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EFFECT OF NON-GENETIC FACTORS ON PRODUCTION AND REPRODUCTION TRAITS IN CROSSBRED CATTLE MAINTAINED AT ORGANIZED FARM

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Abstract: *The aim of this study was to identify non parameters offering the production and traits of crossbred cattle raised on organized farm. The data over the period of 30 years from 1986-2015 was collected from history cum pedigree sheets maintained at College of Agriculture Pune by Dairy department and utilized for the present study. The data were classified according the season of calving, period of calving and lactation order up to 5th lactation and analyzed by least square method as suggested by Harvey (1990). DMRT test as modified by Kramer (1957) was used to make pair wise comparison among the least square means. The data were corrected for significant effect for various non-genetic factors and corrected data were used to estimate correlation among the different trait. The Least squares means of total lactation milk yield (TLMY), 300 days milk yield (THDMY), lactation length (LL), dry period (DP), and calving interval (CI) were 2179.42±44.96 kg, 2096.25±41.44 kg, 329.82±5.52 days, 90.22±3.37 days, 435.31 ± 11.99 days respectively. The effect of season of calving had significant effect on TLMY (p<0.05) however, period of calving had significant effect on all the traits under study (p<0.01) except CI and DP. The positive and highly significant correlations were noted among the TLMY with 300DMY, LL and CI Similarly, LL with CI and DP with CI. In conclusion, based on the findings of the present study, the production traits of crossbred cattle raised at organized farm with ideal feeding and management strategies was in accordance with standards.*

Key words: *Crossbred cattle, Production traits, Reproduction traits, Non-Genetic effect.*

Introduction:

Animal husbandry plays a prominent role in the rural economy supplementing the income of rural household, particularly the landless, small and marginal farmers. It also provides subsidiary occupation in semi urban area and more so far people living in hilly and draught prone areas. Indian economy is dependent upon the agriculture, where 55% population is directly or indirectly depends on agriculture and its allied activities for livelihood. India has 190.90 million cattle, out of which 39.73 million are crossbreds and 151.2 million are indigenous cattle (Anonymous 2012). The number of crossbred cattle has been increased by 19.93% and indigenous cattle decreased by 8.94% during 2012 as compared to previous livestock census (Anonymous, 2007). Cow produces about 45 % of the total milk in India. Crossbred cows produce 25% of cow milk and indigenous cow produce 20% (Anonymous, 2012).

The low milk yield in Indian dairy industry can be reasoned by poor genetic stock, improper management, inadequate feeding and health cover. Factors that affect on production and reproduction traits are classified under two broad categories viz. genetic and non-genetic or environmental factors. In order to improve the productivity of our animals, systematic efforts on large scale, are being made to elevate the genetic potentiality in respect of economic traits through crossbreeding. Crossbreeding with improved European dairy breeds has been effective in introducing new genes in our cattle and improving their production performance. The possibility of complement the present gene in Indian cattle by better ones and providing favorable

environment seems to be the only solution for improving their milk producing capacity.

Genetic improvement of crossbred cattle for their overall productivity is a necessity, but before application of any genetic improvement program, it is necessary to identify fixed effects on different production and reproduction traits. The aim of this paper is to study of nongenetic factors on different production and reproduction traits in crossbred cattle of organized farm. Yet there is not a complete study on some of these traits of this breed.

Material and Methods

The data was collected from college dairy farm, Pune, Maharashtra for the period from 1986 to 2015 and classified according to the season of calving, period of calving and order of lactation upto 5th lactation. The period was classified according to the year of calving into five groups i.e. P_1 (1986-1991), P_2 (1992-1997), P_3 (1998-2003) P_4 (2004-2009) and P_5 (2010-2015).Year was divided into three seasons i.e. Rainy (June to September), winter (October to January) and summer (February to May). Further, the data were divided into five parities i.e. L_1, L_2, L_3, L_4 and L_5. The least squares means of lactation yield, 300 days milk yield, lactation length, dry period and calving interval was estimated by considering season of calving, period of calving and lactation order by least square analysis using following model (Harvey 1990).

$$Y_{ijkl} = \mu + S_i + P_j + L_k + e_{ijkl}$$

Where,

Y_{ijkl} = Observation of lth productive traits in ith season of calving, jth period of calving and kth lactation order

μ = Population mean

S_i = Effect of ith season of calving (i=1, 2 and 3)

P_j = Effect of jth period of calving (j= 1,2,…5)

L_k = Effect of kth lactation order (k=1, 2, ….5)

e_{ijkl} = Random error associated with NID ~ (0,σ^2 e)

Duncan's multiple range tests as modified by Kramer (1957) was used to make pair wise comparison among the least squares means of various traits with the use of inverse elements and root mean square for error. The correlations among different milk production trait were estimated (Snedecor and Cochran, 1994).

$$r = \frac{\Sigma xy}{\sqrt{(\Sigma x^2).(\Sigma y^2)}}$$

x and y were various milk production traits.

