International Journal of Veterinary Sciences and Animal Husbandry

ISSN: 2456-2912
NAAS Rating (2025): 4.61
VET 2025; 10(9): 344-347

www.veterinarypaper.com
Received: 25-07-2025
Accepted: 27-08-2025

Ghoshita Suryakant Hingonekar
Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, India

Dilip Kundalik Deokar
Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, India

Ulhas Shivaji Gaikwad
Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, India

Dinkar Keshav Kamble
Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, India

Amar Tabaji Lokhande
Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, India

Corresponding Author:
Ghoshita Suryakant Hingonekar
Department of Animal Husbandry and Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, India

Effect of genetic and non-genetic factors on first lactation 305 days milk yield in Gir halfbreds

Ghoshita Suryakant Hingonekar, Dilip Kundalik Deokar, Ulhas Shivaji Gaikwad, Dinkar Keshav Kamble and Amar Tabaji Lokhande

DOI: https://www.doi.org/10.22271/veterinary.2025.v10.i9f.2581

Abstract
The productive performance data of Gir halfbreds maintained at the Research cum Development Project on Cattle (RCDP), Mahatma Phule Krishi Vidyapeeth, Rahuri district, Ahilyanagar, Maharashtra, were utilized for the present study. First lactation 305-day milk yield least squares means were analyzed considering both sire (genetic factor) and non-genetic factors such as period, season, and age at first calving. The least squares mean observed for FL305DMY in Gir halfbreds was 1965.64±61.51 kg. The period of calving had a significant effect on first lactation 305-day milk yield (FL305DMY) ($P<0.01$) indicating that the year when a Gir halfbreds gives birth has an important impact on the amount of milk she produces during her first lactation, measured over 305 days. Age at first calving had a significant effect on first lactation 305-day milk yield (FL305DMY) ($P<0.01$) indicating that the age at which a cow first gives birth has a statistically significant impact on the amount of milk she produces during her first lactation period, measured over a standard 305-day period while The season of calving did not have a significant effect on FL305DMY indicating that the season in which a cow gives birth for the first time does not have an impact on the total milk she produces during her first lactation, measured over 305 days. The genetic factor, sire, did not have a significant effect on the trait indicating that the genetic influence of the sire does not have a statistically meaningful impact on the milk yield produced by his daughters during their first lactation 305-day period based on the data analyzed.

Keywords: Gir halfbreds, FL 305 DMY, genetic and non-genetic factors

Introduction
Milk yield is a fundamental economic trait that forms the basis of the dairy industry. The first lactation 305-day milk yield (FL305DMY) is widely used as an efficient indicator to evaluate an individual animal's genetic potential and to estimate its breeding value. Consequently, it is internationally recognized that milk production during the first 305 days of lactation should be used for comparing the production performance of dairy cattle.

Materials and Methods
Data on Gir halfbreds maintained at the Research-cum-Development Project on Cattle (MPKV), Rahuri, covering a 20-year period from 2000 to 2020, were collected for the present study to analyze first lactation 305-day milk yield

Trait for study
a) First lactation production trait
1) First lactation 305-days milk yield (FL305DMY).
For analysis, the data were classified by calving period (P_1: 2000-2006; P_2: 2007-2013; P_3: 2014-2020), calving season (S_1: Rainy, June-September; S_2: Winter, October-January; S_3: Summer, February-May), and age at first calving (A_1: <900 days; A_2: 901-1000 days; A_3: >1000 days).
First lactation 305-day milk yield least squares means were estimated by accounting both genetic and non-genetic factors, following the approach of Harvey (1990), assuming linearity,

independence, and additivity of model components. The model is given below:

$$Y_{ijkl} = \mu + P_i + S_j + M_k + A_l + e_{ijklm}$$

Where, Y_{ijklm}, Observation of m^{th} animal belonging to, i^{th} period of calving, j^{th} season of calving, k^{th} sire, l^{th} age at first calving; μ, Overall mean; P_i, fixed effects of i^{th} period of calving (1 to 3); S_j, fixed effect of j^{th} season of calving (1 to 3); M_k, fixed effects of k^{th} sire; A_l, fixed effect of l^{th} age at first calving (1 to 3); e_{ijklm}, random error ~ NID (0, $\sigma^2 e$).

Duncan's Multiple Range Test (DMRT)

Pairwise comparisons among the least squares means were performed using Duncan's Multiple Range Test, as modified by Kramer (1957) [17], employing inverse elements and the root mean square error.

