



ISSN: 2456-2912

VET 2024; 9(1): 490-492

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www.veterinarypaper.com

Received: 17-10-2023

Accepted: 29-12-2023

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Effect of genetic and non-genetic factors on reproduction traits of first lactation in Tharparkar Cattle

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Abstract

The study sampled 91 Tharparkar cattle reared at Buchwald Livestock Research Station in Bikaner over a period of 11 years, i.e. from 2006 to 2016. The data was analyzed to evaluate the performance of reproductive traits of Tharparkar cattle and study the effect of genetic and non-genetic factors (e.g. season and period of calving). The total least squares average of age at first calving (AFC), first service period (FSP) and first calving interval (FCI) are 1510.88 ± 22.29 days, 149.66 ± 5.15 days and 423.60 ± 6.23 , respectively. This study found that the sire has a significant impact on the traits of the first lactation. While calving period had a significant effect on AFC and FCI, calving season had no significant effect on first lactation reproductive traits.

Keywords: Cattle, reproduction, traits and Tharparkar

Introduction

The arid regions of western India are home to many species that contribute to agriculture, livelihoods and food security. Cattle have an important place in rural life. In arid and semi-arid regions, Tharparkar cattle are raised in the arid regions of northwestern India, especially Jaisalmer and Jodhpur in Rajasthan and the Kutch region of Gujarat. The animal is white gray in color, medium sized, strong, with straight legs and feet, and an alert and docile temperament. The Tharparkar variety can thrive in harsh climates with temperatures as high as 48°C . Animals can also thrive on locally available non-conventional feed and fodder (Mathur *et al.*, 1989)^[10]. Considering the importance of breeding, efforts should be made to save the Tharparkar breed and various options for genetic improvement can be used to improve the overall performance of Tharparkar cattle. In order to create a successful breeding program, understanding the genetic and non-genetic factors that influence fertility is crucial. Keeping in view its importance, the genetic (paternal effect) and non-genetic (season and period of calving) effects on the first lactation performance of Tharparkar cows were analyzed.

Materials and Methods

Data for this survey was collected from Bichhwal Livestock Research Station, Bikaner, Rajasthan. Cows that calved between 2006 and 2016 (91 cows) were included in this study. Breeding traits examined included age at first calving (AFC), first service period (FSP) and first calving interval (FCI). The entire period from 2006 to 2016 is divided into four periods: P1 (2006-2008), P2 (2009-2010), P3 (2011-2013) and P4 (2014-2016). Each year is divided into three seasons such as summer S1 (March to June), monsoon S2 (July to October) and winter S3 (November to February). Data were analyzed using Harvey's (1990)^[7] least squares and maximum likelihood computer programs and the following mixed formula:

$$Y_{ijkl} = \mu + S_i + A_j + B_k + b(X_{ijkl} - \bar{X}) + e_{ijkl}$$

Where, Y_{ijkl} = observation on the i^{th} cow of i^{th} sire, born in j^{th} period and k^{th} season,

μ = Total population mean,

S_i = Random effect of i^{th} sire,

A_j = fixed effect of jth period of calving,
 B_k = fixed effect of kth season of calving,
 b = regression of variable on age at first calving,
 X_{ijkl} = age at first calving corresponding to Y_{ijkl},
 \bar{X} = average age at first calving,
 e_{ijkl} = Random error NID (0,σ²).

Results and Discussion

The average values of the reproductive characteristics of the first lactation calculated by the least squares method are shown in Table 1. The average age at first calving calculated by the least squares method is 1510.88 ± 22.29 days. Estimates of this trait in Tharparkar cattle range from 1117.50 ± 18.60 days (Basu *et al.*, 1979)^[2] to 1876.17 ± 40.86 days (Chand, 2011)^[3]. In this study, the effect of calving period on age at first calving (AFC) was significant, the highest age at first calving (AFC) was in the first period and the lowest was in the third period. It was also reported by Das *et al.* (1971)^[4], Panneerselvan *et al.* (1990)^[12], Vij *et al.* (1992)^[17], Gahlot (1999)^[6], Chand (2011)^[3] in Tharparkar cow. Significant differences in age at first calving between different calving periods may be due to climate change, feed availability and farm management. It was found that the effect of calving season on age at first calving was not significant. Dhaware *et al.* (2008)^[5] in Khillar, Chand (2011)^[3] in Tharparkar, Balasubramiam *et al.* (2013) and a study by Raj and Gandhi (2015) in Sahiwal is similar to this study. The study found that the effect of sire was significant on age at first calving of Tharparkar dairy cows. Similar findings were also reported by Kishore (2012)^[9] in Tharparkar cattle, Singh (2012)^[15] in Rathi and Balasubramiam *et al.* (2013)^[11] in Sahiwal cattle.

