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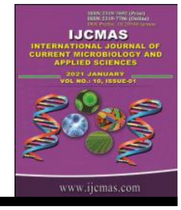

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Effect of Non-genetic Factors on Production Traits of for HF × GIR Halfbreds

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ABSTRACT

Keywords

HF × Girhalfbreds, TMY, LL, DP, PMY, POC, SOC, LO

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The data on production performance of HF × Gir halfbreds maintained at Research cum Development Project on Cattle (RCDP), Mahatma Phule Krishi Vidyapeeth, Rahuri district, Ahmednagar, (M.H) were utilized for present study The least squares means of total milk yield (kg), lactation length (days), dry period (days) and peak milk yield (kg) were estimated by considering the effects of period of calving, season of calving and lactation order as non-genetic factors. The effect of period of calving was significant on traits TMY, PMY ($P<0.01$) and DP ($P<0.05$) while it was non significant in LL. The effect of season of calving was non significant on all the traits viz TMY, DP and PMY except LL. The effect of order of lactation was significant on trait PMY and DP ($P<0.01$), while it was non significant on traits TMY and LL.

Introduction

Increased pressure for intensified milk production and simultaneous rise in environmental temperature due to global warming has increased the thermal load on dairy animals. Elevated environmental temperature combined with high humidity causes discomfort and escalates the stress level in animals which is reflected in terms of reduced physiological and metabolic activities that results in reduced growth, drop in production and reproduction in farm animals. Heat stress is one of the most vital environmental stressor that has negative impact on milk yield, milk composition (fat%, SNF%, protein % etc). Construction of Temperature Humidity Index (THI) by combining several climatological parameters like dry bulb, wet bulb temperature along with relative humidity to quantify the thermal stress is one of the best methods to assess heat stress on animals. Several research workers have reported that there exists a threshold THI value, above which the negative effects of heat stress is observed on animals. Mitigation strategies to combat heat stress includes selection of heat tolerant animals and their breeding, inclusion of heat tolerance as a trait while constructing selection index, providing balanced nutrition to the animals and implementation of good ventilation along with suitable cooling system in the farm (Behera *et al.,* 2020).

Materials and Methods

The data of Phule Triveni cows maintained at Research Cum-Development Project on Cattle, M.P.K.V., Rahuri for a period from 2009 to 2019 (10 years) were collected for present investigation for following Traits:

a) Productive traits:1) Total lactation milk yield (kg),2) Lactation length (days),3) Dry period (days),4) Peak milk yield (kg).

To examine the Production traits, the research data was classified into 3 periods of calving viz. P_1 (2009-2011), P_2(2012-2014),P_3 (2015above);3 seasons of calving, viz. S_1 (Rainy) June- September, S_2 (Winter) October-January and S_3 (Summer) February-May; 5 order of lactation viz. L_1 first lactation, L_2 second lactation, L_3 third lactation, L_4 fourth lactation, L_5fifth lactation

The effects of non-genetic factors like period of calving, season of calving and parity were estimated by using least-square analysis as suggested by Harvey (1990). The model was used with the assumption that different components being fitted into the model were as linear, independent and additive. The model used was as follows:

Model I

$Y_{ijkl} = \mu + A_i + B_j + C_k + e_{ijkl}$

where Y_{ijkl}, observation of l^{th} animal, k^{th} parity, j^{th} season of calving, i^{th} period of calving; μ overall mean, A_i fixed effect of i^{th} period of calving (1 to 3), B_j fixed effect of j^{th} season of calving (1 to 3), C_k fixed effect of k^{th} parity (1 to 5); e_{ijkl} random error ~ NID (0, σ^2e).

Duncan's Multiple Range Test (DMRT)

Duncan's Multiple Range Test as modified by Kramer (1957) was used to make pair wise comparison among the least square means with the use of inverse elements and root mean squares for error.

