ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2025): 4.97
IJAFS 2025; 7(10): 464-467
www.agriculturaljournals.com
Received: 04-09-2025
Accepted: 05-10-2025

Sakshi Patil
M.Sc (Agri) Scholar, Department of Livestock Production Management, College of Agriculture, Dhule, MPKV Rahuri, Maharashtra, India

SP Poul
Assistant Professor, Department of Animal Husbandry and Dairy Science, College of Agriculture, Pune, MPKV Rahuri, Maharashtra, India

RJ Desale
Professor, Head of Section of Animal Husbandry and Dairy Science, College of Agriculture, Dhule, MPKV Rahuri, Maharashtra, India

Deepika Wakhare
M.Sc (Agri) Scholar, Department of Livestock Production Management, College of Agriculture, Dhule, MPKV Rahuri, Maharashtra, India

Yash Patil
MBA-PGDM, Business Trainee, ICICI Prudential, Jalgaon, Maharashtra, India

Corresponding Author:
Sakshi Patil
M.Sc (Agri) Scolar, Department of Livestock Production Management, College of Agriculture, Dhule, MPKV Rahuri, Maharashtra, India

Effect of Non-Genetic Factors on Production Traits in Gir Cattle

Sakshi Patil, SP Poul, RJ Desale, Deepika Wakhare and Yash Patil

DOI: https://www.doi.org/10.33545/2664844X.2025.v7.i10g.909

Abstract
The data on production performance of Gir maintained at "Shree Nashik Panchavati Panjarpole, Nashik (M.S) were utilized for present study. The least squares means of total lactational 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 overall least squares mean for total lactational milk yield, lactation length, dry period and PMY in Gir cattle were 1887.38 ± 16.68 kg, 266.14 ± 1.38 days, 108.15 ± 1.25 days and 9.14 ± 0.12 kg, respectively. The effect of period of calving was significant on all traits TLMY, LL, DP, PMY; the effect of season of calving was significant on TLMY, LL and DP, while it was non-significant on trait PMY; the effect of order of lactation was significant on traits LL, PMY and DP while it was non-significant on trait TLMY.9.

Keywords: Gir, TMY, LL, DP, PMY, POC, SOC, LO

Introduction
India ranks first globally in cattle population, where rearing practices primarily aim to fulfill two essential functions milk production and draught power. Economic limitations often compel farmers to maintain cattle capable of serving both purposes, providing milk as well as labour. Although a majority of native breeds are primarily used for draught purposes, breeds such as Gir, Red Sindhi, and Sahiwal are widely recognized for their exceptional milk-producing ability. The efficiency of indigenous dairy herds is governed by both productive and reproductive performance, which are affected by genetic potential along with environmental influences such as management practices, nutrition, and seasonal variations. Among these, Gir cattle hold a distinguished position as one of India's finest dairy breeds, native to the Gir forests and hilly regions of Saurashtra in Gujarat, with their distribution extending into adjoining areas of Maharashtra and Rajasthan. Locally, the breed is referred to by several names, including *Bhodali, Desan, Gujarati, Kathiawari,* and *Sorthi.* Gir cattle are easily identifiable by their characteristic convex forehead, long drooping ears, and smooth, glossy skin. In the Indian context, milk yield remains the key criterion for assessing breed suitability, and evaluation is based on attributes such as lactation duration, peak yield, and total lactation milk yield, which collectively indicate the animal's adaptability and productive potential under prevailing environmental and management conditions.

Materials and Methods
The data of Gir cows maintained at "Shree Nashik Panchavati Panjarpole" for a period from 2018 to 2024 (7 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 were classified into 3 periods of calving viz. P_1 (2018-2019), P_2(2020-2021), P_3 (2022-2024); 3 seasons of calving, viz. S_1 (Rainy) June- September, S_2 (Winter) October-January and S_3 (Summer) February-May; 7 order of lactation viz. L_1 first lactation, L_2 second lactation, L_3 third lactation, L_4 fourth lactation, L_5 fifth lactation, L_6 sixth lactation and L_7 seventh 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) [6].

