Indian Journal of Animal Sciences **84** (12): 1325–1327, December 2014/short communication
https://doi.org/10.56093/ijans.v84i12.45402

Effect of non-genetic factors on replacement rate and its components in Murrah buffaloes of Tamil Nadu

A K THIRUVENKADAN[1] and P DEVENDRAN[2]

Veterinary College and Research Institute, Namakkal, Tamil Nadu 637 002 India

Received: 4 November 2012; Accepted: 12 August 2014

Key words: Culling, Mortality, Murrah, Replacement rate

The effectiveness of selection depends on population size and selection intensity, which determines the rate of genetic improvement. The herd size and its maintenance in subsequent years are the most important factors limiting the intensity of selection. Therefore efforts should be made to increase the intensity of selection, which becomes possible by increasing the herd size and the number of female offspring reaching the milking herd in the next generation. The number of adult cows lost from the herd due to death and culling, should be replaced by equal number of heifers entering the milking age, so as to maintain herd size. Such information is required for formulation and operation of breeding plans for genetic improvement. Therefore, present study was planned to determine the effect of different non-genetic factors affecting the replacement rate and its components in Murrah buffaloes of Tamil Nadu, India (Singh *et al*. 2002, Shahi and Kumar 2006).

The data for the present study was collected from the calving records of 2,234 Murrah buffaloes maintained at Central Cattle Breeding Farm, Alamadhi, Tamil Nadu, India. The data, spread over 24 years extending from 1979 to 2002, were divided into 6 periods. The different components of replacement rate considered were: losses due to prenatal mortality, sex ratio, female calf mortality and culling. Periods, seasons and parity were considered as different non-genetic factors affecting replacement rate and its components. The year of birth was divided into winter (January and February), summer (March to May), south-west (June to September) and north-east (October to December) monsoon. The replacement rate was calculated (Singh *et al*. 2002) on the basis of total female calves born (i.e. percentage of female calves reaching the milking herd over the total number of female calves born) and total female calves born basis (i.e. percentage of female calves reaching the milking herd over the total number of calves born). The model considered for the study was as follows: $Y_{ijklm} = m + S_i + T_j + U_k + V_l + e_{ijklm}$ where, Y_{ijklm} = number of abnormal birth, male birth, female calves died/culled and reached to age at first calving born during ith sire, jth season, kth period and lth parity of lactation; S_i effect of ith sire, T_j, effect of jth season of birth ($_j$, 1 to 4); U_k, effect of kth period of birth ($_k$, 1 to 6); V_l,effect of lth parity of lactation ($_l$,1 to 6) and e_{ijklm}, random error assumed to be normally, independently distributed with mean 0 and variance σ_e^2. The sum of squares of different effects was estimated as per Tomar *et al.* (1991). Replacement traits were analysed for studying the effect of various non-genetic factors according to all-or-none traits.

The incidence of female kid losses and replacement rate in Murrah buffaloes is presented in Table 1. The Chi-square test revealed that the observed sex ratio was not significantly different from the normal expected ratio of 50:50. Analysis of variance showed that period, season of birth and parity had non-significant effect on sex ratio. The non-significant effects of period, season and parity on sex ratio were in conformity with the results of earlier workers (Singh *et al*. 2002, Banik and Naskar 2006, Shahi and Kumar 2006). The overall prenatal calf losses observed in the herd was lower than the values reported by most of the previous workers (Tomar and Tripathi 1995, Gowane and Tomar 2007) made on Murrah buffaloes maintained under organized farm conditions in India. About 65.0 % of the abortions took place from 8 to 9 months of pregnancy. Whereas, the maximum cases (64.3 %) of still births were recorded after 300 days of pregnancy. Abortions took place, on an average, after 208.1±17.7 days (n,22) of gestation and stillbirth occurred after 303.4±5.7 days (n,42) of gestation. The coefficient of variation for stillbirth was lower (12.7 %) than that observed in abortion (39.9 %). The analysis of variance for abnormal birth showed that season and parity had non-significant effect, whereas the period had highly significant (P<0.01) effect on this trait. The incidence of abnormal birth was lowest in north-east monsoon season, where it was highest during the summer.

Present address: [1]Professor and Head (drthirusiva @gmail.com), Department of Animal Husbandry Statistics and Computer Applications, Veterinary College and Research Institute, Namakkal, Tamil Nadu. [2]Professor and Head (devauma @gmail.com), Department of Animal Genetics and Breeding, Veterinary College and Research Institute, Orathanadu, Tamil Nadu.

