

Analysis on the productive and reproductive traits of Murrah buffalo cows maintained in the coastal region of India

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Abstract

Data of 698 Murrah cows sired by 43 bulls maintained at the Central Cattle Breeding Farm, Alamadhi were analysed to study the performance of Murrah buffaloes at the coastal region of Tamil Nadu, India. Least-squares means and genetic parameters were estimated for different first lactation traits. The averages for 305-day and total lactation milk yields were 1616.3 ± 39.6 and 1686.2 ± 44.4 kg, respectively, with heritability estimates of 0.17 ± 0.10 and 0.14 ± 0.10 respectively. The means for lactation length, service period, dry period and calving interval were 312.8 ± 5.7 , 253.7 ± 17.3 , 250.5 ± 15.9 and 559.6 ± 17.3 days, respectively. The heritability estimates for these traits were 0.01 ± 0.08 , 0.10 ± 0.13 , 0.16 ± 0.15 and 0.09 ± 0.13 , respectively. The low heritability estimates observed for service period, dry period and calving interval suggested improvements in these traits through better management. It is therefore imperative to emphasis improvement in the husbandry practices and the introduction of genetic evaluation programmes at the same time.

Keywords: Age at first calving, 305-day milk yield, calving interval, heritability

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Introduction

The Murrah breed is the finest genetic material of milk producing buffalo, not only in India but, probably in the world and it has been used quite extensively for upgrading local stock to improve performance. The breeding policy of Tamil Nadu is to use Murrah or Surti as a breed of choice to improve the non-descript buffaloes. From the literature reviewed, it was found that the bulk of scientific information on buffaloes were mainly from the analysis of records made available from Institutional and Government farms in northern parts of India (Sethi & Khatkar, 1997; Dass & Sadana, 2000; Gogoi *et al.*, 2002; Kundu *et al.*, 2003; Yadav *et al.*, 2007). Such information from the southern peninsular region, especially under hot and humid coastal regions of Tamil Nadu is scanty (Kandasamy, 1987; Suresh *et al.*, 2004). Hence, the present study has been conducted at the Central Cattle Breeding Farm, Alamadhi, Tamil Nadu with the objective of understanding the performance and the influence of various non-genetic factors affecting economic traits of Murrah buffaloes and to suggest suitable management practices, selection and breeding strategies for genetic improvement of Murrah buffaloes in the coastal regions of India.

Materials and Methods

The data pertaining to different production and reproduction traits of 698 Murrah cows sired by 43 bulls, collected from the Central Cattle Breeding Farm, Alamadhi, Tamil Nadu were analysed. The performance records were distributed over a period of 28 years (1979 to 2006). This farm is located approximately at 13° N latitude and 80° E longitude at an altitude of about 20 metres above mean sea level. The climate is generally hot, humid and tropical in nature. The mean annual maximum and minimum temperatures were 33 °C and 24.7 °C, respectively, and the mean relative humidity ranged between 69.2 and 76.2%. The animals were maintained under semi-intensive management systems and artificial insemination was practised. Data on different traits were extracted from History and Pedigree Sheets after excluding the records with the history of abnormal lactation due to abortion, premature birth and incomplete lactation due to death or disposal of cows. Traits included under the study were age at first calving, 305-day milk yield, lactation length, lactation milk yield, service period, calving interval and dry period. Period and season were

the fixed environmental factors considered for all the traits studied. The physiological effect considered was age at first calving. The entire duration of the study was divided into seven periods, each with an interval of four years. Furthermore, each calendar year was sub-divided into four seasons, viz. winter (January and February), summer (March to May), south-west monsoon (June to September) and north-east monsoon (October to December). Least-squares analysis (Harvey, 1990) was applied to study the effects of various non-genetic factors and the means were compared using Duncan's multiple range test. Sires with five and more progeny alone were included for estimation of heritability with the paternal halfsib method (Harvey, 1990). In addition, heritabilities were also estimated by the REML method using the Derivative Free Restricted Maximum Likelihood (DFREML) software package of Meyer (2000).

Results and Discussion

The overall least-squares mean for age at first calving was 1578.7 ± 20.3 days ($n = 698$) or 51.9 months, which is higher than the value (47.1 ± 0.6 months) reported for Murrah cows on the same farm (Patnaik, 1988). The difference in performance over the period might be due to the fact that the earlier study was based on less number of observations ($n = 143$) with a limited period i.e. from 1978 to 1983. The finding of this study is in accordance with the values reported previously by Kandasamy (1987) and Kumaravel *et al.* (2006). Period of calving had a highly significant effect on this trait.

