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Sakshi Vijay Patil
M.Sc (Agri) Scolar, 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

Pavan Bansode
M.Sc (Agri) Scolar, Department of Livestock Production Management, College of Agriculture, Dhule, MPKV Rahuri, Maharashtra, India

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

RS Korde
PG Student, PGI MPKV, Rahuri, Maharashtra, India

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

Study on association among production traits of GIR cattle

Sakshi Patil, SP Poul, Pavan Bansode, RJ Desale and RS Korde

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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. Phenotypic correlations among these traits were estimated using Snedecor and Cochran (1994). The strong positive association between milk yield and lactation traits indicates that improvement in one trait may lead to a desirable change in the other. The study suggests that selection for higher peak yield and optimum lactation length can result in enhanced total milk production.

Keywords: Gir, TLMY, LL, DP, PMY

Introduction
India is endowed with one of the world's richest bovine genetic resources, comprising several well-established indigenous cattle breeds. Among these, Gir cattle hold a distinctive position due to their remarkable milk production potential, adaptability to adverse climatic conditions, and natural resistance to tropical diseases. Originating from the Gir forest region of Gujarat, this breed is well known for its characteristic appearance, gentle temperament, and superior dairy performance. The production performance of dairy cattle is affected by a combination of genetic and non-genetic factors, including period of calving, season of calving, and lactation order. These factors significantly influence key economic traits such as total lactational milk yield, peak milk yield, lactation length, and dry period. Evaluating production performance is therefore essential for identifying high-yielding animals and improving herd management efficiency under organized farm conditions.

In addition, understanding the relationship among various production traits is crucial for efficient selection and breeding strategies. Traits like total lactational milk yield (TLMY), peak milk yield (PMY), lactation length (LL), and dry period (DP) are often interdependent. Knowledge of their interrelationships helps in formulating effective selection indices that facilitate simultaneous genetic improvement of multiple economically important traits. Considering the economic importance and dairy potential of Gir cattle, it becomes essential to assess their present performance under organized herd conditions and to study the interrelationship among milk production traits. Understanding the association among production traits is essential for effective selection and genetic improvement programs. Correlation studies provide valuable information on how one trait influences another, thereby helping breeders identify key traits for selection. Previous studies on indigenous breeds have reported positive correlations between total milk yield and lactation length, and negative associations with dry period. Hence, the present investigation was undertaken to study the association among production traits in Gir cattle.

Material and Methods
Source of data
The investigation's data collection consisted of information about production performance of Gir cattle from 2018 to 2024 that was in the history cum-pedigree sheets kept at the "Shree Nashik Panchavati Panjarpole, Nashik (M.S).

Location and Climate
The dairy farm is located at Nashik district in Northern side of Maharashtra state spread between Latitude 18.33' to 20.53' N and longitude 73.16' to 75.16' E.
It is located the height 700 meters above mean sea level. Climate of district is tropical wet and dry climate. Temperature range between 42.5 ^{0}C maximum to 05 ^{0}C minimum. The average rainfall is 500 mm to 3400 mm.

Collection of data
The data of Gir cow maintained at cattle farm "Shree Nashik Panchavati Panjarpole" for a period from 2018 to 2024 were collected for present investigation for following Traits:
1. Total lactational milk yield (kg)
2. Lactation length (days)
3. Dry period (days)
4. Peak milk yield (kg)

Classification of data
To examine the Production traits, the research data was 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.

Statistical analysis
The least squares analysis method as suggested by Harvey (1990) was used for analysis of data.

Least squares analysis
The least squares analysis of data was carried out by considering non- genetic factors as per Harvey (1990) model. Total Lactation milk yield (kg), lactation length (days), dry period (days), peak milk yield (kg) was estimated by considering period of calving, season of calving and lactation order. The following statistical models were used.

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

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)

Correlation
Correlation among different milk production trait will be studied as per the technique of Snedecor and Cochran (1994)

$$r = \frac{\sum xy}{\sqrt{(\sum x2).(\sum y2)}}$$

Where,
x and y are various traits under study

Result and Discussion
Production Performance
Total Lactational Milk Yield (TLMY)
The overall least squares mean for total lactational milk yield of Gir cattle was 1887.38 ± 16.68 kg. These findings are in close agreement with Javed *et al.* (2000) in Sahiwal (1779.04 ± 18.17 kg). The lower total lactational milk was found by Yadav *et al*. (1994) in Tharparkar (1442.21 ± 21.05 kg). The highest lactational milk yield was reported by Jadhav *et al.* (2010) in HF × Gir halfbreds (2971.94 ± 101.84 kg).

Lactation length (LL)
The overall mean lactation length of Gir cows was 266.14 ± 1.38 days. Similar results were observed by Bairwa *et al.* (2022) in Gir (273.83 ± 5.01 days). Whereas, higher lactation length were reported by Patond (2013) in Gir triple cross cows. The lowest lactation length in the present investigation was reported by Kumar *et al.* (2006) in Deoni.

Dry period (DP)
The overall least squares mean of the dry period in Gir cattle was 108.15 ± 1.25 days. These results were similar to those reported by Jadhav (2011) in Phule Triveni (100.84 ± 3.78 days). The highest dry periods were observed by Javed *et al.* (2000) in Sahiwal. However, the lowest dry period was observed by Khade (2001) in HF × Gir halfbreds.

Peak milk yield (PMY)
The overall least squares mean of PMY in Gir cattle was 9.14 ± 0.12 kg. These results were similar to Chigale *et al.* (2016) in Red Sindhi (9.13 ± 0.18 kg). However, the highest PMY observed by Patond (2009) in Jersey cows. The lower PMY was found by Kumar *et al.* (1992) in Hariana (5.00 kg).

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

Correlation
The results are belongs to correlation among the milk Productive trait of Gir cow are given in Table 2.

Table 2: Correlation among the Productive traits

	TLMY	LL	DP	PMY
TLMY	1	0.5790956**	-0.53041**	0.487429**
LL		1	-0.93544**	0.64688**
DP			1	-0.67299**
PMY				1

Total lactational Milk Yield with LL, PMY and DP
The correlation between total lactational milk yield with LL and PMY was positive and significant, phenotypic correlation between total lactational milk yield and dry period was negative and significant, suggesting that cows with higher peak yield and longer lactation lengths tend to produce more milk

Lactation Length with DP and PMY
The correlation between lactation length with DP was negative and significant, indicating that cows with shorter

dry periods had better total milk yield. However, the correlation between lactation length and PMY was positive and significant.

Peak Milk Yield with DP, LL and TLMY

The correlation between Peak milk yield with dry period was negative and significant. However, correlation between Peak milk yield with lactation length and total lactational milk yield was positive and significant.

Conclusion

The present study on the production performance of Gir cattle revealed that the breed possesses good milk-producing ability, moderate lactation length, and satisfactory peak yield under farm conditions. The positive and significant associations among total lactation milk yield, peak milk yield, and lactation length indicate that improvement in one trait can lead to enhancement in others. These findings confirm the productive potential and adaptability of Gir cattle and highlight the importance of selecting animals based on key production traits to achieve genetic improvement and sustainable dairy performance.

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