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Analysis of Different Non genetic Factors on Production Performance Traits in Murrah Buffaloes

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A B S T R A C T

The present investigation was conducted to study the effect of various non genetic factors like farm, parity, period of calving and season of calving on different production traits like total lactation milk yield (TLMY), 305 day milk yield (305MY), peak yield (PY), milk yield per day of lactation length (MY/LL) and milk yield per day of calving interval (MY/CI) in Murrah buffaloes. The data analysed include records of 2959 buffaloes, progeny of 219 sires maintained over a period of 24 years (1992-2015) at Buffalo research centre (BRC), LUVAS, Hisar and Animal farm ICAR-CIRB, Hisar. The least squares means for TLMY, 305MY, PY, MY/LL and MY/CI were 2165.1341.55 kg, 2093.2536.16 kg, 11.010.14 kg, 6.370.059 kg and 4.260.052 kg respectively. Least squares analysis of variance indicated significant effect of parity on TLMY, 305MY and PY. The effect of period and season of calving was statistically significant on all the production traits under study except the non-significant effect of season of calving on MY/LL. Analysis of variance also revealed significant effect of farm on TLMY, PY and MY/LL. Significant effect of various non genetic factors on production traits helps to conclude the importance of lactation number, season and managemental farm activities in production performance of Murrah buffaloes.

Introduction

Buffaloes have spread over almost all parts of country with varying population density, the majority (72%) being concentrated in North and Western states. The local defined breeds are stable as well; these can survive the varieties of feed/fodder/shortage, extreme of temperature and/or prevalence of diseases. Preference for buffaloes has continued to increase due to higher fat and SNF content of milk. India is fortunate in terms of largest buffalo population, buffalo germplasm diversity (13 recognized plus 17 distinct population groups) and the world renowned buffalo breeds: Murrah, Nili-Ravi, Banni, Jaffrabadi and Mehsana. Presently India possesses about 108.70 million buffaloes (BAHS, 2013). The total livestock population has decreased by about 3.33% over the previous census (19th livestock census, 2012), while the number of animals in milk (cows and buffaloes) has increased from 77.04 million to 80.52 million showing a growth of 4.5%. Murrah breed of buffalo is considered to be the best milk-cum-meat breed. The home tract of breed is around the Southern part of Haryana comprising the districts of Rohtak, Jind, Hisar, Gurgaon and Delhi. Home tract has relatively hot and dry climate. In any breeding programme it is important to bring about the improvement in production performance traits so as to select the best performing individuals. These production performance traits were influenced by several non-genetic factors like parity, period of calving, season of calving which have significant effect on full expression of these production traits. Difference in season weather summer or winter, availability of fodder in different climatic areas and also different managemental activities of farm manager largely affect the production traits. Therefore the present investigation was conducted to study the effect various non-genetic factors on production performance traits in Murrah buffaloes.

Materials and Methods

The data for present investigation was collected from history cum pedigree sheets maintained at Buffalo Research Centre (BRC), Lala Lajpat Rai University of Veterinary and Animal Sciences and Central Institute for Research on Murrah Buffaloes (CIRB) Hisar over a period of 24 years from 1992 to 2015. Assuming that there is not much variation in adjacent years, entire period of twenty four years will be divided into 6 periods 1992-1995 (period 1); 1996-1999 (period2); 2000-2003 (period 3); 2004-2007 (period 4); 2008-2011(period 5); 2012-2015 (period 6). Each year will be divided into four seasons; summer, rainy, autumn and winter. Production traits included in the study were total lactation milk yield (TLMY), 305 day milk yield (305MY), peak yield (PY), milk yield per day of lactation length (MY/LL) and milk yield per day of calving interval (MY/CI). Buffaloes having lactation length of less than 100 days, having incomplete or incorrect record were discarded. In general, group feeding system followed except feeding of pregnant animals and breeding bulls, which were kept in individual pens. Ration fed to lactating animals was computed on the basis of milk production, live weight and stage of pregnancy. The green fodder consisted of maize and jowar during the months of June to October and green berseem, mustard and oat from November to March, whereas dry fodder generally consisted of wheat bhosa. Also the silage prepared from jowar and oat offered during non-availability of green fodder in May, June, October and November. Least squares and maximum likelihood computer program of Harvey (1990) using Henderson method 111 (Handerson, 1973) was utilized to estimate the effect of various tangible factors on various traits under study. The following mathematical model will be used to explain the underlying biology of the traits included in the study.

$$Y_{ijklmn} = \mu + s_i + h_j + c_k + rl + b_l(X_{ijklmn} - \bar{X}) + b_2 (X_{ijklmn} - \bar{X})^2 + e_{ijklmn}$$

Y_{ijklmn} (n^{th} record of individual of the i^{th} sire calved at j^{th} farm, k^{th} period, l^{th} season and m^{th} parity), μ(overall population mean), s_i(random effect of i^{th} sire), h_j(fixed effect of j^{th} farm), p_k(fixed effect of k^{th} period of calving), c_l(fixed effect of l^{th} season of calving), r_m(fixed effect of m^{th} parity), b_1 and b_2(linear and quadratic partial regression coefficients of age at first calving on the traits), X_{ijklmn}(age at first calving), $\bar{X}$ (mean of age at first calving) and e_{ijklmn}(random error associated with each observation and assumed to be normally and independently distributed with mean zero and variance σ^2 e).