If the values:

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

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

$\sigma^2 e$: Root mean squares for error

Results and Discussion

a) Effect of non-genetic factors on FL 305 DMY

The least squares mean of FL 305 DMY in Gir halfbred was 1965.64±61.51 kg (Table 2). The present findings are in agreement with the reports of Saha (2001) [28] in Karan Fries and Shelke (2012) [29] and Ambhore *et al.* (2017) [1] in Phule Triveni cattle. However, higher estimates have been reported by Kale (1984) [15] in FG, Kulkarni (1985) [18] in FJG, Chavan (1995) [6] in FG halfbreds, Rathi (2015) [35] in Frieswal cattle (3292.61±53.6 kg), and Jadhav (2019) [13] in HF × halfbreds (2511.70±37.40 kg). The differences in the estimates of average FL 305 DMY reported by many researchers could have been due to sampling variations, as different studies were based on small and different number of observations or herd to herd differences or differences that might have occurred over time depending on the period to which the data pertained.

Effect of period of calving

The analysis of variance indicated that the period of calving had a significant effect ($P<0.01$) on first lactation 305-day milk yield (FL305DMY) (Table 1). These findings are consistent with reports by Jebale (1994) [14], Gawari (1999) [11], Saha (2001) [28], Annual Report, PDC (2003-04), Nagawade (2005) [22], Mukherjee (2005) [21], Kokate (2009) [16], Garudkar (2011) [10], Shelke (2012) [29], Pol *et al.* (2013) [27] in Phule Triveni, Wondifraw *et al.* (2013) [38] in HF × Deoni halfbreds, Patond (2013) [33] in Gir triple-cross cows, Tambe (2016) [37] in HF × Gir halfbreds, and Ambhore *et al.* (2017) [2] in various crossbreds. In contrast, Bhambure and Dave (1989) [5] in Kankrej, Navale (1991) [23] in Gir triple-cross, Chavan (1995) [6] in FG and interse FG halfbreds, Bhadauria and Katpatal (2003) [4] in HF × Sahiwal, Singh and Gurnani (2004) [31], Talape (2010) [36] in Jersey crossbreds, Nehra (2011) [24], and Divya (2012) [7] reported a non-significant effect of calving period on FL305DMY in Karan Fries cattle.

Significant differences were observed in first lactation 305-day milk yield (FL305DMY) among cows calved during periods P_1, P_2, and P_3 (Table 2). Duncan's Multiple Range Test indicated that cows calved in P_2 (2263.28±76.45 kg) produced significantly more milk than those calved in P_1 (1961.35±89.02 kg) and P_3 (1672.28±116.20 kg).

Variations in FL305DMY across periods may reflect differences in production-based culling, management and feeding practices, and shifts in herd population over time.

Effect of season of calving

The effect of season of calving on first lactation 305-day milk yield (FL305DMY) was found to be non-significant in Gir halfbred cows (Table 1). Similar non-significant effects have been reported by Rashia (2010) [34], Nehra (2011) [24], and Divya (2012) [7] in Karan Fries cattle. In contrast, Singh and Gurnani (2004) [31], Mukherjee (2005) [21], Kokate (2009) [16], and Rathi (2015) [35] observed a significant influence of calving season on FL305DMY in various crossbred cattle. In the present study, cows calved during the rainy season produced the highest milk yield (2071.47±103.24 kg), followed by those calved in summer (1922.99±84.73 kg) and winter (1902.44±86.28 kg). However, the differences between different season were not statistically significant and it may hence be deduced that the milch stock was maintained under optimum management conditions round the year. This might be due to the favourable climate and sufficient green fodder available to milking animals.

Effect of age at first calving

Least squares analysis indicated that age at first calving (AFC) groups had a significant effect ($P<0.01$) on first lactation 305-day milk yield (FL305DMY) (Table 1). Similar significant effects of AFC on FL305DMY have been reported by Saha (2001) [28] in Karan Fries cattle, Annual Report PDC (2003-04) and Mukherjee (2005) [21] in Frieswal cattle, Singh *et al.* (2007) [35] in Karan Fries, Nikam (2010) [25] in Phule Triveni, and Patond (2013) [33] in Gir triple-cross cows. In contrast, non-significant effects of AFC on FL305DMY were observed by Singh (1995), Panja (1997) [36], and Divya (2012) [7] in Karan Fries, Bhambure and Dave (1989) [5] in Kankrej, Gawari (1999) [11] in FJG, Kulkarni (2001) [19] in Red Sindhi, Bhadauria and Katpatal (2003) [4] in Friesian × Sahiwal, Dubey and Singh (2005) [8] in Sahiwal crossbreds, Mhasade (2010) [20] in FG halfbreds, Garudkar (2011) [10] and Shelke (2012) [29] in Phule Triveni, and Wondifraw *et al.* (2013) [38] in HF × Deoni crossbreds.