Table 1: Least-squares mean ± SE for AFC, FSP and FCI

Traits	AFC (days)	FSP(days)	FCI(days)
Over all mean	1510.88 ± 22.29 (91)	149.66 ± 5.15 (83)	423.60 ± 6.23 (83)
Sire	*	*	*
Period	**	NS	**
P1 (2006-2008)	1662.67±61.74 ^a (18)	178.86±18.12 (16)	429.51±21.94 ^b (16)
P2 (2009-2010)	1538.22±53.55 ^b (29)	131.68±18.66 (9)	419.15±22.55 ^b (9)
P3 (2011-2013)	1343.71±62.26 ^c (17)	140.13±13.96 (28)	384.48±17.25 ^c (28)
P4 (2014-2016)	1477.03±61.20 ^b (27)	145.28±16.74 (30)	468.44±20.37 ^a (30)
Season	NS	NS	NS
S1 (summer)	1499.04±56.98 (21)	155.45±14.18 (34)	426.74±17.50 (34)
S2 (monsoon)	1500.75±54.85 (26)	144.73±20.70 (9)	434.94±24.88 (9)
S3 (winter)	1516.45±47.97 (44)	146.78±13.31 (40)	414.50±16.53 (40)
Regression on AFC	-	*	**
Regression coefficient	-	.0547±.0273	.0866±.0320

(** - Highly significant ($p \leq 0.01$); * - Significant ($p \leq 0.05$); NS-Non-significant)

The first service period was observed to be 149.66 ± 5.15 days and is in close approximation with findings of Gahlot (1999)^[6] and Hussain *et al.* (2015)^[8] in Tharparkar cattle. There was a non significant effect of calving period on first service period in Tharparkar cattle. Gahlot (1999)^[6] and Nehra (2004)^[11] also reported non-significant effect of period of calving on first service period in Tharparkar and Rathi cattle, respectively. This study found that the season of

calving did not affect the first service period in Tharparkar cattle. Reports in close consonance to this finding were also mentioned in Rathi and Sahiwal cattle by Nehra (2004)^[11] and Singh (2015)^[16] respectively. The results of present study revealed that sire significantly affect the first service period in Tharparkar cattle. Singh (2015)^[16] also reported similar findings for Sahiwal cattle. The results suggested that sire is a significant source of variability in the first service period.

The least-squares mean of first calving interval was 423.60 ± 6.23 days which are near to the findings reported by Hussain *et al.* (2015)^[8] in Tharparkar cows. There was a highly significant effect ($p \leq 0.01$) of period of calving for first calving interval in Tharparkar cattle. The cows calved in fourth period had longest calving interval as compared to those calved in third period having smallest calving interval. Panneerselvan *et al.* (1990)^[12] and Hussain *et al.* (2015)^[8] in Tharparkar cattle also observed significant effect of period of calving on first calving interval. In present study, the season of calving did not affect the first calving interval. Nehra (2004)^[11] in Rathi, Sharma *et al.* (1972)^[14]; Hussain *et al.* (2015)^[8] in Tharparkar and Singh (2015)^[16] in Sahiwal cattle also observed similar results. The results of this study revealed that in Tharparkar cattle there is a significant effect of sire on first calving interval.

In conclusion, the least squares mean for AFC, FSP and FCI were found to be 1510.88±22.29 days, 149.66±5.15 days and 423.60±6.23 days respectively. The effect of season of calving was found non-significant whereas, the effect of period of calving was found to be highly significant on AFC and FCI. The significant difference in AFC and FCI in different periods was probably due to climatic changes and availability of feed across the different periods and management conditions practiced in particular period. Significant effect of sire on all the first lactation reproduction traits under study indicated that sire selection can bring further genetic improvement in the Tharparkar herd for first lactation reproduction traits.

Conclusion

From present study it can be concluded that the effect of season of calving was found non-significant whereas, the effect of period of calving was found to be highly significant on AFC and FCI. The significant difference in AFC and FCI in different periods was probably due to climatic changes and availability of feed across the different periods and management conditions practiced in particular period. Significant effect of sire on all the first lactation reproduction traits under study indicated that sire selection can bring further genetic improvement in the Tharparkar herd for first lactation reproduction traits.

Acknowledgment

The authors are obliged to the competent authorities of Rajasthan university of Veterinary and Animal Sciences, Bikaner for providing all facilities for this research.

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