Evaluation of breeding values of Hariana bulls under organized farms

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ABSTRACT

Best linear unbiased prediction (BLUP) procedure was used to evaluate the breeding value of 33 Hariana bulls (used in 4 sets) on the basis of their daughters first lactation milk yield, maintained at Germplasm unit, CCS Haryana Agriculture University, Hisar, Government Livestock Farm (GLF), Hisar; Kurukshetra Gaushala, Hisar, Bhiwani Gaushala and Jind Gaushala and calved during 1992 to 2005 were utilized for present study. The breeding values of bulls of different sets varied from 840.82 to 901.75 kg in first set, from 827.56 to 891.60 kg in second set, from 876.68 to 927.56 kg in third set and from 834.05 to 880.53 kg in fourth set. The highest breeding value was observed for sire numbers 67–A (927.56 kg) followed by 45–A (923.21 kg) and 47–A (921.10 kg) of third set and their superiority over the herd average ranged between 46.52 and 52.98 kg (5.31 to 6.05%). It indicated genetic progress over different sets of bulls, as bulls of third set were superior to first and second sets. However, performance of fourth set bulls slightly declined.

Key words: Best Linear Unbiased Prediction, Breeding value of bulls, Cattle, Hariana breed, First lactation milk yield, Haryana Agricultural University

Breed improvement program can not succeed unless genetically superior sires are identified and used to bring about genetic improvement of the breed (Nehra *et al* 2003). Over the times various methods have been used for sire evaluation, Henderson's (1973) mixed model or best linear unbiased prediction (BLUP) procedure has become the method of choice for evaluating the genetic worth of the bulls.

BLUP is one of the accurate sire evaluation methods to obtain unbiased estimates of breeding values of sires (Mukherjee *et al*. 2007).

Young progeny tested ranked Hariana bulls are being used in nominated mating for production of future young bulls and genetic improvement in milk production. The present study was, therefore, undertaken to estimate the breeding value of Hariana bulls on the basis of their daughters first lactation milk yield, executed in different sets, using BLUP procedure and to rank them according to their superiority over herd average for their future use in nominated mating for production of future bull calves.

MATERIALS AND METHODS

The Hariana bulls in 4 sets (9, 8, 7 and 9 bulls) were inducted for progeny testing at Germplasm Unit, CCS

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Haryana Agricultural University Hisar; Government Livestock Farm (GLF), Hisar; Kurukshetra Gaushala Hisar; Bhiwani Gaushala and Jind Gaushala during 1987, 1992, 1995 and 1997. The daughters of first 4 sets have completed their first lactation records. The first lactation records of 533 daughters of 33 bulls calved during 14 years from 1992 to 2005, were used for this study. The period of 14 years was divided into 3 periods i.e. 1992–96, 1997–01 and 2002–05. Each year of calving was further classified into 3 seasons, viz. winter (November to February), summer (March to June) and rainy (July to October) based on climatological conditions. Bulls' breeding values were estimated through best linear unbiased prediction (BLUP) procedure using suitable option in least squares and maximum likelihood computer package (Harvey 1990). The bulls were ranked on the basis of their breeding value and considering superiority over the herd average was also estimated. The heritability estimate of total lactation milk yield used in BLUP analysis was assumed to be 0.28. The following model was used for analysis:

$$Y_{ijklmn} = \mu + ST_i + SR_{ij} + PE_k + SN_l + FA_m + b(A_{ijklmn} - \hat{A}_{ijklmn}) + e_{ijklmn}$$

where, Y_{ijklmn} observation on nth daughter of jth sire within ith set belonging to kth period of calving, lth season of calving and mth farm, μ, overall mean, ST_i, fixed effect of ith set, SR_{ij}, random effect of jth sire within ith set, PE_k, fixed effect of kth period of calving, SN_l, fixed effect of lth season of calving, FA_m, fixed effect of mth farm, b, regression of total first lactation milk yield on age at first calving, A_{ijklmn},

observation on age at first calving, $-\hat{A}_{ijklmn}$, average age at first calving, and e_{ijklmn}, random residual error.

RESULTS AND DISCUSSION

The overall least squares mean of total first lactation milk yield (Table 1) was, however, lower than that reported by Pundir and Raheja (1994) and Dahiya et al. (2005) in Hariana cattle, and their values ranged between 998 and 1540 kg. The effect of seasons and period of calving were significant on first lactation milk yield. The cows calved during rainy season (July to October) produced highest quantity of milk (939.30 kg) followed by those calved in winter (853.54 kg) and summer (830.89 kg) seasons. Varshney and Tomar (1982) also observed significant effect of farm, season and year of calving on first lactation milk yield in Hariana cows whereas Swami el al. (2005) observed nonsignificant effect of season of calving on milk yield in Hariana cattle. The cows maintained at Gaushala Jind, produced highest quantity of milk yield (893 kg) followed by those maintained at GLF, Hisar (875 kg). The first lactation milk yield increased over the periods from 808.79 kg in first period (1992–96) to 928.46 kg in third period (2002–05). Set and farm had no effect on first lactation milk yield. The milk yield was highest in third set as compared to former sets. The information on bulls along with their breeding values is given in Table 2. The breeding value of different bulls varied 840.82 to 901.75 kg in first set, 827.56 to 891.60 kg in second set, 876.68 to

927.56 kg in third set and 834.05 to 880.53 kg in fourth set. The highest breeding value was observed for sire no. 67–A followed by 45–A and 47–A of third set.

