The Bioscan 11(3): 1433-1436, 2016
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

GENETIC AND NON-GENETIC FACTORS AFFECTING THE TOTAL CALVES BIRTH IN PHULE TRIVENI CROSSBRED CATTLE

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KEYWORDS
Crossbred cattle
Genetic factors
Total calves born trait
Non-genetic factors

Received on :
01.04.2016

Accepted on :
06.06.2016

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ABSTRACT
Present study was carried out on Phule Triveni crossbred cattle with the aim to determine the effect of genetic and non-genetic factors on total calves born trait and their genetic control. Data on total calves born trait in Phule Triveni crossbred cattle are maintained at Research-Cum-Development Project (RCDP) on cattle, Mahatma Phule Krishi Vidyapeeth Rahuri, Dist. - Ahmednagar (MS) over a period of 39 years (1976 to 2014) were analyzed in the study. The data was grouped into different sub-classes of season of calving, period of calving, age at first calving and genetic group of animals. In present study the average genetic variability for number of total calves born, were 3.21 ± 0.11 and period of birth,season of birth,and generation had non-significant effect on number of total calves born but age at first calving(AFC) had significant effect on total calves born.The random effect of sire had shown non-significant ($p < 0.01$) influence on total calves born trait. So, various environment factors significantly affected the total calves born trait indicating the scope of improvement in management of these crossbred cattle.

INTRODUCTION

The demand for milk and milk products has increased sharply with increase in human population. The selective breeding and crossbreeding are main tools to improve the milk production potential of indigenous breeds (Ratwan *et al.,* 2016). Cross breeding as a mating system optimizes the additive genetic and non-additive (heterotic) breed effects of *Bos taurus* and *Bos indicus* cattle in sustainable breeding systems (Gregory and Cundiff, 1991). Buffalo contributes about 51% and cattle contributes about 45% of the total milk production in India (BAHS, 2013) and milk fat is important constituents of milk (Kumar *et al.,* 2015, 2016; Vohra *et al.,* 2015). Total cattle population of India is 190.9 million out of which indigenous cattle is 151.17 million and crossbred/ exotic cattleis 39.73, indigenous cattle contributes 21% and crossbred/exotic contributes 24% to the total milk production of India (BAHS, 2013). Life time milk and calf productivities are one of the primary interests of dairy cattle producers.

The genetic contribution of a cow to the next generation depends up on herd life(longevity), total calves born, total normal calves born, total female calves born and selective value (Atrey *et al.,* 2005; Kumar *et al.,* 2009) and this contribution in the form of living progeny is known as selective value. It is associated with the life time calf production and their survival up to milking age. Longevity in dairy cattle is an important characteristic both from an economist point as well as from breed improvement. Genetic contribution in the form of live progeny to the next generation from a cow is associated with herd life, calf production and their survival for better replacement. Longer her dlife increases the total lifetime calf and milk production, which in turn leads to higher selection intensity. The ultimate goal of the animal breeder is to acquire maximum return per unit incurred during life time of a cow.

The present investigation was undertaken with the objective to study the influence of various non-genetic and genetic factors on total calves born trait and their genetic control which could be used for selecting Phule Triveni crossbred cattle for life time production traits.

MATERIALS AND METHODS

The present study was conducted on total calves born trait in Phule Triveni crossbred animals maintained at Research-Cum-Development Project (RCDP) on Cattle, Mahatma Phule Krishi Vidyapeeth Rahuri, Dist.-Ahmednagar(MS) over a period of 39 years (1976 to 2014) were analyzed in the study. Generally there would be difference in the production of cattle from period to period due to differential fodder and feed availability, management practices and under different environment conditions. Entire span of 39 years for which data collected was divided into 6 periods; each period of 6 years. Based on prevalent climatic conditions of the area, year of calving was divided into 3 seasons- winter (October to January), summer

(February to May) and rainy (June to September). The age at first calving of animals were classified as 4 groups. Sires having 3 or more progenies were considered in the study. The data was distributed into 9 genetic groups. The data were analyzed using a mixed model least-squares analysis for fitting constants (Harvey, 1990) due to non-orthogonal and disproportionate sub-class frequencies.

The following model was used with assumptions that different components being fitted into the model were independent and additive.

