TEST-DAY GENETIC ANALYSIS OF MURRAH BUFFALO SIRES FOR MILK PRODUCTION

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ABSTRACT

The aim of the study was to investigate efficiency of test-day model (TDM) compared to lactation model (LM) for genetic evaluation of Murrah buffalo bulls. Use of TDM instead of LM is of more interest in genetic evaluation because of variability of lactation days in dairy animals. Data pertaining to first lactation monthly test-day milk yield (FLMTDMY) and first lactation 305-days or less milk yield (FL305DMY) of 1105 Murrah buffaloes during 1993 to 2010 were collected and adjusted against significant environmental influences. It was found that test-day6 milk yield (FLMTD6MY) had the highest genetic and phenotypic correlation with FL305DMY. An attempt is being made in the present investigation to compare the estimated breeding values (EBVs) of Murrah bulls through contemporary comparison method for FL305DMY and FLMTD6MY. The rank correlations between two traits were highly statistically significant indicating that FLMTD6MY equally effective to discriminate amongst sires.

Keywords: Contemporary comparison, lactation model, least-squares, Murrah buffalo, test-day model

INTRODUCTION

India is regarded as a treasure house of world's best buffalo germplasm. Buffalo is not only a better source of milk but also provides meat and works as a draught animal. Indian buffalo contributes 17% of world milk production and 48% of Asian milk production (Food and Agriculture Organization, 2012). Among the various buffalo breeds available in India, the Murrah buffalo is the cynosure for dairy type. Murrah buffalo produces good quantity of milk and it is now well established that it represents a unique breed in terms of feed conversion ability with low grade feeds, ability to sustain under adverse climatic conditions, resistance to diseases and production of high value milk containing a higher fat per cent. Keeping the importance of buffalo in India, Network Project on Buffalo Improvement was initiated with the objective to envisage and undertake progeny testing for improvement of buffalo breeds at various farms in different parts of the country.

In India test bulls are evaluated based on their daughters first lactation 305-days or less milk yield without taking into account variation in lactation days though the variation in lactation length is reflected in persistency. Genetic evaluation of

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dairy bulls for milk production based on individual monthly test-day yields rather than 305-days or less milk yield has a number of benefits (Jamrozik and Schaeffer, 1997). Because of variability of lactation days in dairy animals, the use of test-day models (TDM) instead of lactation model (LM) is of more interest in genetic evaluation. First lactation monthly test-day6 milk yield (FLMTD6MY) had the highest genetic and phenotypic correlation with FL305DMY as obtained by Kumar *et al*. (2014). So FLMTD6MY of daughter was used in the present study. Information on test-day is lacking in Murrah buffaloes and hence, the present study was carried out.

MATERIALS AND METHODS

Source of Data

In the present study, information were collected from 7 sets of progeny testing under Network Project on Murrah buffalo Improvement. In 7 sets of progeny testing 95 (11, 12, 15, 14, 15, 16, and 12) Murrah bulls were evaluated. Lactation records of 1105 Murrah buffaloes during 1993 to 2010, were collected from the history-cum pedigree sheets and milk yield registers maintained at the National Dairy Research Institute (NDRI), Karnal; Central Institute for Research on Buffalo (CIRB), Hisar; Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana and Choudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar.

Information on Murrah buffalo

Sires were evaluated on the basis of first lactation 305-days or less milk yield (FL305DMY) and first lactation monthly test-day 6 milk yield i.e. 155th day milk yield (FLMTD6MY) in the present study. The records of the buffaloes with normal lactation were considered for this study. Data of buffaloes with a minimum of 500 kg of milk production in at least 100 days of lactation, calving and drying under normal physiological conditions were included in the analysis. The buffaloes showing abortion, dystocia and other reproductive disorders were not included in the study. To ensure the normal distribution of records, the outliers were removed and data within the range of Mean ± 3 standard deviation was only considered for the study. Hence after standardization and normalization, records of 832 Murrah buffaloes were retained for analysis.

Statistical analysis

The data were adjusted for significant non-genetic factors for buffaloes calved in different farms, years and seasons of calving using fixed linear models. Since the data was non-orthogonal, the least-squares technique suggested by Harvey (1990) was used to estimate the effect of non-genetic factors, and the means were compared using Duncan's multiple range test (Kramer, 1957). The model considered was as follows:

$$Y_{ijkl} = m + P_i + S_j + F_k + e_{ijkl}$$

where, Y_{ijkl} is the lth observation in Kth farm, jth season and ith year of calving; μ the overall mean; P_i the fixed effect of ith year of calving; S_j the fixed effect of jth season of calving; F_k the fixed effect of the kth farm; and e_{ijkl}, the random error~NID (0, $\sigma^2 e$).

After adjusting data for significant fixed effects, EBVs of Murrah buffalo bulls were estimated for FL305DMY and FLMTD6MY. In 7 sets of progeny testing 95 (11, 12, 15, 14, 15, 16 and 12) Murrah bulls were evaluated by contemporary

comparison (CC) method (Sundaresan *et al*. 1965) as follow:

where,

I: is the sire index

H: is the herd average

N: is the number of daughters of the sire

D: is the average performance of trait of daughters' of the sire

CD: is the average performance of trait of contemporary daughters

The Spearman's rank correlation method (Steel and Torrie, 1960) was used to judge the effectiveness of test-day and lactation models of sire evaluation. To compare two models, Spearman's rank correlations were estimated using ranks of bulls based on EBVs for FLMTD6MY and FL305DMY. Two models were compared for the 7 sets separately and significance of rank correlations were tested.

