) were used to evaluate the sires and their effectiveness were compared for Sahiwal cattle. The information on the production of first lactation is mainly required for getting genetic improvement through selection since it serves as an index of life time production in dairy cows. Therefore, it is very much essential for the sire evaluation to correlate the first lactation milk yield with life time milk production. So, the daughter's standard first lactation traits are suggestive to improve the overall lifetime productivity.

MATERIALS AND METHODS

The data for the present investigation were collected over a period of 71 years (1944-2014) of 1367 Sahiwal cows born to 112 sires maintained at Government Livestock Farm, Chak Ganjaria, Lucknow. Only the sires having the records on at least three or more daughters were included in the present study. The standard procedures for estimation of breeding value of sires by daughter's average ( ), least squares method (LSM) and Best Linear Unbiased Prediction (BLUP) was used for age at first calving, first lactation length, first dry period, first calving interval and first service period.

After estimation of breeding value of sires the sires were given rank as per their genetic merit. The Spearman's rank correlation between breeding values of sires derived by various methods was used to judge the effectiveness of different methods. The rank correlation was estimated as per methods developed by Steel and Torrie (1960). The significance of rank correlation was estimated by t-test. The simple product moment correlations (r) between the estimated breeding values of bulls by different sire evaluation methods were also calculated.

RESULTS AND DISCUSSION

The estimates of rank correlations and product moment correlation for breeding value of first lactation traits by different methods of 112 sires is depicted in table 1. The rank correlation between the sires evaluated by various methods were very high and ranged from 0.74 (and BLUP) to 0.92 (LSM and BLUP) for FLMY, 0.61 (LSM and) to 0.83 (LSM and BLUP) for FLL and 0.63 (and LSM) to 0.98 (LSM and BLUP) for AFC; all these values were highly significant (P<0.01) . These results revealed that ranking of sires using any one of these method could result in similar ranking ranging from 72 to 93 per cent for FLMY and 59 to 88 per cent for FLL and 63 to 98 per cent for AFC. The correlation coefficients between other first lactation traits evaluated by different methods reported as 0.07 (and LSM), 0.56 (and BLUP) and 0.79 (BLUP and LSM) for FCI; whereas, 0.08 (LSM and), 0.40 (and BLUP) and 0.92 (LSM and BLUP) for FDP.Similar to the present findings, Raheja (1992), Sahana (1996), Gaur and Raheja (1996), Singh and Singh (1999), Dhaka and Raheja (2000), Gaur et al. (2001), Dubey (2004), Mukherjee (2005) and Banik and Gandhi (2006)reported high rank correlations between LSM and BLUP method and suggested that these methods were more or less similar in ranking of dairy sires for first lactation milk yield.In the present investigation, least- squares method is equally efficient for ranking of

sires as BLUP

The estimates of correlation were ranged from 0.72 (and BLUP) to 0.93 (LSM and) for FLMY, 0.59 (LSM and) to 0.88 (and BLUP) for FLL and 0.68 (and LSM), to 0.98 (LSM and BLUP) for AFC and all these values were highly significant (P<0.01). The correlation coefficients between other first lactation traits evaluated by different methods were reported to be very low and non-significant 0.24 (and LSM) to highly significant 0.82 (BLUP and LSM) for FCI and -0.09 (LSM and) to 0.61 (and BLUP) for FDP. These findings indicated that in almost all the first lactation traits ranking of sires by and LSM had similarity and lower to highly significant correlation which was moderately over and above the BLUP method.Singh and Singh (1999) Banik (2004) and Banik and Gandhi (2007) reported higher simple correlation coefficients of least-squares with BLUP with their values being 0.967 and 0.850 respectively, while Deulkar and Kothekar (1999) found comparatively smaller value (0.64) of simple correlation between LSM and BLUP method. Similarly, Singh and Singh (1999) and Banik and Gandhi (2006) found BLUP method had high and significant product moment correlation than LSM.

