



ISSN: 2456-2912

VET 2024; 9(1): 628-633

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www.veterinarypaper.com

Received: 16-10-2023

Accepted: 29-11-2023

Radha Rani Sawami

Assistant Professor and OIC
LRS, Department of Animal
Genetics and Breeding, College of
Veterinary and Animal Science,
Rajasthan University of
Veterinary and Animal Sciences,
Bikaner, Rajasthan, India

Virendra Kumar

Ph.D. Scholar, Department of
Animal Genetics and Breeding,
College of Veterinary and Animal
Science, Rajasthan University of
Veterinary and Animal Sciences,
Bikaner, Rajasthan, India

Anil

MVSc. Student, Department of
Animal Genetics and Breeding,
College of Veterinary and Animal
Science, Rajasthan University of
Veterinary and Animal Sciences,
Bikaner, Rajasthan, India

Rajesh Kumar Bochlya

MVSc. Student, Department of
Animal Genetics and Breeding,
College of Veterinary and Animal
Science, Rajasthan University of
Veterinary and Animal Sciences,
Bikaner, Rajasthan, India

Priyanka Swami

Ph.D. Scholar, Department of
Animal Genetics and Breeding,
College of Veterinary and Animal
Science, Rajasthan University of
Veterinary and Animal Sciences,
Bikaner, Rajasthan, India

Corresponding Author:

Radha Rani Sawami

Assistant Professor and OIC
LRS, Department of Animal
Genetics and Breeding, College of
Veterinary and Animal Science,
Rajasthan University of
Veterinary and Animal Sciences,
Bikaner, Rajasthan, India

Evaluation of impact of non-genetic factors on overall and lifetime lactation traits in Kankrej cattle

Radha Rani Sawami, Virendra Kumar, Anil, Rajesh Kumar Bochlya and Priyanka Swami

Abstract

The present study was conducted on 274 Kankrej cattle maintained at Livestock Research Station, Kodamdesar, Rajasthan University of Veterinary and Animal Sciences, Bikaner, calved during the period 2012 to 2022. The aim of present investigation was to access the effect of parity, season and period (non-genetic factors) on first overall and lifetime production traits in Kankrej cattle. The traits evaluated as overall lactation length (LL), overall dry period (DP), overall lactation total milk yield (LTMY) and overall calving interval (CI), lifetime milk yield as total milk yield up to 5 lactations (LTMY5) and lifetime milk yield as total milk yield up to 7 lactations (LTMY7). To estimate the effect of non-genetic factors, computer package programme, IBM SPSS version 26.0 was used for least-squares analysis. The least-squares means estimated for overall LL, DP, LTMY, CI were 222.291±2.244 days, 124.429±1.767 days, 1499.066±2.296 kg, and 406.94±2.296 days, respectively. The least-squares means for lifetime traits in Kankrej cattle were 6940.839±299.539 kg for lifetime milk yield upto5 lactations (LTMY5) and 10530.929±765.164kg for lifetime milk yield upto7 lactations (LTMY7), respectively.

The effect of parity of the cows was observed to be highly significant on overall lactation length and on overall calving interval. Period and season of calving had a highly significant ($P \leq 0.01$) effect on overall lactation length, overall lactation total milk yield. Period of calving had a significant effect on overall calving interval. Period of calving had highly significant effect on LTMY5 and significant effect on LTMY7. Findings of present study will help in further research in a large population of indigenous cattle.

Keywords: Kankrej, non-genetic factors, season, period

Introduction

Animal husbandry contributes 30% of the Gross Value Added (GVA) in agricultural and Allied sector and 6.2% to the country's overall GVA (Basic Animal Husbandry Statistics, 2021). The total number of Cattle in India is 193.46 million, out of which 142.11 million is the population of indigenous/ nondescript cattle. Indigenous cattle (*Bos indicus*) have experienced a 6 percent decline since the last census, despite having the advantage of being better adapted to the local climatic conditions and having superior disease resistance. With 13.9 million cattle, Rajasthan is the sixth-largest cattle producing state in India (20th Livestock Census, 2019).

