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CONTENTS

Estimation of breeding value of sires using first lactation traits by BLUP method in crossbred cattle

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ABSTRACT: The present investigation was carried on crossbred cattle maintained at Instructional Dairy Farm, Nagla of G.B. Pant University of Agriculture and Technology, Pantnagar. The study was conducted on 700 crossbred cattle, progeny of 68 sires which were born over a period of 28 years from 1990-2017. The sires were evaluated for first lactation traits namely Age at First Calving (AFC), First Lactation Milk Yield (FLMY), First Lactation Period (FLP), First Dry Period (FDP), First Calving Interval (FCI), First Service Period (FSP) and First Lactation 305 Day Milk Yield (FL305DMY) on the basis of analysed breeding value using univariate animal model i.e., BLUP (Best Linear Unbiased Prediction). Of late, the sires having different level of exotic inheritance were ranked on the basis of estimated breeding value. The average value of AFC, FLMY, FLP, FDP, FCI, FSP and FL305DMY observed in the present study were 1180.53 days, 2861.30 kg, 326.14 days, 124.15 days, 450.56 days, 261.33 days and 2615.9 kg, respectively. The minimum and maximum breeding values estimated for the respective traits were 1111.48 to 1245.82 days for AFC, 2530.32 to 3282.84 kg for FLMY, 301.86 to 345.44 kg for FLP, 104.49 to 145.62 days for FDP, 421.91 to 476.10 days for FCI, 248.79 to 268.88 days for FSP and 2392.69 to 2939.84 kg for FL305DMY. Taken into consideration the estimated average breeding value of different sires, the crossbred bulls were ranked for different first lactation traits and top ten sires according to traits of interest were recommended for selection and utilization in improvement programmes.

Key words: BLUP, breeding value, crossbred cattle, first lactation traits

Selection is an ongoing process since the domestication of farm animals. The major break-through occurred in the mid 20thcentury with the advancement of quantitative genetics and modern statistical theory (Hazel, 1943). Due to low genetic base for lactation yields, the improvement by the means of selection has not been very efficient to the desired level. The selection in female has limited scope due to insufficient 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. The selection of the superior sires with maximum accuracy is also importance for any breed improvement programme. Genetic progress in economic characters remains the sole objective of the dairy cattle breeding since most of the traits of economic importance are polygenic in nature (Lodhi *et al*, 2016).

Henderson (1973)developed a methodology called Best Linear Unbiased Prediction (BLUP) for estimation of breeding values, by which fixed effects and breeding values can be simultaneously estimated. It maximizes the correlation between true and predicted breeding values or minimizes prediction error variance (PEV), and estimation of realized values for a random variable, such as animal breeding values, and of estimable functions of fixed effects are unbiased. BLUP has found widespread usage in genetic evaluation of domestic animals because of its desirable statistical properties. This has been enhanced by the steady increase in computing power and has evolved in terms of its application to simple models, such as the sire model, in its early years, and to more complex models, such as the animal, maternal, multivariate and random regression models, in recent years.

Several methods of sire evaluation have been used among which BLUP is an extensively used method. The evaluation of sire's expected breeding value or transmitting ability to its descendants enables the breeders to choose the best bull among its contemporaries to be used for subsequent

improvement of the herd.Considering all these facts, the present investigation was undertaken utilizing the first lactation records of crossbred cattle for estimation of breeding value of sires.

MATERIALS AND METHODS

Data on 700 cows sired by 68 sires, spread over a period from 1990-2017 and maintained at Instructional Dairy Farm(IDF), Nagla of G.B. Pant University of Agriculture and Technology, Pantnagar, taken from history sheets were utilized. The abnormal records due to different reason viz., abortion, pre-mature birth and other reproductive disorders were not considered in the present investigation. Standard managemental practices include housing, milking, health coverage, feeding regime, breeding policy, and other managemental practices followed at the farms. The crossbreeding at IDF, Nagla was started in 1968 by adopting AI of Sahiwal and Rathi cows with the bulls of exotic breeds *viz.*, Holstein Friesian, Red Dane or Jersey. The efforts have been made to maintain the exotic inheritance level less than 62.5 percent.The data were categorized according to seven different genetic groups, three seasons namely summer (March-June), rainy (July - October) and winter (November - February) and period on the basis of date of firstcalving in seven different periods.The sires were evaluated on the basis of breeding value for AFC, FLMY, FLP, FDP, FCI, FSP and FL305DMY using BLUPF90 Dairy pack version 2.0 (Misztal *et al*., 2004) software of Henderson (1973). Since, non-orthogonal in nature with unequal subclass numbers, they were subjected to least squares analysis of variance without interactions using different models to examine the effect of genetic and non-genetic factors on various first lactation traits as per standard procedure of Harvey (1990). This model was based on assumption that different components fitting in the model were linear, independent and additive, while sire was treated as random effect, the other genetic and non-genetic factors (genetic group, season and period) were taken as fixed effect in the model.