$Y_{ijklmn} = \mu + S_i + (Sea)_j + P_k + (AFC)_l + (GG)_m + e_{ijklmn}$

where,

Y_{ijklmn} is n^{th} total calves born of cattle which is progeny of i^{th} sire, calved in j^{th} season, k^{th} period, l^{th} age at first calving and m^{th} genetic group of the animal; ì is overall mean, S_i is random effect of i^{th} sire, Sea_j is fixed effect of j^{th} season of calving, P_k is fixed effect of k^{th} period of calving, AFC_l is effect of l^{th} age at first calving, GG_m is effect of m^{th} genetic group and e_{ijklmn} is random error associated with each observation assumed to be NID (0, $\sigma^2 e$).

The differences of means between subclasses of periods, seasons, age at first calving and genetic groups were tested for significance using Duncan's multiple range test as modified by Kramer (1957). The analysis of variance for season, period of calving, age at first calving and genetic group of total calves born trait were computed and presented in Table 3.

RESULTS AND DISCUSSION

In present study the over all least squares mean for total calve born was 3.02 ± 0.11 in cross bred Phule Triveni cattle. When compare present results with other researchers then lower value of total calves born as compare to the result was reported by Atrey *et al*. (2005) in Frieswal cattle (2.57 ± 0.06). But, the higher value of total calves born were noticed byTomar *et al*. (1995) in Red Sindhi cattle (3.42 ± 0.07); Poonma and Goswami (2005b) in Tharparkar cattle (4.37 ± 0.71); Kumar *et al*. (2009) in Hariana cattle (5.2 ± 0.16) and Singh *et al*. (2011) in Sahiwal cattle (4.19 ± 0.20).

Effect of period of birth

The analysis of variance revealed that the period of birth had non-significant effect on total calves born in Phule Triveni cow (Table 1). These results were in agreement with the findings of Gowane and Tomar (2007) in Murrah buffalo. Where as, contradictory findings were reported by Mukherjee and Tomar (1996a) In Brown Swiss crosses, Mukherjee and Tomar (1996b) in Karan Swiss cattle, Singh (2001) in Karan Fries cattle, Atrey *et al*. (2005) Frieswal cattle, Goshu (2005) in Friesian-Boran crossbred cow, Kumar *et al*. (2009)in Hariana cattle, Singh *et al*. (2011) in Sahiwal cattle and Kumar *et al*. (2014) in Frieswal cattle. In Phule Triveni cow, the highest total calves born (3.37 ± 0.25) was observed during period P4 (1994-99) followed by period P1 (1976-71)(3.23 ± 0.14) and lower value of total calve born (2.41 ± 0.32) was noticed in period P6 (2006 and above) (Table 2). These findings were in close agreement with Singh *et al*. (2011) in Sahiwal cattle and Kumar *et al*. (2014) in Frieswal cattle. These variations might be due to in fluence of environmental factors and also genetic inheritance of parent.

Effect of season of birth

Table 1: Least squares means for total calves born as affected by various factors in Phule Triveni cattle

Effects	N	Total calves born	
		Mean	SE
μ	611	3.021	0.11
Period of birth			
P1 (1976-81)	216	3.23	0.14
P2 (1982-87)	136	2.78	0.17
P3 (1988-93)	129	3.15	0.17
P4 (1994-99)	65	3.37	0.25
P5 (2000-05)	32	3.18	0.33
P6 (2006- above)	33	2.41	0.32
Age at first calving (days)			
A1 (< 900)	273	3.20b	0.14
A2 (901-950)	69	3.29a	0.23
A3 (951-1000)	63	2.90abc	0.24
A4 (> 1000)	206	2.68c	0.13
Season of birth			
S1 (Winter)	233	2.79	0.14
S2 (Summer)	197	3.03	0.15
S3 (Rainy)	181	3.23	0.15
Generation			
G1	121	3.07	0.16
G2	152	3.02	0.14
G3	107	3.05	0.17
G4	85	2.74	0.19
G5	56	3.27	0.24
G6	41	3.04	0.28
G7	36	2.82	0.30
G8	9	3.13	0.60
G9	4	3.82	0.90

Table 2: Least squares means for total calves born as affected by only 10 top ranked Sire in Phule Triveni cattle

Effect	N	Total calves born	
		Mean	SE
μ	611	3.12	0.12
Sire			
R92	40	3.20	0.28
R29	31	3.50	0.32
R81	29	3.13	0.33
R65	23	3.31	0.37
R36	22	3.21	0.38
R24	21	2.95	0.39
R68	20	2.97	0.40
R40	19	3.07	0.41
R67	18	3.13	0.42
R90	18	2.92	0.42

