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Review Article

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Effect of Non-genetic Factors on Performance Traits of Murrah Buffaloes: Review

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A B S T R A C T

The success of a dairy industry in India is much dependent on buffaloes and the level of production and reproduction traits. These performance traits depend on several genetic and non-genetic factors which introduce biasness in the estimation of genetic value of performance traits. In the absence of accurate phenotypic value of milk production traits, it becomes difficult to estimate genetic parameters of the traits which determine the optimum selection criterion for planned improvement programme of the animals. Also genetic evaluation of animals require the assumption that phenotypic measurements are adjusted for non-genetic factors that can affect production efficiency and reproduction traits (ex. Year/period of calving, season of calving, calving order, age at calving, length of lactation) to obtain accurate estimates of the genetic parameters and the breeding value of animals. This review summarizes the means/averages of milk production and reproduction traits, effect of non-genetic factors on performance traits in buffaloes. The production traits reviewed were Total Lactation Milk Yield (TLMY), 305 Day Milk Yield (305DMY), Peak Yield (PY), Lactation Length (LL) and Dry Period (DP). The reproduction traits reviewed were Service Period (SP) and Calving Interval (CI). In order to improve productivity, obtain efficient reproduction and health of dairy animals it is necessary to develop an understanding of the factors affecting milk production, reproduction traits.

Introduction

Buffaloes are considered as the major dairy animal and backbone of Indian dairy industry. India ranks first in milk production accounting for 18.5% of worlds' milk production with an annual output of 146.3 million tons resulting in per capita availability of 322 g/day (NDDB, 2014–15). Buffaloes with a population of 108.7 million, the largest in the world, contribute 51.06% (74.71 million tons) to the total milk production in the country, which is valued for its quality being twice as rich in fat and other milk constituents as compared to the cow milk. Besides this, buffaloes contribute significantly towards meat production, draft power, dung for manure and fuel.

Thus, buffaloes are the most important and indispensable component of livestock sector in the country. The buffalo genetic resources of the country are represented by 13 registered breeds and graded buffalo populations adapted to different ecological niches. Murrah is one of the superior breeds

of Indian buffaloes with a population of 20.49 million, which constitutes around 65% of Indian buffaloes of well-defined breeds. owing to its potential, it has short productive period in terms of milk and high unproductive life with longer inter calving period and age at first calving, which may be happened due to several genetic and non–genetic factors like parity, period of calving and season of calving. The situation gets more complicated when environment become harsh and non-supportive for exploitation of animal fullest potential in term of milk production. Evaluations of genetic value of performance traits require knowledge of several genetic parameters so that suitable breeding schemes can be developed for improvement of this species.

The present breeding goals in the country are primarily focused on increasing milk production and not directed towards the cost effective performance of dairy animals. It is therefore imperative that attempt should be made to consider production and reproduction traits together in genetic improvement programmes. The non-genetic factors such as management, amount and quality of feed, season, period of calving, parity etc. influences these performance traits. Under this background, this review was aimed to evaluate the effects of various non-genetic factors on production and reproduction traits of Murrah buffaloes. This will help to formulate suitable evaluation procedures and selection of superior animals for future generation for improving economic traits of buffaloes.

Averages of milk production and reproduction traits

The least square means of milk production and reproduction traits reported by various workers in buffaloes are presented in table 1 and 2, respectively.

Effect of genetic and non-genetic factors on performance traits

Production traits

Total lactation milk yield

Milk yield is the central trait over which whole of the animal improvement programme revolves. Lactation milk yield reflects the real economic worth of the buffalo and is considered as a major performance trait considered in the selection criteria for the genetic improvement of dairy animals and almost all other traits, directly or indirectly associated with it.