Where, $x = \bar{X} - X$, $y = \bar{Y} - Y$

Results and Discussion

Total Lactation milk yield (TLMY)

The overall least squares mean for total lactation milk yield was 2179.42 $\pm$ 44.96 kg. in crossbred cattle (Table 1). Differences associated due to the season of calving ($p<0.05$) and period of calving ($p<0.01$) had significant effect on lactation milk yield. However, differences due to order of lactation had non significant. Present results were in accordance with Patond (2009) in Jersey, Waghmode (2014) in crossbreds. However, the higher milk production than present results were reported by Mandawade (2010) in HF crossbreds, Talape (2010) in Jersey crossbreds, Garudkar (2011) in FJG. The results revealed that animals calved during winter had higher total lactation milk followed by summer and rainy season. The similar results were reported by Talape (2010) in Jersey crossbred cattle, Waghmode (2014) in crossbreds. However significant results were reported by Khade (2001) in HF crossbreds, Garudkar (2011) in Phule Triveni synthetic cow, Patond (2009) in Jersey cattle, Mandwade (2010) in HF crossbreds. The DMRT revealed that P_3 P_4 and P_5 had significantly higher total milk yield than P_1, and P_2. There was an improvement in total lactation milk yield over the period of time. Similar results were reported by Thakur and Singh (2001) in Jersey x Red Sindhi crossbred cattle, Garudkar (2011) in Phule Triveni synthetic cow, Waghmode (2014) in crossbreds.

However the non significant effect was reported by Dalal *et al.* (1993) in Hariana halfbreds, Mandwade (2010) in HF crossbreds, Talape(2010) in Jersey crossbred cattle and Patond (2009) in Jersey cattle

300 days milk yield

The overall least squares mean for 300 days milk yield in crossbred cattle was 2096.25 ± 41.44 Kg(Table 1). The period of calving had significant effect on 300 days milk yield in crossbred cattle ($p<0.01$). However season of calving and order of lactation had non significant effect on 300 days milk yield. Similar results were reported by Patond (2009) in Jersey cattle. However, lower values reported by Pramanik *et al.* (2000) in JH halfbreds and Waghmode (2014) in crossbreds. The least squares mean for P_1, P_2, P_3, P_4 and P_5 were 1800.67±106.07, 1446.36±58.58, 2440.77±71.67, 2271.26±81.58 and 2522.18±108.33 Kg, respectively. There was an improvement in 300 days milk yield over the period of time. The results revealed that animals calved during period P_3, P_4 and P_5 had significantly higher 300 days milk yield than P_1 and P_2. Similar results were reported by Mandwade (2010) in HF crossbred cow, Talape (2010) in Jersey crossbred cattle. However the significant effect was reported by Nagawade (2005) in Phule Triveni cattle, Garudkar (2011) in Phule Triveni synthetic cow, Patond (2009) in Jersey cattle, Waghmode (2014) in crossbreds. The higher 300 days milk yield in P_5 and lower value of 300 days milk yield in P_2, might be due to difference in the availability of green fodder and concentrate during these periods.

Lactation length

The overall least squares mean of lactation length in crossbreds was 329.82 ± 5.52 days (Table 1). The period of calving had significant effect on lactation length (0.01). Season of calving and order of lactation had non significant effect on the lactation length (Table 1). Similar results were reported by Thakur and Singh (2001) in JF halfbreds, Mandwade (2010) in HF crossbred cow, Waghmode (2014) in crossbreds. Lower lactation length was reported by Talape (2010) in Jersey crossbreds. However, higher lactation length was reported by Khade (2001) in IFG, Kamble (2003) in FG crossbreds and Garudkar (2011) in FJG cow. The least squares mean for P_1, P_2, P_3, P_4 and P_5 were 297.80±13.84, 366.62±8.85, 343.06±10.27, 328.67±10.79 and 312.97±13.02 days respectively. The DMRT recorded that significantly higher lactation length was recorded the animals calved during in P_2 period. The lactation length recorded for period P_2 and P_3 was at par with each other. The lactation length recorded for the period P_1, P_4 and P_5 was on par with each other. However lowest lactation length was recorded in P_1. Significant effects of period of calving were reported by Zol (2007) in Phule Triveni

Calving interval (CI)

The overall mean for calving interval in crossbred cows was 435.31 ± 11.99 days (Table 1). The analysis of variance revealed that season of calving, period of calving and order of lactation had non significant effect on calving interval (Table 1). Present results were in accordance with results reported by Waghmode (2014) in Crossbreds. However the shorter calving interval than present results was reported by Ulhas Gaikwad *et al.* (2018) in HF x Gir Halfbreds. However the longer calving interval than present result (435.31±11.99 days) was reported by Talape (2010) in Jersey crossbreds (472.11±8.05 days).

Dry period

The overall dry period recorded for crossbreds was 90.22 ± 3.37 days (Table 1). The analysis of variance revealed that season of calving, period of calving and order of lactation had non significant effect on dry period ($p<0.05$). The present results were in arrangement with Waghmode (2014) in Crossbreds. However, lower dry period was reported by Kamble (2003) in FG halfbreds (81.41 ± 3.77) and Mandwade (2010) in HF crossbreds (82.90±3.85). However higher dry period was noted in the cows calved during the period 1992-1997 in rainy season and in 4th lactation order (Table 1).

