Evaluation of sires using different sire evaluation methods in Sahiwal cattle

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ABSTRACT

The performance records of 927 Sahiwal cattle daughters of 72 sires maintained during 1978 to 2007 at State Livestock Farm Chak Ganjaria, Lucknow were used to evaluate sire for first lactation and life time traits. The traits included were first lactation milk yield, first dry period, first calving interval, first service period and life time milk yield. The breeding values of sire were estimated by two methods viz. least squares and best linear unbiased prediction methods. The estimated breeding values (EVB'S) showed large genetic variation between sires for all the traits under study. The ranks of sires for different traits revealed that 4-5 % top sires had similar rank for all the traits. The Best Linear Unbiased Prediction (BLUP) method using single trait viz. first service period (FSP) , first dry period (FDP), first calving interval (FCI), first lactation milk yield (FLMY) and life time milk yield (LTMY) is having lowest error variances as compare to the least squares method (LSM) this indicates that BLUP is the most efficient sire evaluation method.

Keywords: Breeding value, first lactation milk yield, lifetime milk yield, genetic variation

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INTRODUCTION

The primary objective of animal breeder is to maximize genetic improvement in economically important traits, which can be achieved through proper selection and utilization of breeding system. Selection for enhancing milk production in dairy animals has been practiced for many years because of economic importance. For bringing about over all genetic improvement in production, reproduction and growth traits of dairy cattle; the selection in females has limited scope due to in sufficient number of replacement stock. On the contrary, intensive selection can be practiced in case of males, as a few males are required for breeding purpose (Robertson and Randel, 1954).

The selection of the superior sires with maximum accuracy is also of utmost importance for any breed improvement programme. An early and accurate appraisal is essential for maximum genetic gain for computation of breeding value of sire. The various methods based on simple average, daughter dam comparison, herd mate comparison, daughter contemporary herd comparison to highly complicated, Derivative-Free Restricted Maximum Likelihood (DFREML) could be used to evaluate sires for a single traits i.e. milk yield (Meyer, 1998). The main object of this study was to obtain an accurate, efficient sire evaluation method and ranking of sires according to their merit to enable the breeder to choose the best bull.

MATERIALS AND METHODS

The performance records of 927 Sahiwal cattle daughters of 72 sires, maintained at State Livestock Farm Chak Ganjaria, Lucknow, during 1978 to 2007 were used to estimate sire breeding value for first lactation traits. Cows with abnormal and incomplete records were excluded from the study. Each year was divided into four seasons viz. summer (April – June), rainy (July – September), autumn (October – December) and winter (January – March) based on climatological conditions. The period of calving was divided into 6 period on the basis of period in which their first daughter was born. First lactation and life time traits included in this study were first service period (FSP), first dry period (FDP), first calving interval (FCI), first lactation milk yield (FLMY) and life time milk yield (LTMY).

Breeding values of sires for first lactation traits were estimated by least squares method as described by Harvey (1990) and Best linear unbiased prediction (BLUP) method as proposed by Henderson (1973). The effectiveness of different sire evaluation methods was judged by within sire variance (error variance). The method having lowest error variance showed higher efficiency and was considered most appropriate. The efficiency of other methods relative to the most efficient method under the present study was calculated as.

$$\text{Relative efficiency of a method (\%)} = \frac{\text{Error variance of most efficient method}}{\text{Error variance of any other method}} \times 100$$

RESULTS AND DISCUSSION

Estimated breeding value of sires by least squares and best linear unbiased prediction methods for first lactation and life-time traits are given in table 1. The estimated overall average breeding values of sires, by LSM for first service period, first dry period, first service period, first dry period first calving interval, first lactation milk yield and life time milk yield were 248.47 days, 186.93 days, 527.56 days, 1432.30 kg and 7944.68 kg respectively.

Out of 72 sires 24 (33.33%), 7 (9.22%), 15 (20.83%), 18 (25.0%) & 30 (41.67%) were having values above the average breeding values while 58 (66.67%), 65 (90.28%),

57 (79.17%), 54 (75 %) and 42 (58.33%) sire had the below the average breeding value (Table – 2).

The estimated breeding values by BLUP method for first service period, first dry period, first calving interval, first lactation milk yield and life time milk yield were 248.47 days, 186.93 days, 527.56 day, 1432.30 kg and 7944.68 kg.

By least squares method the estimated breeding value for first service period ranged from 93.64 to 372.89 days, for first dry period 52.9 to 466.37 days, for first calving interval 394.67 to 635.51 days, for first lactation milk yield 472.92 to 2636.04 kg and for life-time milk yield 7944.68 to 10544.72 kg, respectively.

By best linear unbiased prediction method the estimated breeding value for first service period 148.74 to 305.67 days for first dry period 146.95 to 262.89 days, for first calving interval 462.92 to 585.45 days, for first lactation milk yield 1090.16 to 1772.92 kg and for life-time milk yield 7254.43 to 8956.68 kg respectively. EBV'S for sires did not showed any systematic trend for all the traits under study. The estimated breeding values of sires estimated for first lactation traits and lifetime milk yield by LSM and BLUP methods revealed that EBV'S of sire estimated by LSM showed small genetic variation in comparison to BLUP method.

