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Appraising sires for first lactation traits in Tharparkar cattle using the least-squares method

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Abstract

This study utilized performance data from 91 cows, offspring of 10 sires, observed over an 11-year period (2006 to 2016) at LRS, Beechwal, Bikaner, to assess sire performance based on first lactation traits. The traits analyzed included age at first calving, first lactation milk yield, first lactation period, first dry period, first calving interval, and first service period. Breeding values were estimated using the Least Squares Method (LSM). The results indicated substantial genetic variation among sires for all first lactation traits. Additionally, the rankings of the top sires varied when evaluated using LSM, suggesting heterogeneous performance across traits. These findings underscore the diverse genetic profiles among sires under study for these specific traits.

Keywords: Breeding value, First lactation traits, Sire evaluation

Introduction

Efficient production in dairy farming, encompassing both yield and reproductive aspects, is crucial for ensuring sustained profitability and genetic progress in cattle breeds like Tharparkar (Verma and Thakur, 2015) [7]. Evaluating sires based on their performance in first lactation traits is fundamental for genetic improvement programs. Breeding values estimation, particularly through methods like Least Squares, plays a pivotal role in identifying superior sires for enhancing both productive and reproductive traits in dairy herds (Raheja, 1992; Bajetha and Singh, 2015) [6, 1].

Tharparkar cattle, known for their resilience in arid environments and milk production potential, provide a unique context for studying sire evaluation methods. Selecting sires based on their genetic potential for first lactation traits such as milk yield, calving intervals, and reproductive efficiency is critical for overall herd improvement and profitability (Verma and Thakur, 2015) [7]. This study aims to employ the Least-Squares method to evaluate sires based on their first lactation traits in Tharparkar cattle. By understanding and utilizing the genetic variability within this breed, we can optimize breeding strategies to enhance dairy productivity and profitability in Tharparkar cattle.

Materials and Methods

We utilized performance data from 91 daughters of 10 sires, housed at LRS, Beechwal, Bikaner, between 2006 and 2016, to estimate sire breeding values for first lactation traits.

Cows with incomplete or abnormal records were excluded from the analysis. Each year was categorized into three seasons: summer (March to July), monsoon (August to October), and winter (November to February), based on climatic conditions. The first lactation traits examined included age at first calving, first lactation milk yield, first lactation period, first dry period, first calving interval, and first service period.

For estimating least-squares breeding values, we employed the following model:

$$Y_{ijk} = \mu + S_i + A_j + e_{ijk}$$

where:

S_i represents the fixed effect of the i th sire,

A_j includes all other fixed effects considered in preceding models,

e_{ijk} is the residual error term.

The least-squares breeding values (LSBV) were calculated as:

$$LSBV_i = \mu + S_i$$

where:

μ denotes the overall least-squares mean,

S_i signifies the least squares constant for the i th sire.

Results and Discussion

Table 1: Estimates of breeding values of sires and their ranks for AFC, FSP, FCI, FDP, FLL and FLMY by LSM method of sire evaluation

Sire No.	AFC	Rank	FSP	Rank	FCI	Rank	FDP	Rank	FLL	Rank	FLMY	Rank
1997	1604.58	8	151.50	6	432.53	7	153.29	9	294.42	3	1914.84	3
2081	1571.11	4	151.70	9	432.52	6	153.16	4	285.06	8	1763.56	9
2087	1626.11	10	150.85	2	432.39	4	153.26	8	290.11	5	1924.65	2
2164	1540.57	2	151.38	5	432.86	8	153.39	10	290.81	4	1833.53	8
2249	1558.31	3	151.16	3	432.50	5	153.23	7	287.91	7	1898.94	4
2355	1571.59	5	154.55	10	438.57	10	153.03	2	327.41	1	1993.66	1
2385	1608.71	9	149.56	1	433.87	9	151.88	1	280.24	9	1875.50	5
Tb-01	1604.19	7	151.59	8	429.27	1	153.22	6	270.58	10	1651.06	10
Tb-02	1517.51	1	151.25	4	432.28	3	153.05	3	289.51	6	1859.62	7
Tb-03	1601.59	6	151.54	7	432.11	2	153.21	5	298.15	2	1871.12	6

The estimated breeding values (EBVs) obtained using the LSM method varied significantly among sires for first lactation traits, as shown in Table 1. Specifically, for age at first calving, EBVs ranged from 1517.51 to 1626.11 days, for first lactation milk yield from 1651.06 to 1993.66 kg, for first lactation period from 270.58 to 327.41 days, for first dry period from 151.88 to 153.39 days, for first calving interval from 429.27 to 438.57 days, and for first service period from 149.56 to 154.55 days. Similar findings were reported by Dalal *et al.* (1999) ^[2], highlighting substantial genetic variability in sires for these traits.

In analyzing the rankings based on these traits, sire TB-02 ranked first for age at first calving, while sire 2355 led in first lactation milk yield and first lactation length. Sire 2385 ranked first for first dry period and first service period, and sire TB-01 topped the list for first calving interval according to the LSM method. These results underscore the variability in sire performance across different first lactation traits, indicating that not all sires perform uniformly across these parameters.

The observed diversity in EBVs suggests considerable genetic variation within the herd, possibly influenced by factors such as selective breeding practices and management strategies. These findings are consistent with previous studies by Kishore (2012) ^[3], Kumar and Gandhi (2010) ^[4], and Parekh and Singh (1989) ^[5], emphasizing the importance of sire selection based on specific lactation traits to optimize genetic improvement in dairy cattle.

Conclusion

The estimated breeding values (EBVs) of sires exhibited significant genetic diversity across all first lactation traits. The rankings of the top sires varied when assessed using the LSM method for sire evaluation. These findings highlight that not all sires rank similarly for first lactation traits.

This study reveals substantial variation in the estimated breeding values of sires for first lactation traits, indicating a broad spectrum of genetic diversity within the herd. This variability underscores the complexity and potential for genetic improvement through selective breeding strategies tailored to specific lactation traits in dairy cattle.

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