If the values:-

$$(Y_i - Y_j) \times \sqrt{\frac{2}{C_{ii} + C_{jj} + 2\,C_{ij}}} > \sigma^2 e,\ Z(P,ne)$$

Where,

$Y_i - Y_j$: Difference between two least squares means

C_{ii}: Corresponding i^{th} diagonal elements of C matrix

C_{jj}: Corresponding j^{th} diagonal elements of C matrix

Z (P, ne): Standardized range value in Duncan's table at the chosen level of probability for the error degrees of freedom

P: Number of means involved in the comparison

σ^2e: Root mean squares for error

Results and Discussion

Total milk yield (kg)

The overall least squares mean of total milk yield in HF × Girhalfbreds was 2448.92 ± 73.72kg. This was in accordance with Deokar

(2003) in Gircrossberd cows. Whereas, higher values were reported by Ambhore *et al.,* (2017) in Phule Triveni (2855 ± 43 kg), Kamble *et al.,* (2016) in Phule Triveni (2835.05 ± 57.47 kg), Raut *et al.,* (2017) in HF × Girhalfbreds (2556.82 kg), Jadhav *et al.,* (2019) in HF × Girhalfbreds (2701.77 ± 46.04 kg), Gaikwad *et al.,* (2018) in HF × Girhalfbreds (2703.10 ± 97.91 kg), However, Arya *et al.,* (2013) in crossbred cows and Thombare *et al.,* (2013) in HF × Deoni cows.

The influence of period of calving on total milk yield was significant (P<0.01). This was in accordance with Pandey M. *et al.,* (2018) in Sahiwal cattle and Baranwal *et al.,* (2018) in Vrindavani cows. In HF × Girhalfbreds, total milk yield (kg) of cows calved during P1 (2928.84 ± 104.85 kg) was significantly higher than those cows calved during period P2(2345.76 ± 108.88 kg) and P3 (2072.16± 163.45 kg) which were at par to each other.

The variation due to season of calving in total milk yield was non-significant in HF × Girhalfbreds. Similar results were obtained by Pandey *et al.,* (2018) Sahiwal cattle, Ambhore *et al.,* (2017) in Phule Triveni (2855 ± 43 kg), Kamble *et al,.* (2016) in Phule Triveni, Raut *et al.,* (2017) in HF × Girhalfbreds, Jadhav *et al.,* (2019) in HF × Girhalfbreds, Gaikwad *et al.,* (2018) in HF × Girhalfbreds. In presents study, the highest TMY was observed in cows calved during season winter (2532.30 ± 114.38kg) followed by summer (2435.48 ± 117.47kg) and lowest in rainy (2378.98± 131.64kg).

The difference due to order of lactation in total milk yield (kg) was non-significant in HF× Girhalfbreds. This was in accordance with Radhika *et al.,* (2012) in crossbred cows. In HF × Gir crossbreds, the highest TMY was observed in cows during L5 (2658.30 ± 158.04) followed by L4 (2578.43 ± 141.97), L2 (2479.13 ± 161.05), L3 (2458.66 ± 147.16) and lowest in L1 (2070.05 ± 167.87) lactation. In HF × Gir cows in the present study no specific trend of lactation lengths was noticed for total milk yield. The results revealed that the total milk yield linearly increased in cows calved during succeeding lactation order over preceding i.e. L1 to L5 in HF × Gir cows.

Lactation length

The overall mean lactation length of HF × Gir cows recorded was 282.68 ± 5.70 days. Which was in close agreement with Shubha Laxmi *et al.,* (2009) in HF × Sahiwal and Pol *et al.,* (2013) in Phule Triveni cows. Whereas, higher lactation length were reported by Ambhore *et al.,* (2017) in Phule Triveni cows (331.3 ± 3 days), Jadhav *et al.,* (2019) in HF×Girhalfbreds (320.43 ± 3.04days), Mote *et al.,* (2019) in IFG (352.21 ± 5.14 days) FG (327.22 ± 4.15days), FIG (331.71 ± 3.97days), IFJG (358.33 ± 3.81days), R(343± 7.52 days), Gaikwad *et al.,* (2018) in HF × Girhalfbreds (332.80 ± 8.72 days). However, lower lactation length was observed by Thombare*et al.,* (2013) in HF × Deonicows.

The variation due to period of calving in lactation length was non-significant in HF × Girhalfbreds. Thenon significant effect of period of calving on lactation length was also noticed by Jadhav*et al.,* (2019) in HF × Girhalfbreds, Mote *et al.,* (2019) in FG, FIG, Gaikwad *et al.,* (2018) in HF×Girhalfbreds. However, significant effect of period of calving on lactation length was reported by Ambhore *et al.,* (2017) in Phule Triveni cows, Mote *et al.,* (2019) in IFGIFJG. In HF x Girhalfbreds, lactation length (days) was highest in cows calved during period P1(300.36 ±8.10) followed by P2 (276.18 ± 8.41) and lowest in P3 (271.51 ± 12.63).