Table 1: Least Squares Means (± SEM), Significance and Multiple comparison test results for the effect of season of calving, period of calving and order of lactation on production and reproduction traits

Factors	Production and Reproduction Traits				
	TLMY (Kg.)	300DMY (Kg.)	LL (Days)	CI (Days)	DP (Days)
Overall mean (μ)	2179.42±44.96 (275)	2096.25±41.44 (189)	329.82±5.52 (275)	435.31±11.99 (239)	90.22±3.37 (243)
Season of Calving	*	NS	NS	NS	NS
S_1 (Rainy)	2016.98^{b}±77.26 (77)	1985.94±71.54 (49)	320.29±9.48 (77)	420.16±20.35 (66)	95.60±5.67 (69)
S_2 (Winter)	2298.17^{a}±67.18 (96)	2184.46±61.93 (76)	341.55±8.25 (106)	434.03±18.15 (90)	92.39±5.16 (90)
S_3 (Summer)	2223.13^{a}±70.72 (102)	2118.35±62.22 (64)	327.64±8.61 (92)	451.74±17.93 (83)	82.67±5.08 (84)
Period of Calving	**	**	**	NS	NS
P_1 (1986-1991)	1744.78^{bdf}±112.71 (40)	1800.67^{bc}±106.07 (24)	297.80^{bf}±13.84 (40)	451.21±28.21 (38)	92.13±8.10 (37)
P_2 (1992-1997)	1674.61^{bdf}±72.09 (82)	1446.36^{bd}±58.58 (68)	366.62^{a}±8.85 (82)	471.11±19.52 (68)	100.01±5.38 (71)
P_3 (1998-2003)	2626.60^{a}±83.63 (61)	2440.77^{a}±71.67 (44)	343.06^{ac}±10.27 (61)	435.72±21.89 (52)	93.36±5.97 (57)
P_4 (2004-2009)	2346.71^{be}±87.88 (54)	2271.26^{a}±81.58 (33)	328.67^{be}±10.79 (54)	423.25±22.55 (48)	86.29±6.61 (46)
P_5 (2010-2015)	2504.42^{bc}±106.01 (38)	2522.18^{a}±108.83 (20)	312.97^{bd}±13.02 (38)	395.27±27.62 (33)	79.29±7.99 (32)
Order of lactation	NS	NS	NS	NS	NS
L_1	2182.03±72.69 (81)	2026.80±63.57 (57)	347.29±8.92 (81)	427.00±17.51 (81)	85.87±5.60 (79)
L_2	2127.20±75.95 (73)	2000.08±69.16 (48)	331.95±9.32 (73)	466.59±19.16 (66)	97.10±5.48 (66)
L_3	2206.75±85.06 (59)	2101.86±75.72 (43)	339.41±10.44 (59)	455.35±22.80 (47)	86.17±6.45 (48)
L_4	2115.33±104.59 (39)	2054.36±96.04 (25)	309.15±12.84 (39)	420.21±30.21 (27)	98.73±8.12 (31)
L_5	2265.81±134.85 (23)	2298.15±117.95 (16)	321.32±16.56 (23)	407.41±36.54 (18)	83.22±10.18 (19)

Means in the same column with different superscript differed significantly ($p<0.05$; $p<0.01$)
Figure in parenthesis indicate number of observation

Correlation

It was observed that Lactation milk yield had highly significant and positive correlation with 300 days milk yield, lactation length and calving interval (Table 2.). Similar results were reported by Waghmode (2014) in crossbred cattle. The correlation between 300 days milk yield with dry period and calving interval were negative and significant (Table 2). Similar results were reported by Garudkar (2011) in Phule Triveni synthetic cow, Patond (2009) in Jersey cattle. Dry period had highly significant and positive correlation with calving interval (Table 2). Similar results were reported by Garudkar (2011) in Phule Triveni synthetic cow, Mandawade (2010) in HF crossbreds and Waghmode (2014) in crossbred cattle. The lactation length had highly significant positive correlation with calving interval (Table 2). Similar results were reported by

Garudkar (2011) in Phule Triveni synthetic cow, Patond (2009) in Jersey cattle.

Table 2: Correlation amongst different production and reproduction traits

	LMY	300DMY	LL	DP	CI
LMY	1				
300DMY	.895**	1			
LL	.453**	-.016	1		
DP	-.124	-.235**	.081	1	
CI	.178**	.-157*	.548**	.285**	1

Conclusions

The least squares means for total lactation milk yield, 300 days milk yield, lactation length, dry period and calving interval, in crossbreds maintained at Organized farm were 2179.42+44.96 kg., 2096.25+41.44 kg., 329.82+5.52 days, 90.22+ 3.37 days, and 435.31+11.99 days, respectively. The effect of season of calving had non significant effect on all traits except total lactation milk yield. The period of calving had highly significant effect on TLMY, 300DML and LL. The non significant effects of lactation order were noted on all traits under study. The positive and highly significant correlations were observed between LMY with LL and CI; LL with CI and DP with CI.

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