The breeding values of 112 Sahiwal sires with three or more daughters were estimated for the first lactation traits viz. AFC, FLMY, FLP, FDP, FCI and FSP by applying three sire evaluation methods i.e. simple daughter's average ( ), least- squares method (LSM) and BLUP. The highest overall breeding value for AFC (1299.54 days) was obtained by daughter's average and lowest breeding value (1281.25 days) was obtained by BLUP method. The highest overall breeding value for FLMY (1941.16 kg) was obtained by least-squares method and lowest breeding value (1711.63 kg) was obtained by daughter's average method. The highest overall breeding value for FLP (321.60 days) was obtained by least-squares method and lowest breeding value (313.70 days) was obtained by BLUP method. The highest overall breeding value for FDP (207.60 days) was obtained by daughter's average and

Table 1. Centromeric index and arm ratio of sub-metacentric chromosomes of Paralakhemundi and Crossbred buffaloes

First Lactation Milk Yield (FLMY)			
Methods	**$\overline{D}$**	**LSM**	**BLUP**
$\overline{D}$	1.0	0.88**	0.74**
LSM	0.93**	1.0	0.92**
BLUP	0.72**	0.88**	1.0
First Lactation Length (FLL)			
Methods	**$\overline{D}$**	**LSM**	**BLUP**
$\overline{D}$	1.0	0.61**	0.80**
LSM	0.59**	1.0	0.83**
BLUP	0.88**	0.79**	1.0
First Calving Interval (FCI)			
Methods	$\overline{D}$	LSM	BLUP
$\overline{D}$	1.0	0.07	0.56**
LSM	0.24	1.0	0.79**
BLUP	0.67**	0.82**	1.0
First Dry Period (FDP)			
Methods	$\overline{D}$	LSM	BLUP
$\overline{D}$	1.0	0.08	0.40**
LSM	-0.09	1.0	0.92**
BLUP	0.61**	-0.27	1.0
Age at First Calving (AFC)			
Methods	$\overline{D}$	LSM	BLUP
$\overline{D}$	1.0	0.63**	0.67**
LSM	0.68**	1.0	0.98**
BLUP	0.73**	0.98**	1.0

$\overline{D}$ = Daughter's Average, LSM = Least-Squares Method, BLUP = Best Linear Unbiased Prediction
** Significant at 1% level

Table 2. Rank of Top 10 Sahiwal sires for their estimated breeding values (EBVs) for FLMY and Life-time traits

	FLMY			LTMY			LTLL		
Rank	$\overline{D}$	**LSM**	**BLUP**	$\overline{D}$	**LSM**	**BLUP**	$\overline{D}$	**LSM**	**BLUP**
					SIRE CODE				
1	52	52	52	18	18	18	18	18	73
2	9	18	9	7	7	87	73	73	18
3	7	7	18	38	38	73	8	8	112
4	2	9	7	73	73	112	112	112	87
5	18	38	87	52	52	92	19	19	92
6	48	2	94	48	48	38	25	25	88
7	38	51	54	9	9	88	60	60	24
8	51	48	38	60	60	56	77	77	60
9	31	54	26	31	31	94	87	87	8
10	26	26	88	112	112	7	24	24	55

$\overline{D}$ = Daughter's Average, LSM = Least-Squares Method, BLUP = Best Linear Unbiased Prediction
FLMY = First Lactation Milk Yield, LTMY = Lifetime Milk Yield, LTLL = Lifetime lactation length

lowest breeding value (194.46 days) was obtained by BLUP method. The highest overall breeding value for FCI (524.25 days) was obtained by daughter's average and lowest breeding value (508.56 days) was obtained by BLUP method. The highest overall breeding value for FSP (240.61 days) was obtained by daughter's average and lowest breeding value (225.28 days) was obtained by BLUP method. So, the estimated breeding values of sires for first lactation traits by different methods of sire evaluation showed a large genetic variation between sires. Considering first lactation milk as principal first lactation trait in this study, five sires (Sire code 7, 9, 18, 26 and 52) were present in top ten sires on the basis of estimated breeding values from FLMY in all the three methods of sire evaluation table 2.

Breeding values of 112 Sahiwal sires having three or more daughters were estimated for lifetime traits viz. LTMY, LTLL applying three different methods ((, LSM and BLUP) of sire evaluation. The average breeding value of sires for LTMY was 8803.58 kg, 9262.50 kg and 9815.95 kg, respectively, using , LSM and BLUP methods of sire evaluation. Whereas, the average breeding value for lifetime lactation length was 1543.20 days, 1534.28 days and 1547.30 days, respectively, using , LSM and BLUP methods of sire evaluation. So, the estimated breeding values of sires for lifetime traits by different methods of sire evaluation showed a large genetic variation between sires. Considering, LTMY as principal lifetime trait in this study, five sires (Sire code 7, 18, 38, 73 and 112) were present in the list of top ten sires on the basis of estimated