Results and Discussion

The least squares analysis of variance for different production traits were presented in table 1. The overall least squares means for TLMY was 2165.13 ± 41.55 kg, 2093.25±36.16 kg, 11.01±0.14 kg, 6.37±0.059 kg and 4.26±0.052 kg respectively. Present findings were in correspondence with the findings of Chakraborty *et al.*, (2010), kumar *et al.*, (2014), Chaudhari (2015), Jakhar *et al.*, (2016). Higher averages were reported by Pawar *et al.*, (2012), whereas Dutt *et al.*, (2001), Thiruvenkadan *et al.*, (2010), Gupta *et al.*, (2012), Thiruvenkadan *et al.*, (2015), Pandey *et al.*, (2015) reported lower least-squares means in Murrahbuffaloes. Least squares analysis of variance revealed significant effect of farm difference on TLMY, PY and MY/LL. This difference in farm performance may be attributed to difference in managemental activity of farm. Hamed *et al.*, (2003) reported the difference in performance traits based on locality of different farm and concluded that buffaloes maintained in farms located in urban and peri-urban areas had better performance than those in rural areas. The present investigation revealed highly significant ($p<0.01$) effect of period of calving on all production traits. TLMY and 305MY showed an increasing trend across the periods. The effect of period of calving may be due to changes in production from year to another, can be attributed to selection of better progeny, changes in herd size, age of animals, improved management practices introduced in different years. Suresh *et al.*, (2004), Thiruvenkadan *et al.*, (2010), Thiruvenkadan *et al.*, (2015), Chaudhari, M. (2015), Pandey *et al.*, (2015) and Jakhar *et al.*, (2016) reported highly significant ($p<0.01$) effect of period of calving on TLMY and 305MY in Murrah buffaloes. However, Barman *et al.*, (2012), Pawar *et al.*, (2012) and Kumar *et al.*, (2014) reported non-significant effect of period of calving on TLMY and 305MY. The 305 day milk yield was highest in period 2008-11. Pawar *et al.*, (2012) found that 305 DMY increased over the first three periods with highest milk yield in the year 2006 followed by year 2005 and year 2004. The PY and MY/LL was highest in period 6 and lowest in period 3. Suresh *et al.*, (2004), Thiruvenkadan *et al.*, (2011) on MY/LL and Chaudhari (2015) on PY reported significant ($p<0.05$) effect of period of calving in Murrah. Jakhar *et al.*, (2016) reported highly significant ($p<0.01$) effect of period of calving on PY. Non-significant effect of period on PY was reported by Prakash and Tripathi (1987) in Murrah buffaloes. While, Singh *et al.*, (2011) reported non-significant effects of period of calving on MY/LL in Nili-Ravi buffaloes. The milk yield per day of calving interval was highest in period 6. Suresh *et al.* (2004) and Thiruvenkadan (2011) reported significant influence of period of calving on MY/CI in Murrah buffaloes.

The effect of season of calving was highly significant ($p<0.01$) on TLMY, 305MY, PY while significant effect ($p<0.05$) on MY/CI and non-significant effect was observed on MY/LL. The TLMY, 305MY and PY was highest in winter calvers. The higher least squares means for these production traits in winter calver may be contributed to availability of green fodder, condusive environment also buffalo calving in winter period having less gestational stress as a result of longer service period and delayed conception, also during their descending stage of lactation. Pawar *et al.*, (2012), Thiruvenkadan *et al.*, (2015), Chaudhari (2015) reported highly significant ($p<0.01$) effect of season of calving on TLMY in Murrah buffaloes. A significant effect of season was also reported by Barman (2009) and Barman *et al.*, (2012) in Murrah buffaloes. However, Suresh *et al.*, (2004), Kumar *et al.*, (2014) and Jakhar *et al.*, (2016) observed non-significant effect of season of calving on TLMY in Murrah buffaloes Dass and Sadana (2000), Thiruvenkadan *et al.*, (2010) and Jakhar *et al.*, (2016) reported highly significant ($p<0.01$) effect of season of calving on 305 DMY in Murrah buffaloes and concluded that winter calvers had higher 305