Table 1. Per cent contribution of different components of replacement rate in the Murrah buffalo herd

Effect	Total calvings	Abnormal births		Total normal calvings	Male births (% normal births)		Female births (% normal births)		Mortality and culling of female calves and heifers (% female births)					Replacement rate (%)	
		n	%		n	%	n	%	Number died	%	Number culled	%	Number retained	Female births	Total births
Overall	2,234	63	2.82	2,171	1,116	51.4	1,055	48.6	409	38.8	224	21.2	422	40.0	19.4
Period															
P_1 (1979–1982)	300[a]	6	2.00	294	135	45.9	159	54.1	62	39.0	8	5.03	89	56.0	30.3
P_2 (1983–1986)	575	12	2.09	563	290	51.5	273	48.5	141	51.6	50	18.3	82	30.0	14.6
P_3 (1987–1990)	548	16	2.92	532	290	54.5	242	45.5	56	23.1	117	48.3	69	28.5	13.0
P_4 (1991–1994)	312	13	4.17	299	156	52.2	143	47.8	35	24.5	17	11.9	91	63.6	30.4
P_5 (1995–1998)	202	9	4.46	193	96	49.7	97	50.3	44	45.4	13	13.4	40	41.2	20.7
P_6 (1999–2002)	297	7	2.36	290	149	51.4	141	48.6	71	50.4	19	13.5	51	36.2	17.6
Season															
Winter	310[b]	10	3.23	300	159	53.0	141	47.0	40	28.4	25	17.7	76	53.9	25.3
Summer	165	7	4.24	158	83	52.5	75	47.5	24	32.0	19	25.3	32	42.7	20.3
South-west	815	25	3.07	790	401	50.8	389	49.2	153	39.3	75	19.3	161	41.4	20.4
North-east	944	21	2.22	923	473	51.2	450	48.8	192	42.7	105	23.3	153	34.0	16.6
Parity															
1	715	18	2.52	697	361	51.8	336	48.2	144	42.9	74	22.0	118	35.1	16.9
2	508	17	3.35	491	246	50.1	245	49.9	95	38.8	51	20.8	99	40.4	20.2
3	368	10	2.72	358	187	52.2	171	47.8	74	43.3	41	24.0	56	32.7	15.6
4	250	5	2.00	245	129	52.7	116	47.3	37	31.9	24	20.7	55	47.4	22.4
5	164	4	2.44	160	83	51.9	77	48.1	25	32.5	14	18.2	38	49.4	23.8
≥6	229	9	3.93	220	110	50.0	110	50.0	34	30.9	20	18.2	56	50.9	25.5

The fourth parity showed lowest incidence of abnormal calving, whereas, sixth and above parities showed highest incidence of abnormal calving in the herd. The incidence of abnormal births was not significantly different over parities, which was in line with the results of Singh *et al.* (2002).

The postnatal mortality of female calves from birth to reaching age at first calving was estimated as 38.8 % of total female birth, which is higher than the values reported by the Rao and Rao (1996) and Gowane and Tomar (2007). The analysis of variance for postnatal mortality of female calves showed that period, season and parity had highly significant (P<0.01) effect on this trait. The mortality rate was lowest for the animals born in summer and highest for the animals born in north-east monsoon. The highest mortality in summer was due to exposure of animals to extreme hot and humid climatic condition during this period in this herd. The overall culling rate of Murrah buffalo calves and heifers observed in this study corroborated with the earlier findings (Rao and Rao 1996, Gowane and Tomar 2007). However, much lower value of 11.09 % was reported for Murrah buffaloes maintained at NDRI, Karnal (Gowane *et al*. 2006). The analysis of variance showed that period and season had highly significant (P<0.01) effect on culling rate, whereas, the parity had non-significant effect on this trait. There is a great variation in culling rate among different periods. The lowest culling rate was observed in period 1 (1979–1982) and the highest culling rate was observed in period 3 (1987–1990). The highest and lowest culling rates were observed in winter and summer respectively. The effect of period on culling rate was significant, which was supported by previous research findings (Tomar and Rawal 1994, Mukherjee and Tomar 1997, Singh *et al*. 2002). The fluctuation in culling rate over the period could be because of variation in management practices, disease occurrence and environmental stress.

Out of 2,234 births, 422 female calves reached age at first calving. It indicated that 40.0 % of female calves born or 19.4 % of total pregnancies were turned into replacement heifers, which means that a very high proportion of calves born could not contribute to the future herd because of male births, abnormal births, culling and mortality of female calves up to the age at first calving. Singh *et al.* (2002) found 51.41 % of replacement stock on female calf basis in Murrah buffaloes of India. The average replacement rates on both female and total calves basis observed were found to be lower than the values reported by Gowane and Tomar (2007) for Murrah buffaloes at NDRI, Karnal. The replacement rate observed (on total calf basis) in the present investigation indicated that it required about 4 to 5 pregnancies to produce one heifer entering the milking herd. It indicated that each cow should produce a minimum of 2 female calves during its herd life so as to replace itself or make genetic contribution to the future generation before being lost.