All the bulls executed in set 3 exceeded over herd average with respect to breeding value. Bull number 67–A had the highest superiority (52.98 kg i.e. 6.05%) over herd average followed by 45–A (48.63 kg i.e. 5.56%) and 47–A bull (46.52 kg i.e. 5.31%). Dalal et al. (1999) reported breeding value in Hariana bulls between–34 and 523 kg (deviated from herd average) and showed large variation among sires for first lactation traits. Dahiya et al. (2005) reported 998 kg breeding value of Hariana bulls based on BLUP method and he also observed that BLUP was the best method of sire evaluation having the lowest error variance. The estimated breeding

Table 1. Least squares means of first lactation milk yield (FLMY)

Factors	Number of observations	FLMY (kg)
Overall (μ)	533	874.58±21.12
Set of bulls		
1	191	876.62±33.30
2	104	857.93±46.24
3	119	904.08±9.81
4	119	859.69±48.96
Farm		
Germ Plasm Unit, Hisar	103	864.24±32.57
Govt. Livestock Farm, Hisar	79	875.45±42.57
Kurukshetra, Gaushala	141	873.21±32.98
Gaushala, Bhiwani	69	866.84±45.69
Gaushala, Jind	107	893.16±37.64
Season of calving		**
Winter	220	853.54[a]±27.88
Summer	194	830.89[a]±28.49
Rainy	119	939.30[b]±34.96
Period of calving		**
1 (1992–96)	96	808.79[a]±48.14
2 (1997–01)	266	886.49[b]±26.51
3 (2002–05)	171	928.46[c]±38.40

** Significant P < 0.01; Values with different superscript differ significantly.

Table 2. Breeding values of Hariana bulls based on first lactation milk yield of their daughters

	Factors	Number of daughters	Breeding value (kg)	Rank	Superiority over the herd average (kg)
	μ	533	874.58		
Set 1	Sire number				
	1-A	16	874.42	18	-0.16 (-0.01%)
	2-A	18	890.36	9	15.78 (1.80%)
	3-A	14	882.56	10	7.98 (0.91%)
	42–H	25	896.24	6	21.66 (2.47%)
	58–H	23	840.82	29	-33.76 (- 3.86%)
	94–MD	16	901.75	5	27.17 (3.10%)
	104–MD	43	875.84	17	1.26 (0.14%)
	227–MD	18	867.05	19	-7.53 (-0.86%)
	229–MD	18	860.53	24	-14.05 (-1.60%)
2	101-MD	11	843.64	28	-30.86 (-3.52%)
	213–MD	21	879.72	14	5.14 (0.58%)
	216–MD	17	827.56	33	-47.02 (-5.37%)
	241-MD	11	891.60	8	17.02 (1.94%)
	24–A	8	860.96	23	-13.62 (-1.55%)
	25–A	8	865.35	20	-9.23 (-1.05%)
	26–A	12	838.32	30	-36.26 (-4.14%)
	27–A	16	856.33	25	-18.25 (-2.08%)
3	32–A	21	902.55	4	27.97 (3.19%)
	45–A	16	923.21	2	48.63 (5.56%)
	47–A	23	921.10	3	46.52 (5.31%)
	48–A	22	895.23	7	20.65 (2.36%)
	60–A	8	876.68	16	2.10 (0.24%)
	67–A	12	927.56	1	52.98 (6.05%)
	72–A	17	882.05	11	7.47 (0.85%)
4	73–A	5	864.74	22	-9.84 (-1.12%)
	94–A	8	837.03	31	-37.55 (-4.29%)
	100–A	24	877.44	15	2.86 (0.32%)
	109–A	13	880.53	12	5.95 (0.68%)
	118–A	14	845.51	27	-29.07 (-3.32%)
	124–A	12	852.63	26	-21.95 (-2.50%)
	132–A	17	865.24	21	-9.34 (-1.06%)
	139–A	7	834.05	32	-40.53 (-4.63%)
	145–A	19	880.02	13	5.44 (0.62%)

value ranging from–26 to 1260 kg (deviated from herd average) for 300 days milk yield was reported by Gaur and Raheja (1996) in Sahiwal bulls. Singh *et al.* (2006) observed breeding values of Ongole bulls between 486 and 568 kg. These estimates were lower to breeding value of Hariana bulls observed in the present investigation. In the present study, bulls within the set had lower variation for first lactation milk yield as compared to between sets. However, no specific trend in breeding values of the bulls was observed in relation to number of daughters. The breeding value of 5 bulls in set 1, 2 bulls in set 2, 7 bulls in set 3 and 3 bulls in set 4 exceeded over herd average, whereas 16 bulls in all sets were below the herd average. The frozen semen of top ranked bulls has been recommended for use on elite cows to produce future bulls calves for inducting in a new set (s).

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