In the present investigation the estimated breeding values of sires for first lactation yield and lifetime milk yield showed large variation between estimated breeding values of sires with revealed more genetic variation in the herd. Large genetic variation the estimated breeding values of sires was also observed (Dalal et al. 1999; Chandra et al. 2004; Dahiya et al. 2005; Dubey et al. 2006; Moges et al. 2009; Singh and Singh, 2011).

There were changes in the rank of first few top sires by different methods of sire evaluation. The results of present investigation reveal that all sires would not rank same for all the traits. However, the rank of sires for different traits revealed that 4-5% of top sires almost had similar ranks for all the traits under study. Sires of top 10 ranks on the basis of EBV'S of sires for first lactation traits and lifetime milk yield are presented in Table- 3. The result revealed that the ranks for all the sires are not similar for all the traits. Similar results were also reported in different studies (Pundir and Raheja, 1994; Deul kar and Kathekar, 1999; Dalal et al. 1999, Chander et al. 2004; Dahiya et al. 2005; Dubey et al. 2006; Singh and Singh, 2011).

Top 10 sires ranked on the basis of FSP revealed that sire 64 ranked 1st followed by sire, 21, 61 ,56, 57, 60, 5, 51 & 31. While under BLUP method, sire 37 ranked 1st position followed by 12, 31, 21, 61, 64, 59, 5, 51 & 49. Sire ranked on the basis of FDP revealed that sire 20 occupied 1st position by LSM. While under BLUP method sire 52 ranked first, sire ranked on the basis of FCI revealed that sire 21 ranked 1st under LSM under BLUP method sire ranked 37 ranked 1st sire ranked on the basis of FLMY observed that the sire 13 ranked 1st under LSM. While under BLUP method sire 69 ranked 1st. Sires ranked on the basis of LTMY revealed that sire 59 ranked 1st under LSM. While under BLUP method sire 69 ranked 1st. The error variances of breeding values of sires were calculated and used in the computing the relative efficiency by BLUP and least squares method. The sire evaluation method, which estimated the breeding values of sires with the least error variance was taken as the best and most efficient method. In the present investigation, the BLUP using single trait viz. FSP, FDP, FCI, FLMY and LTMY were having lowest error variances as compared to the least squares method (LSM). On the basis of the results in the present study BLUP was considered as the most efficient method of sire evaluation. Various workers also described BLUP method is the most efficient than the other methods (Taneja and Rai, 1990; Raheja, 1992; Singh and Singh, 1999: Tailor et al. 2000; Dahiya et al. 2005; Bajetha, 2006; Moges et al. 2009; Singh and Singh. 2011).

Table 1. Average breeding value estimates and genetic variation for first lactation traits and life-time milk yield by least squares and BLUP Methods

Traits	Sire evaluation method	Average breeding value	Minimum breeding value	Maximum breeding value	Numbers of value sires above average breeding	Number of sires below average breeding value
FSP	LS	248.47	93.64	372.89	39 (54.17)	33 (45.83)
	BLUP	248.47	184.74	305.67	24 (33.33)	58 (66.67)
FDP	LS	186.93	52.9	466.37	40 (155.56)	32 (44.44)
	BLUP	186.93	146.95	262.89	7 (9.72)	65 (90.28)
FCI	LS	527.56	394.67	655.51	11 (15.23)	61 (84.72)
	BLUP	527.56	462.92	585.45	15 (20.83)	57 (79.17)
FLMY	LS	1432.30	472.92	2636.04	35 (48.61)	37 (51.39)
	BLUP	1432.30	1090.16	1772.94	18 (25.0)	54 (75.01)
LTMY	LS	7944.68	5114.94	10544.72	33 (45.83))	39 ()54.17
	BLUP	7944.68	7254.43	8956.68	30 (41.67)	42 (58.33)

Table 2. Sires of top 10 ranks on the basis of estimated breeding values of sires for first lactation and life-time traits under least-squares and BLUP methods

Rank	Least square (Sire number)					BLUP (sire number)				
	FSP	FDP	FCI	FLMY	LTMY	FSP	FDP	FCI	FLMY	LTMY
1.	64	20	21	13	59	37	52	37	69	69
2.	21	21	64	69	69	12	49	12	27	59
3.	61	46	61	72	13	31	20	21	58	71
4.	59	52	59	70	71	21	21	31	13	53
5.	56	19	57	38	63	61	27	61	38	27
6.	57	2	56	58	60	64	10	5	53	11
7.	60	27	60	53	58	59	19	64	59	39
8.	5	9	51	60	28	5	37	51	50	22
9.	51	4	5	48	72	51	46	49	72	20
10.	31	28	45	63	57	49	35	59	18	52

The present study indicated that estimated breeding values (EVB'S) showed large genetic variation between sires for all the traits under study. The ranks of sires for different traits revealed that 4-5 % top sires had similar rank for all the traits. The EBV's of sire revealed that BLUP method showed small genetic variation in comparison to Least Squares method. Because of its desirable properties, the BLUP method may be considered to be more appropriate than that of Least Squares method.

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