A significant effect of period of calving on total lactation milk yield was reported by Yadav *et al.,* (2002), Wakchaure *et al.,* (2008), Jakhar *et al.,* (2016) in Murrah buffaloes. Thiruvenkadan (2011) reported highly significant ($p<0.01$) effect of period of calving on TLMY in Murrah buffaloes. Non-significant effect of period of calving was also reported Barman (2009), Barman *et al.,* (2012), Pawar *et al.,* (2012) and Kumar *et al.,* (2014) on TLMY in Murrah buffaloes.

TLMY was significantly affected by season of calving was reported by Pawar*et al.,* (2012) and Thiruvenkadan (2011) reported the highly significant ($p<0.01$) effect of season of calving on TLMY in Murrah buffaloes. Significant effect was also reported by Grewal *et al.,* (2003), Godara *et al.,* (2004), Barman (2009) and Barman *et al.,* (2012) in Murrah buffaloes.

Kumar (2002), Suresh *et al.,* (2004) and Kumar *et al.,* (2014), Jakhar *et al.,* (2016) in Murrah buffaloes reported non- significant effect of season of calving on TLMY. Significant effect of age at calving on TLMY was reported by Gurung and Johar (1982) in Murrah buffaloes, Dhirendra *et al.,* (2003) in

Murrah buffaloes. However Barman (2009) and Barman *et al.,* (2012) in Murrah buffaloes observed non-significant correlation between age at calving and TLMY. Dhar *et al.,* (1995) revealed highly significant effect of parity on TLMY in Murrah buffaloes. Thiruvenkadan (2011) reported the highly significant ($p<0.01$) effect of parity on TLMY in Murrah buffaloes. Jakhar *et al.,* (2016) reported significant ($p<0.01$) effect of parity of lactation on TLMY in Murrah buffaloes. However Pawar *et al.,* (2012) reported non-significant effect of parity on TLMY in Murrah buffaloes.

305 days milk yield

Gupta *et al.,* (2012) reported the least square means for first lactation 305 day milk yield was 1942.75 ± 53.79 kg ($p< 0.01$) in Murrah buffalo. Highly significant ($p<0.01$) effect of period of calving on 305 days milk yield in Murrah buffaloes reported by Thiruvenkadan (2011) and Jakhar *et al.,* (2016). Pawar *et al.,* (2012) observed significant ($p< 0.05$) effect of season on 305 day milk yield in Murrah buffalo. Thiruvenkadan (2011) and Jakhar *et al.,* (2016) reported highly significant ($p<0.01$) effect of season of calving on 305 days milk yield in Murrah buffaloes.

Non-significant effect of season of calving on 305DMY was reported by Kumar *et al.,* (2014) in Murrah buffaloes. Thiruvenkadan (2011) and Jakhar *et al.,* (2016) reported the highly significant ($p<0.01$) effect of parity on 305 days milk yield in Murrah buffaloes. Pawar *et al.,* (2012) reported no significant effect of parity on 305 day milk yield.

Peak yield

Attainment of peak yield reflects manifestation of maximum milk secretion during a day in a lactation. The trait shows considerable variability within breed. Thiruvenkadan (2011) reported the highly significant ($p<0.01$) effect of period of calving on peak yield in Murrah buffaloes.

Thiruvenkadan (2011) reported the highly significant ($p<0.01$) effect of season of calving on peak yield in Murrah buffaloes. Jakhar *et al.,* (2016) reported the highly significant ($p<0.01$) effect of season of calving on peak yield in Murrah buffaloes. Non-significant effect of season of calving was reported by Prakash and Tripathi (1987a) in Murrah buffaloes.

Thiruvenkadan (2011) and Jakhar *et al.,* (2016) reported the highly significant ($p<0.01$) effect of parity on peak yield in Murrah buffaloes. Significant influence of parity was observed by Prakash and Tripathi (1987b) in Murrah.

Lactation length

The period from the initiation of production to the day when production stops, in short, the actual productive period is defined as the lactation length. Thiruvenkadan *et al.,* (2010) reported highly significant influence of period of calving on lactation length observed corroborated with previous finding on Murrah buffalo (Suresh *et al.,* 2004). Dhar *et al.,* (1995) reported highly significant influence of period of calving on lactation length in Murrah buffaloes.