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

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

Where,
Y_{ijkl}: Observation of l^{th} parameters for i^{th} season of calving, j^{th} period of calving & k^{th} lactation order
μ: Overall mean
S_i: Effect of i^{th} season of calving (i=1, 2, 3)
P_j: Effect of j^{th} period of calving (j=1, 2, 3)
L_k: Effect of k^{th} lactation order (k=1, 2, 3, 7)

Duncan's Multiple Range Test (DMRT)
Duncan's Multiple Range Test as modified by Kramer (1957) [12] 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 value:

$$(Yi - Yj) \times \sqrt{\frac{2}{Cii+Cjj+2\,Cij}} > \sigma^2 e, Z(P, ne)$$

Where,
Yi - Yj: Difference between two least squares means
Cii: Corresponding i^{th} diagonal elements of C matrix
Cjj: 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

Overall least-squares means of production traits

The production traits of Gir cattle are shown in Table 1. The overall least-squares means for production traits were 1887.38 ± 16.68 kg for Total Lactational milk yield (TLMY), 266.14 ± 1.38 days for Lactation length (LL), 9.14 ± 0.12 kg for peak milk yield (PMY) and 108.15 ± 1.25 days for Dry period (DP), respectively.
The findings for TLMY are in close agreement with Javed *et al.* (2000) [9] in Sahiwal (1779.04 ± 18.17 kg). Similar results were observed by Bairwa *et al.* (2022) [1] in Gir (273.83 ± 5.01 days) for lactation length. Close agreement to the value reported by Krishna *et al.* (1991) [13] in HF x Deoni (10.48 ± 0.22 kg) and Chigale *et al.* (2016) [2] in Red Sindhi (9.13 ± 0.18 kg) for PMY. The result of present findings were in close agreement for DP reported by Jadhav (2011) [7] in Phule Triveni (100.84 ± 3.78 days) and Tawadar *et al.* (2021) [21] in Red Sindhi cattle.

Effect of non-genetic factors on production traits

Total lactational milk yield (kg)

The influence of period of calving on total lactational milk yield was significant. These results were in agreement with the results by Kulkarni (2001) [14] in Red Sindhi cattle, Patond (2013) [18] in Gir triple cross cows and Jadhav *et al.* (2019) [8] in HF × Gir halfbreds. In Gir, the total lactational milk yield (kg) of cattle calved during period P_1 (1968.22 ±35.18 kg) was substantially higher than those cows calved during P_2 (1918.65 ± 24.15 kg) and P_3 (1775.26 ± 15.35 kg).
The influence of season of calving on lactational milk yield was highly significant in Gir cow. These results were in agreement with Khade (2001) [11] in Gir crossbred cows, Nanavati and Singh (2004) [16] in Gir cattle, Garudkar (2011) [3] in Phule Triveni, Patond (2009) [17] in Jersey cattle. In the present study, total lactational milk yield was detected highest when cows calved during winter season S_2 (1990.02 ± 19.31 kg) than those who calved during rainy season S_1 (1768.21 ± 26.03 kg) and summer season S_3 (1903.90 ± 23.50 kg).
The variation due to lactation order in total lactational milk yield (kg) was non-significant in Gir cattle. Similar effects were reported by Radhika *et al.* (2012) [19] in crossbred cows and Kumar *et al.* (2020) in Sahiwal cows. In Gir cows, the higher total lactational milk yield (kg) was found during L_5 (1940.51 ± 36.05 kg), followed by L_6 (1919.91 ± 41.81 kg), L_3 (1887.53 ± 27.87 kg), L_2 (1879.65 ± 23.83 kg), L_1 (1877.74 ± 23.69 kg), L_4 (1867.06 ± 30.05 kg) and lowest in L_7 (1839.24 ± 57.13 kg) lactation. In Gir cattle, no specific trend of total lactational milk yield was observed during different lactations.

Lactation length (LL)

The influence of the period of calving in lactation length was highly significant on Gir cattle. The significant effect of the period of calving on lactation length was noticed by Kulkarni (2001) [14] in Red Sindhi cows, Jadhav (2011) [7] in Phule Triveni. In Gir cow, lactation length (days) was higher in cows calved during period P_1 (283.19 ± 2.92 days) followed by P_2 (267.96 ± 2.00 days) and P_3 (247.27 ± 1.27 days).
The variation due to the season of calving on lactation length was highly significant in Gir cattle. These results were similar to Javed *et al.* (2000) [9] in Sahiwal, Varade *et al.* (2002) [23] in Jersey crossbreds, and Thombare *et al.* (2013) [22] in HF x Deoni halfbreds. In Gir cattle, the highest lactation length was observed in cows calved during the winter S_2 (278.36 ± 1.60 days) season followed by rainy S_1 (265.56 ± 1.60 days) and lowest in summer S_3 (254.49 ± 1.95 days) season.
The influence of the order of lactation on the lactation length was highly significant in Gir cattle. These results were similar found with Gawari (1999) and Kamble (2003) [4, 10] in Gir crossbred cows and Jadhav (2011) [6] in FG halfbreds. In Gir cattle, the highest lactation length was observed in L_1 (271.65 ± 1.96 days) lactation followed by L_3 (271.61 ± 2.31 days), L_5 (269.84 ± 2.99 days), L_2 (269.70 ± 1.97 days), L_6 (267.23 ± 3.47 days), L_4 (262.48 ± 2.56 days), and which was lowest in L_7 (250.44 ± 4.74 days) lactation.