First lactation 305-day milk yield (FL305DMY) was significantly higher in cows belonging to the A_3 age-at-first-calving group (≥1001 days) compared to A_2 and A_1 groups. In Gir halfbreds, cows in the A_3 group produced 2206.74±61.46 kg, followed by the A_2 group with 1949.09±123.96 kg, while the lowest yield was observed in the A_1 group (1741.08±111.44 kg). The difference in FL 305 DMY of cows of group A_1 and A_2 similarly of group A_2 and A_3 were at par to each other (Table 2).

b) Effect of genetic factor sire on FL305DMY

The least squares mean of FL305DMY was 1971.83±45.34. (Table 4).

The effect of sire on FL305DMY was non-significant (Table 3). Similar results were reported by Gaikwad (2010) on 300 DMY in Phule Triveni cows. Significant sire effects were observed in previous studies by Patond (2013) [33] in Gir triple-cross and Tambe (2016) [37] and Jadhav (2019) [13] in HF × Gir halfbreds, contrasting with the present results.

Table 1: Analysis of variance for FL305DMY as affected by non-genetic factors

Source of Variation	d. f.	M. S. S	F ratio
POC	2	2893676.45019	10.069**
SOC	2	305938.87488	1.065
AFC	2	2057925.36695	7.161**
Error	124	287380.71473	

(**P<0.01)

Table 2: Least squares means for first lactation FL305DMY as affected by non-genetic factors

Effect	N	Least squares means of FL305DMY	
		Mean	SE
μ	131	1965.64	61.51
Period of Calving			
P_1	54	1961.35[b]	89.02
P_2	52	2263.2 8[a]	76.45
P_3	25	1672.28[c]	116.20
Season of Calving			
S_1	32	2071.47	103.24
S_2	50	1902.44	86.28
S_3	49	1922.99	84.73
Age at First Calving			
A_1	25	1741.08[b]	111.44
A_2	21	1949.09[ab]	123.96
A_3	85	2206.74[a]	61.46

Table 3: Analysis of variance of FL305DMY as affected by genetic factor sire

Source of Variation	d. f.	M. S. S	F ratio
SIRE	38	274564.64158	1.0023
Error	92	273932.10539	

Table 4: Least squares means for FL305DMY as affected by sire

Effect	N	Least squares means of FL305DMY	
		Mean	SE
μ	131	1971.83	45.34
SIRE			
1	11	1794.45	109.81
2	2	1676.84	257.52
3	2	1495.79	257.52
4	15	1983.09	94.03
6	5	1712.83	162.87
8	4	2202.20	182.09
10	10	1971.43	115.17
11	8	2225.47	128.76
12	3	2707.88	210.27
15	4	2239.17	182.09
16	4	1773.73	182.09
21	13	1898.78	101.01
22	4	2011.96	182.09
25	6	2009.28	148.68
28	3	2015.76	210.27
29	2	1682.03	257.52
30	4	1656.83	182.09
31	4	2155.28	182.09
32	3	2242.73	210.27
33	4	1873.54	182.09
35	2	1359.41	257.52

Acknowledgement
Not available

Author's Contribution
Not available

Conflict of Interest
Not available

Financial Support
Not available

References

1. Ambhore GS, Singh A, Deokar DK, Gupta AK, Singh M, Prakash V. First lactation production and reproduction performance of Phule Triveni cattle in hot arid region of Maharashtra. Indian J Anim Sci. 2017;87(1):105-108.
2. Ambhore GS, Singh A, Deokar DK, Singh M, Sahoo SK. Life time performance of Phule Triveni synthetic cows at an organized farm. Indian J Anim Sci. 2017;87(11):1406-1409.
3. Ambhore GS, Singh A, Deokar DK, Singh M, Sahoo SK. Phenotypic genetic and environmental trends of production traits in Phule Triveni synthetic cow. Indian J Anim Sci. 2017;87(6):736-741.
4. Bhadauria SS, Katpatal BG. Effect of genetic and non-genetic factors on 300 days milk yield of first lactation in Friesian × Sahiwal crosses. Indian Vet J. 2003;80(12):1251-1254.
5. Bhambure CV, Dave AD. Effect of non-genetic factors on milk production in Kankrej cows. Indian Vet J. 1989;66(5):422-425.
6. Chavan SM. To study the effect of growth on some economic reproductive and productive traits of FG halfbreds and their interbreds [MSc thesis]. Rahuri: MPKV; 1995.
7. Divya P. Single versus multi-trait models for genetic evaluation of fertility traits in Karan Fries cattle [MVSc thesis]. Karnal: NDRI; 2012.
8. Dubey PP, Singh CV. Estimates of genetic and phenotypic parameters considering first lactation and lifetime performance traits in Sahiwal and crossbreed cattle. Indian J Anim Sci. 2005;75(2):1289-1294.
9. Gaikwad PN. Genetic and environmental factors influencing cumulative part lactation and 300 day milk production in Phule Triveni cattle [MSc thesis]. Rahuri: MPKV; 2010.
10. Garudkar SR. Peak yield and its relationship with persistency and lactation milk production in Phule Triveni synthetic cows [MSc thesis]. Rahuri: MPKV; 2011.
11. Gawari RG. Genetic studies on persistency of milk yield in triple crossbred cattle [MSc thesis]. Rahuri: MPKV; 1999.
12. Harvey WR. Least-squares analysis of data with unequal subclass numbers. Washington: USDA; 1990. Report No.: ARS H-4.
13. Jadhav SS. Genetic evaluation of sires and cows of HF × Gir halfbreds using single and multi-trait models [PhD thesis]. Rahuri: MPKV; 2019.
14. Jebale KP. Studies on peak yield, total milk yield and their correlation in BFG and their interbreeds [MSc thesis]. Rahuri: MPKV; 1994.