Dhar *et al.,* (1995) reported highly significant influence of season of calving on lactation length in Murrah buffaloes. Jakhar *et al.,* (2016) reported highly significant influence of season of calving on lactation length in Murrah buffaloes. Dhar *et al.,* (1995) reported highly significant influence of parity on lactation length in Murrah buffaloes. Jakhar *et al.,* (2016) reported highly significant ($p<0.01$) effect of parity on LL in Murrah buffaloes.

Table.1 Means and standard error for production traits of buffaloes

Sr.No.	Traits	Mean±SE	N	non genetic factors			references
				period	season	parity	
1.	Total Lactation Milk Yield (kg)	1844.99 ± 21.31	628	S	NS	-	Nath (1998)
		1997.9 ± 66.2	1479	NS	NS	-	Singh *et al.*, (2011)
		1942.75 ± 53.79	330	NS	NS	-	Gupta *et al.*, (2012)
		1365.08 ± 2.98	116	S	S	-	Pandey *et al.*, (2015)
		2182.82 ± 20.19	1637	S	NS	-	Jakhar *et al.*, (2016)
2.	305 Day Milk Yield (kg)	1853.49 ±15.88	961	S	S	-	Sahoo *et al.*, (2014)
		1365 ± 03	113	S	S	-	Pandey *et al.*, (2015)
		2065.76 ± 41.29	162	S	NS	-	Kumar *et al.*, (2016)
		2060.93 ± 20.22	1637	S	NS	-	Jakhar *et al.*, (2016)
		2078.20 ± 31.21	154	S	NS	-	Jamuna *et al.*, (2016)
		1977.9 ± 36.2	315	S	S	-	Chitra *et al.*, (2016)
3.	Peak Yield (kg)	7.920.16	279	-	-	-	Kumar(2000)
		7.92.016	289	-	-	-	Kumar *et al.*, (2005)
		10.160.26	326	-	-	-	Chakraborty *et al.*, (2010)
		9.090.07	395	S	S	S	Thiruvenkadan (2011)
4.	Lactation Length (days)	1853.49 ±15.88	961	S	S	-	Sahoo *et al.*, (2014)
		1365 ± 03	113	S	S	-	Pandey *et al.*, (2015)
		2065.76 ± 41.29	162	S	NS	-	Kumar *et al.*, (2016)
		2060.93 ± 20.22	1637	S	NS	-	Jakhar *et al.*, (2016)
		2078.20 ± 31.21	154	S	NS	-	Jamuna *et al.*, (2016)
		1977.9 ± 36.2	315	S	S	-	Chitra *et al.*, (2016)
		1853.49 ±15.88	961	S	S	-	Sahoo *et al.*, (2014)
		1365 ± 03	113	S	S	-	Pandey *et al.*, (2015)
5.	Dry period (days)	205.4 ± 8.7	236	S	NS	-	Tailor *et al.*, (1992)
		187 ± 2.2	2107	-	-	-	Kuralkar and Raheja (1997)
		164.18 ± 4.70	1200	S	S	-	Wakachaure *et al.*, (2008)
		250.5 ± 15.9	698	S	S	-	Thiruvenkadan *et al.*, (2010)
		331.30 ± 9.2	917	-	-	-	Sharma *et al.*, (2010)
		173.34 ± 5.59	1637	NS	S	-	Jakhar *et al.*, (2016)