Dry period (DP)

The influence of the period of calving in the dry period had a highly significant effect on Gir cattle. Similar results were noticed by Hadge *et al.* (2012) [5] in Jersey x Sahiwal crossbred cows, Nanavati and Singh (2004) [16] in Gir cattle. In Gir cattle, the highest dry period was found in P_3 (124.18 ± 1.15 days) followed by P_2 (106.93 ± 1.81) and lowest in P_1 (93.34 ± 2.64). The influence of the season of calving in the dry period was highly significant in Gir cattle. These results were in agreement with Javed *et al.* (2000) [9] in Sahiwal cows and Jadhav (2011) [7] in IFG cows. In Gir cows, the longest dry period was observed in cows calved during summer S_3 (116.87 ± 1.77 days) season followed by

rainy S_1 (108.60 ± 1.96 days) and shortest in those calved in winter S_2 (98.98 ± 1.45 days) season.

The influence of the order of lactation in the dry period was highly significant in Gir cattle. These results were similar to Talape (2010) [20] in Jersey cows and Jadhav (2011) [7] in FG cows. In Gir cattle, the highest dry period (days) was observed in cows during L_7 (121.28 ± 4.30 days) followed by L_4 (111.12 ± 2.32 days), L_6 (107.93 ± 3.14 days), L_5 (105.98 ± 2.71 days), L_2 (104.67 ± 1.79 days), L_3 (104.28 ± 2.09 days) and lowest in L_1 (101.79 ± 1.78 days) lactation.

Peak milk yield (PMY)

The variation due to period of calving in PMY was highly significant in Gir cattle. Similar results were reported by Patond (2009) [17] in Jersey cows, Kulkarni (2001) [14] in Red Sindhi. The PMY of cows calved during period P_1 (9.74 ± 0.25 kg) was significantly higher than those calved in P_2 (9.37 ± 0.17 kg) and P_3 (8.31 ± 0.11 kg).

The variation due to the season of calving in PMY was non-significant in Gir cattle. Similar results were noticed by Patond (2009) [17] in Jersey and Garudkar (2011) [3] in Phule Triveni cattle. In Gir cattle, the highest PMY was observed in cows calved during the winter S_2 (9.18 ± 0.13 kg) season followed by S_1 (9.13 ± 0.18 kg) and lowest in S_3 (9.10 ± 0.17 kg). The difference due to order of lactation in PMY was significant in Gir cattle. Similar significant effect of the order of lactation on PMY was observed by Kulkarni (2001) [14] in Red Sindhi, Nanavati and Singh (2004) [16] Gir cattle. In Gir cattle, the highest PMY was observed during L_3 (9.57 ± 0.17 Kg) followed by L_2 (9.49 ± 0.17 kg), L_5 (9.35 ± 0.26 kg), L_1 (9.20 ± 0.20 kg), L_4 (9.16 ± 0.22 kg), L_6 (9.16 ± 0.30 kg) and lowest in L_7 (8.03 ± 0.41 kg) lactation.

Table 1: Least Square means of TLMY, LL, DP and PMY in Gir Cattle

Effect	N	TLMY	LL	DP	PMY
µ	199	1887.38 ± 16.68	266.14 ± 1.38	108.15 ± 1.25	9.14 ± 0.12
Period of Calving					
P_1	30	1968.22 ±35.18^a	283.19 ± 2.92^a	93.34 ± 2.64^c	9.74 ± 0.25^a
P_2	58	1918.65 ± 24.15^b	267.96 ± 2.00^b	106.93 ± 1.81^b	9.37 ± 0.17^b
P_3	111	1775.26 ± 15.35^c	247.27 ± 1.27^c	124.18 ± 1.15^a	8.31 ± 0.11^c
Season of Calving					
S_1	49	1768.21 ± 26.03^c	265.56 ± 1.60^{ab}	108.60 ± 1.96^{ab}	9.13 ± 0.18
S_2	88	1990.02 ± 19.31^a	278.36 ± 1.60^a	98.98 ± 1.45^b	9.18 ± 0.13
S_3	62	1903.90 ± 23.50^{ab}	254.49 ± 1.95^b	116.87 ± 1.77^a	9.10 ± 0.17
Lactation Order					
L_1	42	1877.74 ± 23.69	271.65 ± 1.96^a	101.79 ± 1.78^b	9.20 ± 0.20^{ab}
L_2	41	1879.65 ± 23.83	269.70 ± 1.97^a	104.67 ± 1.79^{ab}	9.49 ± 0.17^{ab}
L_3	38	1887.53 ± 27.87	271.61 ± 2.31^a	104.28 ± 2.09^{ab}	9.57 ± 0.17^a
L_4	29	1867.06 ± 30.05	262.48 ± 2.56^{ab}	111.12 ± 2.32^{ab}	9.16 ± 0.22^{ab}
L_5	24	1940.51 ± 36.05	269.84 ± 2.99^a	105.98 ± 2.71^{ab}	9.35 ± 0.26^{ab}
L_6	17	1919.91 ± 41.81	267.23 ± 3.47^{ab}	107.93 ± 3.14^{ab}	9.16 ± 0.30^{ab}
L_7	08	1839.24 ± 57.13	250.44 ± 4.74^b	121.28 ± 4.30^a	8.03 ± 0.41^b