Among the different non-genetic factors, period of calving contributed major source of variation in replacement rates than season of calving and parity of the dam. Period and season of birth significantly (P<0.01) affected the replacement rate estimated on female calves and total calves basis. Mukherjee and Tomar (1997) found that period of birth significantly (P < 0.05) affected the trait, while season of birth had no significant effect. The lowest and the highest replacement rates were observed in periods 3 (1987 to 1990) and 4 (1991 to 1994) respectively. The variation in mortality rates among the periods might be the major reason for difference in replacement rates and it generally varied between 23.1 and 51.6 % among different periods. The lowest and highest replacement rates were observed in north-east and winter born calves. Parity of dam significantly affected (P<0.01) replacement rate estimated on the basis of total pregnancies and is in accordance with the findings of Banik and Naskar (2006) in Sahiwal cattle. The replacement rate observed in third parity was the lowest and the highest replacement rate was observed in sixth and above parities.

The study on different components of replacement rate revealed that maximum loss was found to be due to mortality. Hence, better care of new born calves especially during their first month of life and in the rainy season and better feeding management in later parts of their calfhood stage will reduce the incidence of mortality. The reduction of mortality rate will result in more number of heifers being available to replace the old and low productive cows in the herd for better profitability. The difference in mortality and replacement rates among different periods indicated variation in management practices. Hence, better health care to the young ones not only reduce mortality rate but also would increase the replacement rate of Murrah buffaloes in the present herd. Heritability estimates for different replacement traits were calculated on sires having five or more progenies. The heritabilities for all the replacement traits were very low (ranged between 0.0364±0.008 and 0.054±0.002) indicating that selection is not likely to yield favourable response in improving any of the replacement traits. These results are in consonance with the report of Singh *et al*. (2002).

SUMMARY

The average value (in %) for abnormal birth, male birth, female birth, death of female calves, culling of female calves, replacement rate on basis of total pregnancies and total female calves born were 2.82, 51.4, 48.6, 38.8, 21.2, 19.4 and 40.0 respectively. On an average 4 to 5 pregnancies were required for one female calf to reach milking herd. Among the non-genetic factors, period of birth contributed for major variation in replacement rate and its components. The effects of different non-genetic factors (viz. season, periods and parity) affecting replacement rate and its components revealed that period of birth affected the replacement rate and its components highly significantly (P<0.01). Beyond fifth lactation the efficacy of cows to replace a heifer decreased gradually.

REFERENCES

Banik S and Naskar S. 2006. Effect of different non-genetic factors on replacement rate and its components in Sahiwal cattle. *Indian Journal of Animal Sciences* **76**: 343–45.

Gowane G R and Tomar S S. 2007. Genetic and non-genetic factors affecting selective value in a herd of Murrah Buffaloes. *Indian Journal of Dairy Sciences* **60**: 25–29.

Gowane G R, Tomar S S and Sachdeva G K. 2006. Annual replacement index in a herd of Murrah buffaloes. *Indian Journal Dairy Sciences* **59**:120–21.

Mukherjee K and Tomar S S. 1997. Genetics of female calf losses up to maturity and replacement rate in crossbred cattle. *Indian Journal of Dairy Sciences* **50**: 473–76.

Rao A V N and Rao H R M. 1996. Longevity, lactation efficiency and culling pattern of Murrah buffaloes in Andhra Pradesh. *Indian Veterinary Journal* **73**: 1196–97.

Shahi B N and Kumar D. 2006. Factors affecting replacement rate and its components in Jersey-Sahiwal cattle. *Indian Journal of Animal Sciences* **76**: 855–56.

Singh S, Khanna A S and Singh R P. 2002. Replacement and lifetime production traits: effect of non-genetic factors and sire evaluation. *Asian-Australisian Journal of Animal Sciences* **1**: 11–15.

Tomar S S, Arun K and Ajay K. 1991. New approach for genetic analysis of proportion data without transformation. *Asian Journal of Dairy Research* **10**: 87–90.

Tomar S S and Rawal S C. 1994. Replacement rate in Sahiwal herd. *Indian Veterinary Journal* **71**: 1334–35.

Tomar S S and Tripathi V N. 1995. Genetic and non-genetic variation in abnormal calving of Murrah buffaloes. *Indian Veterinary Journal* **72**: 153–56.