Table.2 Means and standard error for reproduction traits of buffaloes

Sr.No.	Traits	Mean ±SE	N	Non genetic factors			References
				Period	Season	Parity	
1.	Service period (days	148.40 ± 8.90	170	-	-	S	Swain and Bhatnagar (1983)
		143.41 ± 3.97	465	S	NS	-	Nath (1998)
		161.10 ± 13.51	497	S	S	-	Suresh *et al.*, (2004)
		151.46 ± 3.87	1200	S	NS	-	Wakchaure (2008)
		208.23 ± 9.78	655	NS	NS	-	Gupta (2009)
		161.04 ± 6.03	554	S	S	NS	Patil (2011)
		187.10 ± 5.91	1637	S	S	-	Jakhar *et al.*, (2016)
2.	Calving interval (days)	528 ± 2.9	2107	-	-	-	Kuralkar and Raheja (1997)
		478 ± 5.1	1164	S	S	-	Triveni *et al.*, (2001)
		488.19 ± 5.44	1200	S	S	-	Wakachaure *et al.*, (2008)
		532 ± 5	698	-	S	-	Thiruvenkadan *et al.*, (2015)
		479.47 ± 4.88	1637	NS	S	S	Jakhar *et al.*, (2016)

Dry period

Dry period is the period during which animal remains out of milk production. So, dry period being non-productive period needs to be reduced to the minimum in order to maximize the profits. Barman (2009), Thiruvenkadan (2011), Singh *et al.,* (2011), Barman *et al.,* (2012), Jakhar *et al.,* (2016) also reported significant effect of period of calving on dry period in different breeds of buffaloes. However, non-significant effect was reported by Kumar (2000) in Murrah buffaloes. Jakhar *et al.,* (2016) reported highly significant ($p<0.01$) effect of season of calving on dry period in Murrah buffalo. However Kumar (2000), Suresh *et al.,* (2004), Barman (2009) and Barman *et al.,* (2012) in Murrah buffaloes reported non-significant effect of season of calving on dry period.

Reproduction traits

Service period

It is the period between calving and the subsequent successful conception. Generally, an optimum period of 60 days is allowed as post-partum rest.

Besides, managemental and environmental factors, it is generally regarded as the function of initiation and regularity of estrus and number of service per conception. Suresh *et al.,* (2004), Godara *et al.,* (2004), Wakchure *et al.,* (2008) and Barman (2009) observed significant effect of period of calving on SP in Murrah buffaloes. While Kumar (2000), Kumar *et al.,* (2005) and Gupta *et al.,*(2012) reported non-significant effect of period of calving on SP in different breeds of buffaloes. Significant effect of season of calving on dry period was reported by Kumar (2000), Dhirendra *et al.,* (2003), Suesh *et al.,* (2004), Kumar *et al.,* (2005), Jakhar *et al.,* (2016) in Murrah buffaloes,

Calving interval

Calving interval is the period between two consecutive calvings. Calving interval has direct bearing on both reproduction and production efficiencies. Short calving interval along with early age at first calving are required for better efficiency of milk production. Jakhar *et al.,* (2016) reported significant effect of parity on calving interval in Murrah buffaloes. Kumar (2000), Kumar *et al.,* (2005) and Barman (2009) in Murrah buffaloes reported non-significant effect of period of calving. Gupta *et al.,* (2012), Jakhar *et al.,* (2016) observed no significant effect of period of calving on calving interval in Murrah buffalo. Lundstrom *et al.,* (2007) reported significant influence of period and season of calving on calving interval in Murrah buffalo. Significant effect of season of calving was reported by Dhirendra *et al.,* (2003), Grewal *et al.,* (2003), Suresh *et al.,* (2004), Kumar *et al.,* (2005), Lundstrom *et al.,* (2007), Barman (2009), Jakhar *et al.,* (2016) in buffaloes.

The primary goal of animal breeder is to maximize the rate of genetic improvement through selection and improvement of several traits simultaneously. 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. 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 and sampling of population. As per the literature, all important non-genetic factors such as season of calving, period of calving and parity of animals had significant influence on the performance traits in buffaloes. Therefore, adjustment of effect of

non-genetic factors is important for accurate and unbiased estimates of genetic parameter.

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