RESULTS AND DISCUSSION

The sires were evaluated using Best Linear Unbiased Prediction (BLUP) the univariate animal model. The first lactation traits viz. AFC, FLMY, FLP, FDP, FCI, FSP and FL305SMY were considered for evaluating the sire for milk production. The sires were ranked on the basis of breeding values obtained by BLUP according to different traits. The average, minimum and maximum breeding values and percentage of sires above and below average breeding value are given in Table 1.

The overall mean value of AFC, FLMY, FLP, FDP, FCI, FSP and FL305DMY traits were 1180.53, 2861.30, 326.14, 124.15, 450.56, 261.33 and 2615.90, respectively. The percentage of sires superior to the population mean was 51.47, 48.53, 55.88, 52.94, 52.94, 57.35 and 57.35 for AFC, FLMY, FLP, FDP, FCI, FSP and FL305DMY traits, respectively.

The breeding values of top ten sires on the basis of first lactation traits computed by BLUP method are presented in Table 2. The estimation of breeding value of different sires and ranking them on the basis of estimated breeding values by BLUP method is recommended for selection and utilization of best

Table 1: Average Breeding Values (B.V.) of crossbred sires for first lactation performance traits by BLUP method

Traits	Average B.V.	Min. B.V(% below average B.V.)	Max. B.V(% above average B.V.)	No. of sires over the average B.V.(% of sires)	No. of sires below the average B.V.(% of sires)
AFC (days)	1180.53	1111.48 (5.58)	1245.82 (5.53)	35 (51.47)	33 (48.53)
FLMY (days)	2861.30	2530.32 (11.56)	3282.84 (14.73)	33 (48.53)	35 (51.47)
FLP (days)	326.14	301.86 (7.44)	345.44 (5.92)	38 (55.88)	30 (44.12)
FDP (days)	124.15	104.49 (15.84)	145.62 (17.29)	36 (52.94)	32 (47.06)
FCI (days)	450.56	421.91 (6.36)	476.10 (5.67)	36 (52.94)	32 (47.06)
FSP (days)	261.33	248.79 (4.50)	268.88 (2.89)	39 (57.35)	29 (42.65)
FL305DMY (days)	2615.90	2392.69 (8.53)	2939.84 (12.42)	39 (57.35)	29 (42.65)

Table 2: Sires of top 10 ranks on the basis of estimated Breeding Values (B.V.) of sires for first lactation traits

S.No.	Rank	AFC	FLMY	FLP	FDP	FCI	FSP	FL305DMY
1	1	142	134	149	115	115	121	134
2	2	130	121	111	160	145	168	121
3	3	119	149	160	136	154	130	105
4	4	106	105	109	154	107	143	136
5	5	145	136	120	101	128	155	167
6	6	133	110	134	107	163	145	148
7	7	107	138	155	122	137	123	110
8	8	140	148	140	163	136	111	138
9	9	138	109	121	145	101	102	149
10	10	135	120	133	110	156	112	125

sire in any breed improvement programme. Similar studies were also carried out by Singh *et al.* (2001),Kathiravaran (2009), Raja (2010), Shahi and Kumar (2010)and Singh (2015).

BLUP method of sire evaluation along with other methods was also used by Gaur *et al*. (2001), Dahia *et al*. (2002), Bajetha (2006) and Dubey *et al*. (2006) Girimal *et al*., (2022) in Sahiwal, Lodhi *et al*., (2016)in crossbred, Nehra *et al.* (2017) in Rathi cattle and found that BLUP best method of sire evaluation.

CONCLUSION

The estimation of breeding values of different sires and ranking them on the basis of estimated breeding values by BLUP method is recommended for selection and utilization of best sire in any breed improvement programme.

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