DMY, than the monsoon calvers. Pawar *et al.*, (2012) observed significant (p<0.05) effect of season on 305 DMY in Murrah buffaloes. However, non-significant effect of season of calving on 305 DMY was reported by Kumar *et al.*, (2014) in Murrah buffaloes. Thiruvenkadan *et al.*, (2010) reported highly significant (p<0.01) effect, while Jakhar *et al.*, (2016) reported significant (p<0.05) effect of season of calving on PY in Murrah buffaloes. While, non-significant effect of season of calving was reported by Prakash and Tripathi (1987) in Murrah buffaloes and Chowdhary and Chowdhary (1981) in Mehsana buffaloes. The averages for MY/LL and MY/CI was observed to be highest in rainy season. Tiwana *et al.*, (1994) reported non-significant effect of season on MY/LL in Murrah buffaloes. Singh *et al.*, (2011) reported non-significant effect of season on MY/CIin Nili-Ravi buffaloes. However, Dass and Sadana (2000) and Thiruvenkadan (2011) reported that season of calving significantly influenced the MY/CI.

Table.1 Least- squares analysis of variance for different production traits

Source	D.F.	Mean squares				
		TLMY	**305MY**	**PY**	**MY/LL**	**MY/CI**
Sire	219	587501.20	438192.93	6.90	1.651857	1.369157
Farm	1	2365774.07**	41886.68	393.24**	16.83817**	0.086365
Parity	4	2091151.41**	3509612.76**	216.78**	393878.56	160757.12
Period	5	5149373.70**	4707503.56**	104.53**	22.02834**	8.326912**
Season	3	3777400.08**	1924980.26**	12.88**	0.481512	3.416785*
Regression Linear	1	4164003.99**	3181425.86**	41.75**	8.502955**	11.89269**
Regression Quadratic	1	267628.64	441795.01	12.14*	1.374381	0.399298
Remainder	2721	272987.77	191686.14	2.46	1.210977	1.224037

* p<0.05 and ** p<0.01

Table.2 Least- squares means and their standard errors for different production traits

Ind. var.	Obs.	TLMY	305MY	PY	MY/LL	MY/CI
Overall	2959	2165.13 ±41.55	2093.25 ±36.16	11.01±0.14	6.37±0.059	4.26±0.052
Farm F1	1351	2120.90^{a} ±44.0	2087.36^{a} ±38.15	11.58^{a} ±0.15	6.5^{a} ±0.084	4.27^{a} ±0.079
F2	1608	2209.35^{a} ±44.36	2099.13^{b} ±38.43	10.44^{b} ±0.15	6.17^{b} ±0.076	4.25^{b} ±0.071
Parity L1	1102	2082.43^{a} ±42.64	1937.41^{a} ±37.04b	9.38^{e} ±0.14	5.84±0.12	4.29±0.10
L2	737	2239.45^{a} ±43.07	2131.8.3^{a} ±37.39	10.75^{d} ±0.15	6.87±0.11	4.86±0.10
L3	476	2211.48^{a} ±44.85	2140.48^{a} ±38.83	11.15^{cd} ±0.15	7.03±0.12	4.94±0.10
L4	309	2233.84^{a} ±47.95	2168.14^{a} ±41.35	11.45^{bc} ±0.16	7.020.12	5.06±0.10
L5	200	2267.82^{a} ±52.71	2206.14^{a} ±45.23	11.50^{bc} ±0.17	7.28±0.14	5.25±0.12
Periods: P_1(1992-95)	124	2073.33^{d} ±78.86	2025.89^{d} ±66.80	10.51^{d} ±0.24	6.08^{c} ±0.26	3.64^{c} ±0.026
P_2(1996-99)	454	2026.44^{d} ±53.96	1984.34^{cd} ±46.26	10.55^{c} ±0.17	6.11^{c} ±0.15	4.15^{c} ±0.12
P_3(2000-03)	766	1197.24^{d} ±46.55	1939.02^{c} ±40.21	10.45^{c} ±0.15	5.76^{c} ±0.12	4.05^{c} ±0.13
P_4(2004-07)	677	2131.16^{c} ±48.29	2060.21^{b} ±41.62	10.90^{b} ±0.16	6.03^{c} ±0.13	4.16^{c} ±0.19
P_5(2008-11)	605	2220.41^{b} ±51.04	2105.85^{b} ±43.87	10.94^{b} ±0.17	6.35^{b} ±0.14	4.40^{b} ±0.09
P_6(2012-15)	333	2542.17^{a} ±60.74	2444.17^{a} ±51.83	12.71^{a} ±0.19	7.91^{a} ±0.19	5.26^{a} ±0.07
Seasons: Summer	428	2218.21^{a} ±49.13	2124.42^{a} ±42.31	11.00^{a} ±0.16	6.40^{a} ±0.10	4.37^{a} ±0.09
Rainy	1167	2099.32^{b} ±43.29	2052.47^{b} ±37.57	10.92^{a} ±0.15	6.43^{ab} ±0.08	4.38^{a} ±0.09
Autumn	741	2097.60^{b} ±44.44	2040.35^{b} ±38.50	10.90^{a} ±0.15	6.33^{c} ±0.09	4.15^{b} ±0.00
Winter	623	2245.38^{a} ±45.77	2155.74^{a} ±39.58	11.21^{a} ±0.15	6.34^{bc} ±0.09	4.14^{b} ±0.00
Regressions AFC(Linear)		0.2244±0.05	0.196±0.048	0.0007±0.0001	0.0005±0.00	0.0006±0.00
AFC(Quad.)		-0.0001±0.0001	-0.0001±0.0001	00	00	00