Table 3. Percent of common sires in top ten sires with respect to different method of sire evaluation for FLMY and Life-time traits

Traits			FLMY			LTMY			LTLL	
	Methods	$\overline{D}$	**LSM**	**BLUP**	$\overline{D}$	**LSM**	**BLUP**	$\overline{D}$	**LSM**	**BLUP**
FLMY	$\overline{D}$	1.0	0.9	0.6	0.70	0.70	0.30	0.10	0.10	0.10
	LSM		1.0	0.70	0.60	0.60	0.30	0.10	0.10	0.10
	BLUP			1.0	0.50	0.50	0.60	0.20	0.20	0.30
LTMY	$\overline{D}$				1.0	1.0	0.50	0.40	0.40	0.40
	LSM					1.0	0.50	0.40	0.40	0.40
	BLUP						1.0	0.40	0.40	0.60
LTLL	$\overline{D}$							1.0	1.0	0.70
	LSM								1.0	0.70
	BLUP									1.0

D = Daughter's Average, LSM = Least-Squares Method, BLUP = Best Linear Unbiased Prediction
FLMY = First Lactation Milk Yield, LTMY = Lifetime Milk Yield, LTLL = Lifetime lactation length

breeding values from LTMY in all the three methods of sire evaluation table 3.

The rank correlation coefficients and product moment coefficient between the sires evaluated by various methods were very highly significant (P<0.01) for first lactation milk yield, first lactation length and age at first calving. The comparison of different method of sire evaluation for first lactation traits showed that least-squares method is equally efficient for ranking of sires as BLUP for first lactation milk yield, first lactation length and age at first calving.

REFERENCES

Banik S. 2004. Sire evaluation in Sahiwal cattle. Ph.D. Thesis, NDRI Deemed University, Karnal, India.

Banik S. and Gandhi RS. 2006. Animal model versus conventional models of sire evaluation in Sahiwal cattle. Asian Australasian Journal of Animal Science19: 1225-1228.

Banik S and Gandhi RS.2007. Effectiveness of DFREML versus conventional methods of Sahiwal sire evaluation. Indian Journal of Animal Science 77: 1143-1147.

Deulkar PB and Kothekar MD. 1999. Sire evaluation considering first lactation yield for improvement of lifetime production in Sahiwal. Indian J. Anim. Sci., 69: 240-242.

Dhaka SS and Raheja KL. 2000. A comparison of sire evaluation methods. Indian Journal of Animal Science70 : 643-644.

Dubey PP. 2004.Comparison of different sire evaluation methods in dairy cattle. M.Sc. Thesis, G.B. Pant University of Agriculture and Technology, Pantnagar, India.

Gaur GK and Raheja KL. 1996. Comparison of sire evaluation procedures and relationships between estimates of sires breeding value for production traits in Sahiwal. Indian Journal of Animal Science 66 : 735-737.

Gaur GK,Tripathi VN, Mukherjee S and Chaudhary VK. 2001. Efficiency of sire evaluation procedures in Frieswal cattle. Indian Journal of Veterinary Research 10: 1-6.

Ilatsia ED,Roessler R,Kahi AK,Piepho HP and Zarate V. 2011.Production objectives and breeding goals of Sahiwal cattle keepers in Kenya and implication for a breeding programme.Tropical Animal Health and Production. DOI 10.1007/s11250-011-9928-8

Mukherjee S. 2005. Genetic evaluation of Frieswal cattle. Ph.D. Thesis, NDRI Deemed University, Karnal, India.

Raheja KL. 1992. Comparison of progeny testing of Sahiwal sires by the different methods of sire evaluation. Indian Journal of Dairy Science 45: 64-69.

Sahana G. 1996. Effectiveness of sire evaluation methods for milk production alongwith auxiliary traits vis-à-vis other methods in crossbred cattle.Ph.D. Thesis, National Dairy Research Institute (Deemed University), Karnal, India.

Singh PK and Singh BP. 1999. Efficacy of different methods in genetic evaluation of Murrah sires. Indian Journal of Animal Science 69: 1044-1047.

Steel RGD and Torrie JH. 1960. Principles and Procedure of Statistics with Special Reference to the Biological Sciences. McGrew Hill Book Company Inc, New York, 550.