The influence of season of calving on lactation length was non-significant in HF ×

Girhalfbreds. These results were in accordance with Ambhore *et al.,* (2017) in Phule Triveni cows, Mote *et al.,* (2019) in IFG, FG, FIG, R, Gaikwad *et al.,* (2018) in HF×Girhalfbreds, Bhutkar *et al.,* (2014) in Deoni cows. However, present results did not agreed with Patond (2013) in Gir triple cross cows, Kamble *et al.,* (2016) in Phule Triveni cows, Mote *et al.,* (2019) in IFJG. In HF × Girhalfbreds, the highest lactation length was observed in cows calved during winter S2 (294.05 ± 8.84 days) season followed by rainy S1(285.26 ± 10.17 days) and lowest in summer S3(268.73 ± 9.08 days) season.

The effect of order of lactation on lactation length was non-significant in HF × Girhalfbreds. These results were in accordance with Patond (2013) in Gir triple cross and Thombare *et al.,* (2013) in HF × Deoni crossbred cows.

However, significant effect of order of lactation on lactation length was observed by Kamble (2003) in Gir crossbred cows and Jadhav (2011) in FG halfbreds. In HF × Girhalfbreds, the highest lactation length was observed in L1 (296.27 ± 12.98 days) lactation followed by L5 (283.80 ± 12.22 days), L3 (279.55 ± 11.37 days), L4 (277.70 ±10.97 days) and lowest in L2 (276.08 ± 12.45days) lactation. In HF × Gir no specific trend of lactation length was noticed during different lactations.

Dry period

The overall mean dry period in HF × Gir crossbreds was 151.51 ± 8.44 days. These results were in close agreement with Thakur and Singh (2001) in JH halfbreds, Pandey *et al.,* (2009) in FJH, Usman *et al.,* (2012) in HF cows, Hadge *et al.,* (2012) in Jersey × Sahiwal cows and Hassan *et al.,* (2013) in crossbred cows. However, lower values were noticed by Kamble (2003) in HG cows, Deokar *et al.,* (2008) in Phule Triveni cows (93.57 ± 4.94 days). The variation due to period of calving in dry period was significant (P < 0.05) in HF × Girhalfbreds. Similar results were noticed by Hadge *et al.,* (2012) in Jersey × Sahiwal crossbred cows, Mruttu (2013) and Bhutkar *et al.,* (2014) in Deoni cows, Kamble *et al.,* (2016) in Phule Triveni cows, Ambhore *et al.,* (2017) in Phule Triveni cows. In HF x Girhalfbreds, dry period (days) was largest in cows calved during period P3 (173.71 ± 18.71) followed by P2 (158.23 ± 12.46) and lowest in P1(122.57 ± 12.00).The results revealed that the dry period linearly increased in cows calved during succeeding period over preceding period i.e. P1 to P3 HF × Gir cows.

The variation due to season of calving in dry period was non-significant in HF × Girhalfbreds. These results were in agreement with Ambhore *et al.,* (2017) in Phule Triveni cows, Jadhav *et al.,* (2019) in HF × Girhalfbreds and Bhutkar *et al.,* (2014) in Deoni cows. However, the present results did not agree with Jadhav (2019) in HF × Girhalfbreds, Gaikwad *et al.,* (2018) in HF × Girhalfbreds. In HF × Girhalfbreds, the longest dry period was observed in cows calved during summer S3 (172.34 ± 13.45 days) season followed by rainy S1(146.70 ± 15.07days) and shortest in those calved in winter S2(135.47 ± 13.09 days) season.

The difference due to order of lactation in dry period was non-significant in HF × Girhalfbreds. These results were similar to Zol *et al.,* (2009) in Phule Triveni cows, Khade (2001) and Kamble (2003) in Gir crossbreds, Zol (2007) in Phule Triveni. In HF × Girhalfbreds, the longest dry period (days) was observed in cows during L3 (175.48 ± 16.85) followed by L4 (167.17 ±16.25), L1 (160.24 ± 18.22), L5 (129.53 ±18.09) and lowest in L2 (125.11 ± 18.44) lactation. In HF × Gir cows in the present study no specific trend of dry period was noticed for different lactations (Table 1).