The non-significant influence of season of birth on total calves born in Phule Triveni cattle was observed in present investigation (Table 1). Similar non significant results were reported by Mukherjee and Tomar (1997) in crossbred cattle, Kumar (1999) in Hariana cattle, Goshu (2005) in Friesian-Boran cattle, Poonma and Goswami (2005b) in Tharparkar cattle and Singh *et al*. (2011) in Sahiwal cattle. Where as, contradictory result was reported by Pyne and Chakraborthy (1992) in Red Sindhi cow. In PhuleTriveni cattle,the highest total calves born (3.23 ± 0.15) was observed durin grainy season and lower value for total calve born (2.79 ± 0.14) was noticed in winter season (Table 2). These findings were in close agreement with the findings of Poonma and Goswami (2005b) in Tharparkar cattle. These variations might be due to influence of environmental factors and also genetic in heritance of parent.

Effect of age at calving

The difference in the total calves born due to age at first calving group was significant ($P < 0.05$) in Phule Triveni cow (Table1). Similar result were obtained by Mukherjee and Tomar (1996a) in Brown Swiss crosses, Singh (2001) in Karan Fries cattle, Poonma and Goswami (2005a) in Tharparkar cattle, Atrey *et al*. (2005) in Frieswal cattle, Kumar *et al*. (2009) in Hariana cattle and Kumar *et al*. (2014) in Frieswal cattle.While,the contradictory results were reported by Gowane and Tomar (2007) in Murrah buffalo. The DMRT indicated that the total calves born for A2 and A1 AFC group were significantly higher than other AFC group. The highest total calve born was observed in A2 group (3.29 ± 0.23) followed by A1 group (3.20 ± 0.14). The lowest number of total calve born was found in A4 AFC group (2.68 ± 0.13) (Table 2). It indicated that the total calves born decreased with increase in AFC in Phule Triveni cattle. These findings were in close agreement with Kumar *et al*. (2009) in Hariana cattle and Kumar *et al*. (2014) in Frieswal cattle.

Effect of generation

The analysis is of variance indicated that the variation

Table 3: Analysis of variance for total calves born as affected by various non genetic factors in Phule Triveni cattle

Source of variance	d.f.	SS	MSS	F (Cal)
POB	5	35.344	7.0689	2.130
AFC	3	31.836	10.6120	3.197*
SOB	2	19.961	9.9805	3.007
Error	600	1971.578	3.3192	

$P < 0.05$

Table 4: Analysis of variance for total calves born as affected by generation in Phule Triveni cattle

Source of variance	d. f.	SS	MSS	F (Cal)
Generation	8	14.841	1.8551	0.571
Error	602	1956.737	3.250	

Table 5: Analysis of variance for total calves born as affected by sirein Phule Triveni cattle

Source of variance	d.f.	SS	MSS	F (Cal)
Sire	91	296.097	3.254	1.017
Error	519	1660.640	3.200	

associated with the generation differences in total calve born was non-significant in PhuleTriveni cow (Table 3). These results were in agreement with those of Lathwal *et al*. (1992) in Red Sindhi cattle. Where as, contradictory findings were reported by Tomar and Basu (1981) in Murrah buffalo and Rawal and Tomar (1994) in Sahiwal cattle. In Phule Triveni cow, the highest number of total calves born (3.82 ± 0.90) was recorded in G9 generation and less number of total calves born (2.74 ± 0.19) was recorded in G4 generation (Table 1).

Effect of Sire

The analysis of variance indicated that the sire had non-significant effect on total calves born in Phule Triveni cow (Table 5). These results were in close agreement with the estimates reported by Rawal and Tomar (1994) in Sahiwal cattle and Gowane and Tomar (2007) in Murrah buffalo.Where as, contradictory finding were reported by Rawal (1991) in Zebu cattle, Mukherjee and Tomar (1996a) in Brown Swiss crosses, Mukherjee and Tomar (1996b) in Karan Swiss cattle, Atrey *et al*. (2005) in Frieswal cattle, Kumar *et al*. (2009) in Hariana cattle and Kumar *et al*. (2014) in Frieswal cattle. In Phule Triveni cow, the highest number of total calves born (3.50 ± 0.32) noticed for sire R29 and less number of total calve born was observed (2.92 ± 0.42) for sire R90 (Table2).

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