The 305-day milk yield (Table 1) observed for Murrah cows in this investigation was comparable to the values reported by Sethi & Khatkar (1997) and Gogoi *et al.* (2002). The highly significant influence of period of calving observed in the present study was supported by similar findings on Murrah cows maintained at different places in India (Sethi & Khatkar, 1997; Suresh *et al.*, 2004). The winter and summer calvers produced maximum yield compared to the monsoon calvers, owing to two succeeding favourable seasons, i.e. south-west and north-east monsoon seasons. During these periods the climate is conducive and there is abundant availability of good quality fodders. In contrast, the monsoon calvers had the lowest production, as they suffered from hot humid stress and availability of poor quality fodder during major parts of the lactation period. The highly significant influence of period of calving on lactation length observed corroborated with the previous finding on Murrah cows (Suresh *et al.*, 2004). In contrast, some of the studies (Ulaganathan *et al.*, 1985; Kandasamy, 1987) reported non-significant effects of period on the trait. The overall lactation milk yield obtained was higher than that observed by Patnaik (1988) in the same herd. The present study revealed that the period of calving had highly significant effect on lactation milk yield and several reports indicated similar effects on Murrah cows maintained at different places in India (Kandasamy, 1987; Yadav *et al.*, 2007). In general, the lactation milk yield obtained for Murrah cows calving in winter and summer seasons were higher than those observed in monsoon seasons and were significant. This confirms the findings of the earlier reports on Murrah buffaloes (Dass & Sadana, 2000; Gogoi *et al.*, 2002).

The mean service period of Murrah cows observed (Table 1) in the present study was in accordance with the value of 259.93 ± 11.31 days reported by Kundu *et al.* (2003). On the contrary, Patnaik (1988) observed a slightly higher mean service period (283.8 ± 14.2 days) than the present estimate. The calving interval observed in the present study was in agreement with some research reports made on Murrah buffaloes in Tamil Nadu (Kandasamy, 1987; Patnaik, 1988). However, lower estimates for service period, calving interval and dry period were reported on Murrah buffaloes maintained in its home tract (Banik & Tomar, 2003; Yadav *et al.*, 2007). Comparatively lower performance of Murrah cows with respect to fitness traits (viz., service period and calving interval) indicates less adaptability of the breed to the hot and humid coastal climatic conditions. Period of calving had highly significant influence on calving interval and several reports indicated similar effects on this trait in Murrah buffaloes (Dass & Sadana, 2000; Suresh *et al.*, 2004; Yadav *et al.*, 2007). The difference in performance of the animals among different periods might be attributed to differences in management practices, sires used for breeding, environmental conditions such as ambient temperature, humidity, rainfall and variations in feed and fodder availability. The age at first calving had no significant ($P > 0.05$) effect on all the traits studied. Buffalo heifers should have attained the required physiological maturity level at the time of calving and hence variation in age, probably had no influence on both the production and reproduction traits.

It is generally observed that buffalo cows are seasonally polyoestrus during October to February and they breed regularly during these periods. This might be one of the reasons for shorter service periods during monsoon seasons. In addition, environmental temperature can also play an important role in reproductive performance of lactating buffalo cows. In regions with hot summers, the time required for conception is longer in winter and in summer calvers than those calved in monsoon seasons. The cow body temperature in early lactation was positively associated with time to first ovulation. This indicated that the higher the body temperature, the longer it would take to exhibit oestrus (and ovulation), which in turn would result in increased service period and thereby increased calving interval. In addition, high ambient temperatures have a number of detrimental effects on physiological processes that are important for the establishment and maintenance of pregnancy. Thus, managerial interventions to ameliorate the effects of heat load on conception rate should be implemented at least five weeks before anticipated service and should continue until at least one week after service.

Table 1 Least-squares means (\pm s.e.) for different milk production and reproduction traits of Murrah cows