Table.1 Least Square means of TMY, LL, DP and PMY in HF×Girhalfbreds

Effect	N	TMY	LL	DP	PMY
μ	169	2448.92±73.72	282.68±5.70	151.51±8.44	15.21±0.34
Period of Calving					
P_1	72	2928.84^{a}±104.85	300.36±8.10	122.57^{c}±12.00	16.86^{a}±0.48
P_2	67	2345.76^{ab}±108.88	276.18±8.41	158.23^{b}±12.46	15.03^{ab}±0.50
P_3	30	2072.16^{b}±163.45	271.51±12.63	173.71^{a}±18.71	13.74^{b}±0.75
Season of Calving					
S_1	47	2378.98±131.64	285.26^{ab}±10.17	146.70±15.07	15.05±0.61
S_2	60	2532.30±114.38	294.05^{a}±8.84	135.47±13.09	14.93±0.53
S_3	62	2435.48±117.47	268.73^{c}±9.08	172.34±13.45	15.66±0.54
Lactation Order					
L_1	30	2070.05±167.87	296.27±12.98	160.24^{c}±19.22	12.21^{c}±0.78
L_2	31	2479.13±161.05	276.08±12.45	125.11^{d}±18.44	16.02^{b}±0.74
L_3	39	2458.66±147.17	279.55±11.37	175.48^{a}±16.85	15.60^{bc}±0.68
L_4	38	2578.43±141.97	277.70±10.97	167.17^{b}±16.25	16.13^{a}±0.65
L_5	31	2658.33±158.04	283.80±12.22	129.53^{cd}±18.09	16.10^{ab}±0.73

Peak MilkYield

The overall mean PMY was 15.21 ± 0.34 kg which was in close agreement with Patond (2009) reported in Jersey cows, Shelke (2012) in Phule Triveni, whereas, higher values were observed by Patond (2013) in Gir triple cross cows. However, lower values were noticed by Kale *et al.*, (2001) in FJG (14.87 ± 0.13kg) JFG (14.57 ± 0.25kg) and BFG(14.91 ± 0.19 kg), Kamble (2003) in HG cows, Chakravarthy *et al.*, (2002) in Ongole cows, Nanavati and Singh (2004) in Gir cattle.

The variation due to period of calving in PMY was significant (P<0.01) in HF × Girhalfbreds. Which was also noticed by Balbir *et al.*, (2011) in Tharparkar, Patond (2013) in Gir triple cross cows and Bhutkar *et al.*, (2014) in Deoni cattle. However, non-significant effect of period of calving on PMY was noticed by Shelke (2012) in Phule Triveni cows. The PMY (kg) of cows calved during period P_1 (16.86 ± 0.48) is significantly higher than P_3 (13.74 ± 0.75) and at par with those calved during P_2 (15.03 ± 0.50). The differences in PMY among cows calved during P_1 and P_2 and between P2 and P_3 were at par with each other.

The PMY (kg) of cows calved during period P_1 (16.86 ± 0.48) is significantly higher than P_3 (13.74 ± 0.75) and at par with those calved during P_2 (15.03 ± 0.50). The differences in PMY among cows calved during P_1 and P_2 and between P2 and P_3 were at par with each other.

The variation due to season of calving in PMY was non-significant in HF × Girhalfbreds. These results were in agreement with Shelke (2012) in Phule Triveni cows Bhutkar *et al.*, (2014) in Deoni cattle and Radhika *et al.*, (2012) incross bredcows. In HF × Girhalfbreds, the highest PMY was observed in cows calved during summer (15.66 ± 0.54 Kg) season and lowest in winter (14.93 ± 0.53 Kg).

The difference in PMY due to order of lactation was significant (P<0.01) in HF × Girhalf breds. Similar results were noticed by Kale *et al.*, (2001) in FJG JFG and BFG, Kulkarni (2001) in Red Sindhi, Chakravarthy *et al.*, (2002) in Ongole cattle, Nanavati and Singh (2004) Gir cattle and Patond (2013) in Gir triple cross cows. The PMY (kg) of cows calved during order of lactation L_4 (16.13 ± 0.65) is significantly higher than L_3 (15.60 ± 0.68), L_2 (16.02 ± 0.74) and L_1 (12.21 ± 0.78) and at par with those calved during L_5 (16.10 ± 0.73). The differences in PMY among cows calved during L_4 and L5, between L5 and L3 and L_2 and were at par with each other. The significantly lower PMY was recorded in cows during L1 lactation.

In HF × Girhalfbreds, the highest PMY (kg) was observed during L_4 (16.13 ± 0.65) followed by, L_5 (16.10 ± 0.73), L_2 (16.02 ± 0.74), L_3 (15.60 ± 0.68) and lowest in L_1 (12.21 ± 0.78) lactation. In the present investigation no specific trend of PMY was noticed for different lactation.

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