15. Kale KM. Growth, reproduction and production performance of Gir cow and its exotic crosses [PhD thesis]. Rahuri: MPKV; 1984.
16. Kokate L. Genetic evaluation of Karan Fries sires based on test-day milk yield records [MVSc thesis]. Karnal: NDRI; 2009.
17. Kramer CV. Extension of multiple range test to group correlated adjusted mean. Biometrics. 1957;13:13-20.
18. Kulkarni SR. Studies on reproduction and productive performance of FJG, BFG and JFG triple crosses [MSc thesis]. Rahuri: MPKV; 1985.
19. Kulkarni PP. Persistency of milk yield in Red Sindhi cattle [MSc thesis]. Rahuri: MPKV; 2001.
20. Mhasade BS. Effect of age and weight at first calving on production performance of HF × Gir crossbreds [MSc thesis]. Rahuri: MPKV; 2010.
21. Mukherjee S. Genetic evaluation of Frieswal cattle [PhD thesis]. Karnal: NDRI; 2005.
22. Nagawade PP. A study on colostrums yield and its relation with milk production traits and prediction of part lactation yield in Phule Triveni cattle [MSc thesis]. Rahuri: MPKV; 2005.
23. Navale PB. Comparative performance of reproductive and productive economic traits of triple crosses of Gir cattle and their interbreds [MSc thesis]. Rahuri: MPKV; 1991.
24. Nehra M. Genetic analysis of performance trends in Karan Fries cattle [MVSc thesis]. Karnal: NDRI; 2011.
25. Nikam RA. Effect of age and weight at first calving on reproduction and production performance of Phule Triveni synthetic cow [MSc thesis]. Rahuri: MPKV; 2010.
26. Project Directorate on Cattle. Annual report 2003-2004. Meerut: PDC-AR; 2004.
27. Pol KE, Dhage SA, Pachpute ST, Khutal BB. Generation wise production efficiency of Phule Triveni synthetic cow. J Agric Res Technol. 2013;38(1):117-129.
28. Saha. Generation wise genetic evaluation of Karan Swiss and Karan Fries cattle [MSc thesis]. Karnal: NDRI; 2001.
29. Shelke MG. Generation wise persistency of milk production in Phule Triveni Synthetic cows [MSc thesis]. Rahuri: MPKV; 2012.
30. Singh MK. Factors affecting trend in performance of Karan Swiss and Karan Fries cattle [PhD thesis]. Karnal: NDRI; 1995.
31. Singh MK, Gurnani M. Performance evaluation of Karan Fries and Karan Swiss cattle under closed breeding system. Asian Australas J Anim Sci. 2004;17(1):1-6.
32. Singh A, Singh B, Haile A. Genetic and environmental factors influencing first lactation part and 305 day milk production in Karan Fries cattle. Indian J Anim Sci. 2007;77(11):1151-1154.
33. Patond MN. Modelling of lactation curve in Gir triple cross cows [PhD thesis]. Rahuri: MPKV; 2013.
34. Rashia Banu N. Genetic evaluation of the lactation curve in Karan Fries cattle [PhD thesis]. Karnal: NDRI; 2010.
35. Rathi S. Genetic evaluation of Frieswal cattle for life time traits [PhD thesis]. Karnal: ICAR NDRI; 2015.
36. Talape SK. Studies on production performance and breeding efficiency of Jersey crossbreds maintained at Panjarpole Ahmednagar [MSc thesis]. Rahuri: MPKV; 2010.
37. Tambe DR. Modelling of lactation curve in HF × Gir halfbred [PhD thesis]. Rahuri: MPKV; 2016.
38. Wondifraw Z, Thombre BM, Bainwad DV. 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.

How to Cite This Article
Hingonekar GS, Deokar DK, Gaikwad US, Kamble DK, Lokhande AT. Effect of genetic and non-genetic factors on first lactation 305 days milk yield in Gir halfbreds. International Journal of Veterinary Sciences and Animal Husbandry. 2025; 10(9): 344-347.