Means superscripted by different letters differ significantly among themselves.

On critical examination of least squares means values of different production performance traits it was observed that means values were highest in 5th parity followed by 4th parity and lowest in 1st parity. The increase in least squares means from 1st to 5th parity indicated that physiological maturity of buffaloes was attained in 5th parity, hence showed optimum production with advancement in lactation number. Dass and Sadana (2000), Kundu *et al.*, (2003), Thiruvenkadan *et al.*, (2015), Chaudhari (2015) and Jakhar *et al.*, (2016) revealed highly significant ($p<0.01$) effect of parity on TLMY in Murrah buffaloes. Patel and Tripathi (1998) reported that buffaloes in different parities differed significantly in their total lactation milk yield. However, Singh *et al.*, (2011) and Pawar *et al.*, (2012) reported non-significant effect of parity on TLMY in Nili-Ravi and Murrah buffaloes, respectively. Findings of Hussain *et al.*, (2006) and Thiruvenkadan *et al.*, (2010) were also in agreement of reports. However, Javed *et al.*, (2001) and Pawar *et al.*, (2012) reported highest 305 DMY. In fifth parity with no consistent increase or decrease over the advancement of parity. There was a consistently increase in PY from 1stto 5th parity in Murrah buffaloes. Dass and Sadana (2000), Kundu *et al.*, (2003), Thiruvenkadan *et al.*, (2010), Chaudhari (2015), Jakhar *et al.*,

(2016) reported the highly significant (p<0.01) effect of parity on PY in Murrah buffaloes. On the contrary, non-significant influence of parity on PY was observed by Chowdhary and Chaowdhary (1981) in Mehsana buffaloes. There was an increasing trend in MY/LL for Murrah (from 1st to 5th parity). Suresh *et al.,* (2004) reported non-significant effect of parity on MY/LL in Murrah buffaloes. However, Dass and Sadana (2000), Kundu *et al.,* (2003), Thiruvenkadan (2011), Chaudhari (2015) reported highly significant (P≤0.01) effect whereas non-significant influence of parity on PY was observed by Chowdhary and Chaowdhary (1981) in Mehsana buffaloes. There was an increasing trend in MY/LL for Murrah (from 1st to 5th parity). Suresh *et al.,* (2004) reported non-significant effect of parity on MY/LL in Murrah.

The milk yield per day of calving interval was highest in 5th parity and lowest in 1st parity. There was an increasing trend in MY/CI from 1st to 5th parity. Suresh *et al.,* (2004) reported non-significant effect of parity on MY/CI in Murrah buffaloes. However, Dass and Sadana (2000), Thiruvenkadan (2011) and Chaudhari (2015) reported highly significant (P≤0.01) effect of parity on MY/CI in Murrah buffaloes. Suresh *et al.,* (2004) reported non-significant effect of parity on MY/LL in Murrah. The milk yield per day of calving interval was highest in 5th parity and lowest in 1st parity. There was an increasing trend in MY/CI FROM 1st to 5th parity. Suresh *et al.,* (2004) reported non-significant effect of parity on the primary goal of animal breeder is to maximize the rate of genetic improvement through selection and improvement of several traits simultaneously.
Selection of dairy animals is generally based on the records of performance traits. The variations in performance traits may be more of environmental nature as opposed to genetics; sampling of population and data edits might have widened these ranges. We want to select animals that have not only good production performance, but also have good health and reproduction. Genetic improvement through selection in a breeding program depends on the accuracy of identifying genetically superior animals. Therefore, adjustment of effect of non-genetic factors is important for accurate and unbiased estimates of genetic parameters. Accurate measurement of effect of these non-genetic factors on production performance traits help in correct, efficient selection in any breeding programme.

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