Effect	n	305-day milk yield (kg)	Lactation length (days)	Lactation milk yield (kg)	n	Service period (days)	Calving interval (days)	Dry period (days)
Overall mean (μ)	636	1616.3 \pm 39.6	312.8 \pm 5.7	1686.2 \pm 44.4	506	253.7 \pm 17.3	559.6 \pm 17.3	250.5 \pm 15.9
Period of calving		**	**	**		**	**	**
P ₁ (1979-82)	167	1515.0 ^a \pm 49.1	308.5 ^b \pm 7.0	1573.6 ^{ac} \pm 55.1	135	236.2 ^{abc} \pm 21.2	540.6 ^{abc} \pm 21.2	228.9 ^{abd} \pm 19.5
P ₂ (1983-86)	194	1481.6 ^a \pm 45.3	322.1 ^c \pm 6.5	1563.8 ^{ac} \pm 50.8	165	290.8 ^d \pm 19.4	596.2 ^d \pm 19.4	276.2 ^c \pm 17.9
P ₃ (1987-90)	67	1437.8 ^a \pm 63.3	296.2 ^{ad} \pm 9.0	1469.8 ^a \pm 71.0	39	192.1 ^a \pm 29.8	496.3 ^a \pm 29.8	194.5 ^{ad} \pm 27.4
P ₄ (1991-94)	63	1657.7 ^b \pm 60.8	301.2 ^{ab} \pm 8.7	1720.7 ^b \pm 68.2	50	225.9 ^{ac} \pm 26.0	535.1 ^{ac} \pm 26.0	240.4 ^{abc} \pm 24.0
P ₅ (1995-98)	55	1779.4 ^b \pm 62.0	325.7 ^c \pm 8.9	1891.1 ^b \pm 69.6	44	273.7 ^{bcd} \pm 26.9	582.2 ^{bcd} \pm 26.9	258.4 ^{abc} \pm 24.7
P ₆ (1999-2002)	61	1704.8 ^b \pm 62.8	322.5 ^c \pm 9.0	1806.6 ^b \pm 70.5	56	289.7 ^{cd} \pm 25.9	593.5 ^{cd} \pm 25.9	275.8 ^{bc} \pm 23.8
P ₇ (2003-2006)	29	1737.7 ^b \pm 84.9	313.1 ^{bcd} \pm 12.1	1777.7 ^{bc} \pm 95.3	17	267.8 ^{abd} \pm 41.2	573.1 ^{abd} \pm 41.2	279.2 ^{cd} \pm 37.9
Season of calving		**	**	**		**	**	**
Winter (Jan.-Feb.)	49	1697.1 ^b \pm 59.2	322.7 \pm 8.5	1762.2 ^b \pm 66.5	41	319.3 ^c \pm 25.2	625.6 ^c \pm 25.2	305.6 ^c \pm 23.2
Summer (Mar.-May)	9	1678.4 ^{bc} \pm 136.4	309.3 \pm 19.5	1746.0 ^{bc} \pm 153.1	7	248.9 ^{abc} \pm 59.2	554.1 ^{abc} \pm 59.2	258.6 ^{abc} \pm 54.4
South-west monsoon (Jun.- Sep.)	337	1603.1 ^b \pm 24.7	311.8 \pm 3.5	1678.3 ^b \pm 27.7	282	234.0 ^a \pm 10.8	540.2 ^a \pm 10.8	230.3 ^a \pm 9.9
North-east monsoon (Oct.- Dec.)	241	1486.5 ^{ac} \pm 28.4	307.2 \pm 4.1	1558.2 ^{ac} \pm 31.9	176	270.8 ^b \pm 13.1	576.3 ^b \pm 13.1	265.4 ^b \pm 12.0
Partial regression on age at first calving		0.1157 \pm 0.0733	-0.0046 \pm 0.0105	0.1179 \pm 0.0823		0.0254 \pm 0.0322	0.0250 \pm 0.0322	0.0462 \pm 0.0296

n= Number of observations.

* $P < 0.05$, ** $P < 0.01$.

Means bearing same superscript do not differ significantly ($P > 0.05$).

Heritability estimates for different first lactation traits are depicted in Table 2. Due to the small numbers involved in the analysis, the standard errors are fairly large. Low to medium heritability estimates were obtained for age at first calving, 305-day milk yield, lactation milk yield, service period and dry period. The heritability estimates obtained with REML should be more accurate than those from the paternal half-sib method, since REML utilises all kinds of relationship for the estimation of variance components and has the optimal statistical properties of consistency, efficiency and asymptotic unbiased-ness. The comparatively lower heritability for reproduction traits suggested that most of the variation in these traits were caused by environment including the non-additive genetic variance. Therefore selection on the basis of family and/or progeny performance would be a useful tool for genetic improvement in these traits.

Table 2 Estimates of heritability (\pm s.e.) of milk production and reproduction traits of Murrah cows

Trait	Heritability (\pm s.e.)	
	Paternal halfsib	REML
Age at first calving	0.40 \pm 0.13	0.16 \pm 0.12
305-day milk yield	0.26 \pm 0.12	0.17 \pm 0.10
Lactation length	0.10 \pm 0.10	0.01 \pm 0.08
Lactation milk yield	0.20 \pm 0.12	0.14 \pm 0.10
Service period	0.14 \pm 0.12	0.10 \pm 0.13
Calving interval	0.13 \pm 0.12	0.09 \pm 0.13
Dry period	0.19 \pm 0.13	0.16 \pm 0.15

Conclusions

This study revealed that the non-genetic factors such as period and season of calving had highly significant effect on all the traits studied. In general, comparatively lower performance of Murrah cows with respect to fitness traits indicates less adaptability of the breed to the hot and humid coastal regions on India. Since, temporary environmental factors play a major role on these fitness traits, better breeding management like accurate detection of heat and managerial interventions to ameliorate the effects of heat load on conception rate should be implemented for better conception during summer months. In addition, multi-trait evaluation with a combination of production and reproduction traits may be a carry out for simultaneous improvement of production and reproduction performances of Murrah cows.

It is therefore imperative to emphasis improvement in the husbandry practices and the introduction of genetic evaluation programmes at the same time.

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