Kankrej is a dual purpose indigenous breed. With powerful lyre-shaped horns, it is India's heaviest breed of cattle. The color ranges from silver grey to steel grey, and it has a peculiar gait known as "Sawai Chaal" (NBAGR 2019). In harsh climates of arid and semi-arid regions, Kankrej cattle demonstrate good milk production in addition to greater efficiency in converting poor quality fodder.

Despite having a large and diverse pool of cattle genetic resources, the productivity of cows in the country remains low due to a variety of factors, including inadequate nutrition, low genetic potential, inadequate animal health services, harsh climatic conditions, and other management-related issues (Ratwan *et al.*, 2018) [30]. Cattle breeding in India aims to increase output and productivity while preserving diversity (Lodhi *et al.*, 2016) [24]. To develop efficient breeding and management strategies, it is crucial to take into account the impact of numerous environmental and non-genetic factors on production and reproductive qualities.

The lifetime performance of dairy animals is used to determine their overall productivity rather than their performance during a single lactation. Because dairy farmer's main objective is to optimize milk output and profitability, lifetime milk production is a significant economic factor.

Materials and Methods

Experimental Material/Source of data

The performance record of Kankrej cattle maintained at Livestock Research Station, CVAS, Bikaner was used for the present investigation. Bikaner has a geographical location of East Longitude 28°1' and North Latitude 73°19', situated at an average altitude of 797 Feet, witnesses' extreme temperatures. The climate of the region is characterized as semi-arid where temperature reaches up to 48 °C during the summer.

Overall lactation traits

1. Lactation total milk yield (LTMY)
2. Lactation length (LL)
3. Dry period (DP)
4. Calving interval (CI)

Lifetime performance traits

1. Lifetime milk yield as total milk yield up to 5 lactations (LTMY5)
2. Lifetime milk yield as total milk yield up to 7 lactations (LTMY7)

Statistical analysis

Estimation of the effect of non-genetic factors on production and reproduction traits

To estimate the effect of non-genetic factors on production and reproduction traits, computer package programme, General Linear Model (Univariate) procedure of IBM SPSS (2005) version 26.0 was used for data analysis and determination of least-squares means of the traits considered in the study.

For overall traits

$$Y_{ijkl} = \mu + A_i + B_j + C_k + e_{ijkl}$$

Where,

Y_{ijkl} = Observation on the l^{th} cow calved in k^{th} parity, j^{th} season and i^{th} period,

μ = Overall mean

A_i = Fixed effect of i^{th} period of calving ($i = 1, 2, 3$)

B_j = Fixed effect of j^{th} season of calving ($j = 1, 2, 3, 4$)

C_k = Fixed effect of k^{th} parity ($k = 1, 2, 3, 4, 5, 6$)

e_{ijkl} = Residual random error associated with each observation under the assumption NID ($0, \sigma^2$)

For lifetime traits

$$Y_{ijk} = \mu + P_i + S_j + e_{ijk}$$

Where,

Y_{ijk} = Observation on the k^{th} cow calved in j^{th} season and i^{th} period,

μ = Overall mean

P_i = Fixed effect of i^{th} period of first calving,

S_j = Fixed effect of j^{th} season of first calving

e_{ijk} = Residual random error associated with each observation under the assumption

NID ($0, \sigma^2$)

Results and Discussion

Overall lactation traits

The least-squares analysis for the overall lactation traits i.e. lactation length, dry period, lactation milk yield, calving interval in Kankrej has been presented in the Table 1a and 1b.