RESULTS AND DISCUSSION

The data were adjusted for significant non-genetic factors. In the present study FLMTDMY and FL305DMY were significantly affected by farm. EBVs of sires based on FL305DMY and FLMTD6MY were estimated by CC methods and then sires were ranked subsequently (Table 1 and Table 2). Comparison of two models of sire evaluation was done by comparing the spearman's rank correlations between ranks of sires based on EBVs for FL305DMY and FLMTD6MY. The rank correlations between corresponding ranks (Table 3) based on FL305DMY and FLMTD6MY ranged from 0.566 (in set 2) to 0.882 (in set 1). The rank correlations between two traits for sire evaluation were highly statistically significant in 5 sets of progeny testing indicating that both traits of sire evaluation were equally effective to discriminate amongst sires.

Use of test-day record is easier and advance than lactation record as in this case only one or two particular day (test-day) record is required instead of taking all day records up to 305-days of lactation. Test-day milk yields offered a better modeling opportunity and more accurate in genetic evaluation. Also, test-day milk yields in farm should be taken into consideration for selection of the buffalo for milk yield. The test-day models have been suggested as the method of choice for the analysis of milk yield traits in order to maximize the use of all available information. This method becomes even more important in smaller herd size and without well-established milk recording schemes. In fact, the test-day model appears to be a better alternate of 305-day lactation model because early selection on the basis of test-days could reduce generation interval. It could economize the genetic evaluation of dairy animals and improve accuracy of evaluation. Estimation of breeding value based on test-day milk yield would offer a solution to handle complex situation like lack of necessary infrastructure for daily milk recording and hence cost of recording could be reduced substantially.

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Table 1. Rank of sires on the basis of estimated breeding values for first lactation 305-days or less milk yield.

Set 1	Rank	Set 2	Rank	Set 3	Rank	Set 4	Rank	Set 5	Rank	Set 6	Rank	Set 7	Rank
392	4	93	8	993	10	1319	3	1485	13	1135	9	1419	8
896	3	759	3	1023	5	1341	10	1491	6	1153	1	1727	10
3098	1	761	4	1061	2	1360	4	1524	15	1667	12	1746	12
3108	2	829	1	1084	14	1363	12	1536	11	1706	11	1749	3
3117	6	1241	5	1131	3	1434	11	1555	8	1713	14	1796	1
3125	11	1253	6	1153	1	1437	5	1573	12	1717	5	2121	9
3127	10	1290	11	1165	9	1446	13	1641	5	1836	4	2133	11
3206	5	3551	2	1171	11	1451	8	1666	9	1922	8	2184	4
3294	7	3638	7	1315	7	1506	2	1749	14	1933	2	2331	5
3462	9	3689	10	1354	4	1538	14	1798	7	1944	10	2363	6
3567	8	3736	12	3865	15	4071	6	4244	3	2028	15	4807	7
		3750	9	3924	12	4090	9	4245	10	4506	6	4915	2
				3930	8	4124	1	4371	2	4523	7		
				3949	13	4188	7	4393	1	4619	3		
				3966	6			4395	4	4637	13		
										4640	16		

Table 2. Rank of sires on the basis of estimated breeding values for first lactation monthly test day-6 milk yield.

Set 1	Rank	Set 2	Rank	Set 3	Rank	Set 4	Rank	Set 5	Rank	Set 6	Rank	Set 7	Rank
392	4	93	7	993	6	1319	9	1485	15	1135	9	1419	5
896	5	759	6	1023	2	1341	6	1491	7	1153	1	1727	8
3098	3	761	4	1061	11	1360	5	1524	13	1667	8	1746	12
3108	2	829	9	1084	15	1363	14	1536	10	1706	12	1749	3
3117	6	1241	5	1131	7	1434	12	1555	5	1713	13	1796	1
3125	11	1253	3	1153	1	1437	7	1573	11	1717	2	2121	11
3127	10	1290	11	1165	3	1446	8	1641	4	1836	5	2133	9
3206	1	3551	2	1171	13	1451	4	1666	8	1922	11	2184	6
3294	8	3638	1	1315	8	1506	1	1749	14	1933	4	2331	2
3462	9	3689	8	1354	5	1538	13	1798	2	1944	14	2363	10
3567	7	3736	12	3865	14	4071	2	4244	9	2028	16	4807	7
		3750	10	3924	9	4090	10	4245	12	4506	3	4915	4
				3930	4	4124	11	4371	1	4523	6		
				3949	10	4188	3	4393	3	4619	7		
				3966	12			4395	6	4637	10		
										4640	15		

Table 3. Spearman's rank correlations for the ranks between first lactation 305-days or less milk yield and first lactation monthly test day-6 milk yield.

Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7
0.882**	0.566	0.578*	0.478	0.828**	0.862**	0.811**

* Significant at ($P < 0.05$) ** Significant at ($P < 0.01$).

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