Conclusion

The effect of period of calving was significant on all traits TLMY, LL, DP, PMY; the effect of season of calving was significant on TLMY, LL and DP, while it was non-significant on trait PMY; the effect of order of lactation was significant on traits LL, PMY and DP while it was non-significant on trait TLMY.

References

1. Bairwa M, Joshi RK, Bairwa AK. Non-genetic factors affecting production traits in Gir cattle. Pharma Innov J. 2022;11(7):858-860.
2. Chigale PS. Effect of non-genetic factors on production performance of Red Sindhi cattle [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2013.
3. Garudkar SR. Peak yield and its relationship with persistency and lactation milk yield in Phule Triveni synthetic cows [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2011.
4. Gawari RG. Genetic studies on persistency of milk yield in triple crossbred cattle [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 1999.
5. Hadge MR, Kuralkar SV, Ali SZ, Kharkar KP, Sawaimul AD. Genetic studies on productive traits of Sahiwal and Jersey × Sahiwal crossbred cows. Indian J Anim Res. 2012;46(1):92-94.
6. Harvey WR. Least-squares analysis of data with unequal subclass numbers. ARS H-4. Washington, DC: USDA; 1990.
7. Jadhav PD. Generation wise comparative reproduction and production performance of HF × Gir and Phule Triveni synthetic cows [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2011.
8. Jadhav SS, Deokar DK, Fulpagare YG, Bhoite UY, Mandakmale SD, Nimbalkar CV. Effect of genetic and non-genetic factors on first lactation production and reproduction traits in HF × Gir cattle. Int J Curr Microbiol App Sci. 2019;8(1):45-51.
9. Javed K, Mohiuddin G, Abdullah M. Environmental factors affecting various productive traits in Sahiwal cattle. Pak Vet J. 2000;20(4):187-192.
10. Kamble SS. Effect of different types of calving on reproduction and productive performance of crossbred cattle [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2003.
11. Khade PB. Studies on herd structure of Holstein Friesian crosses in relation with production performance at RCDP on cattle Rahuri [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2001.
12. Kramer CV. Extension of multiple range test to group correlated adjusted mean. Biometrics. 1957;13:13-20.

13. Krishna GVR, Reddy CE, Rao MR. Production performance of Deoni × Holstein Friesian cows. Indian J Dairy Sci. 1991;44(3):247-248.
14. Kulkarni PP. Persistency of milk yield in Red Sindhi cattle [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2001.
15. Kumar S, Gupta ID, Sharma N, Revanasiddu D, Kumar A, Chauhan A, *et al*. Effect of season of parity and stages of lactation on productive performance of Sahiwal cattle. Indian J Anim Res. 2020;*volume(issue missing)*.
16. Nanavati S, Singh A. Non-genetic factors affecting production traits in Gir cattle. Indian J Dairy Sci. 2004;57(5):342-346.
17. Patond MN. Persistency of milk yield in Jersey cattle [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2009.
18. Patond MN. Modelling of lactation curve in Gir triple cross cows [PhD thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2013.
19. Radhika G, Ajithkumar S, Rani A, Sathian CT, Anilkumar K, Usha AP, *et al*. Milk yield and composition of crossbred cows in the hilly Wayanad district of Kerala, India. Indian J Anim Sci. 2012;82(10):1251-1254.
20. Talape SK. Studies on production performance and breeding efficiency of Jersey crossbreds maintained at Panjarpole, Ahmednagar [MSc thesis]. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2010.
21. Tawadar AC, Gaikwad US, Mote MG, Dhage SA. Effect of temperature humidity index on production performance of Red Sindhi cattle maintained at organised farm. Int J Acad Res Prog Educ Dev. 2021;16(2):184-187.
22. Thombare BM, Bainwad DV, Wondifraw Z. Effect of non-genetic factors on milk production of Holstein Friesian × Deoni crossbred cows. Afr J Dairy Farming Milk Prod. 2013;1(4):79-84.
23. Varade PK, Khire DW, Ali SZ, Kuralkar SV. Effect of genetic and non-genetic factors on productive and reproductive traits in Jersey crossbred cows. Indian J Anim Prod Mgmt. 2002;18(1-2):38-40.