1. Lactation Length (LL)

The observed least-squares mean for lactation length in Kankrej cattle was estimated as 222.291 ± 2.244 days in the present study. The estimated lactation length was higher than reported by Basak and Das (2018) ^[4] in Deoni. However, Bhutkar *et al.* (2014) ^[5] in Deoni observed similar results. Whereas, Ekka *et al.* (2014) ^[15]; Pareek *et al.* (2016) ^[35]; Singh *et al.* (2018) ^[31]; and Gupta *et al.* (2019) ^[18] in Kankrej; Chand (2011) ^[6]; Choudhary *et al.* (2019b) ^[9] in Tharparkar reported higher estimates of lactation length.

The parity of the animal had a highly significant effect on lactation length in the present study. Animals in their first parity had the longest lactation of 235.721 ± 4.554 kg, whereas it was the shortest in sixth parity cattle but the difference was significant enough to be accorded to the parity of the animal. Results similar to the study were reported by Gupta *et al.* (2019) ^[18] in Kankrej and Sohal (2016) ^[34] in Rathi. Gahlot *et al.* (2000) ^[16]; Chand (2011) ^[6] in Tharparkar; Dangi *et al.* (2013) ^[12] in Rathi; Japheth *et al.* (2015) ^[20] in Karan Fries and Singh and Singh (2018) ^[31] in Sahiwal also observed the trait to be significantly affected ($p \leq 0.05$) by the parity. Whereas, non-significant effect of parity was reported by Patel *et al.* (2000) ^[27] in Tharparkar, Nehra (2004) ^[26] in Rathi and Chigale *et al.* (2016) ^[7] in Red Sindhi contrary to the study.

The period of calving had a highly significant ($p \leq 0.01$) effect on the lactation length of Kankrej cows under study. The average lactation length of 235.531 ± 5.614 days in third period was maximum among all, which indicated conducive environment and better management during the period, whereas a lower lactation length was observed in second period of study. Similar findings were observed by Gupta *et al.* (2019) ^[18] in Kankrej; Basak and Das (2018) ^[4] in Deoni cattle; Ekka *et al.* (2014) ^[15] in Kankrej, Gahlot *et al.* (2000) ^[16]; Patel *et al.* (2000) ^[27]; Chand (2011) ^[6]; Hussain *et al.* (2015) ^[19] in Tharparkar; Dangi *et al.* (2013) ^[12]; Sohal (2016) ^[34] in Rathi; Raja and Gandhi (2015) ^[28] and Singh and Singh (2018) ^[31] in Sahiwal observed significant ($p \leq 0.05$) effect of period of calving on the lactation length. Contrary findings were reported by Singh and Gurnani (2004) in Karan Fries; Nehra (2004) ^[26] in Rathi; Choudhary *et al.* (2019b) ^[9] in Tharparkar and Chigale *et al.* (2016) ^[7] in Red Sindhi.

Season of calving was observed to have a highly significant ($p \leq 0.01$) effect on the lactation length of Kankrej cattle. The animals calving in second season (S2) had a longer lactation of 232.050 ± 3.586 days as compared to other seasons whereas, animals that calved in season four (S4) had a significantly lower LL of 210.940 ± 4.416 days. Similar results were reported by Sohal (2016) ^[34] in Rathi cattle, however a significant effect of season was also reported by Nehra (2004) ^[26]; Dangi *et al.* (2013) ^[12] in Rathi and Choudhary *et al.* (2019b) ^[9] in Tharparkar. On the contrary, Ekka *et al.* (2014) ^[15]; Gupta *et al.* (2019) ^[18] in Kankrej; Singh *et al.* (2013) ^[33] in Rathi; Chand (2011) ^[6]; Hussain *et al.* (2015) ^[19] in Tharparkar; Chigale *et al.* (2016) ^[7] in Red Sindhi and Basak and Das (2018) ^[4] in Red Sindhi observed that season of calving had no effect on the lactation length.

2. Dry Period (DP)

The estimated least-squares mean for dry period in Kankrej was 124.429 ± 1.767 days in the present investigation, which was lower than the average values of 143.17 ± 28.78 days, 144.74 ± 9.65 days and 146.13 ± 5.14 days reported by Pareek *et al.* (2016) [35], Singh *et al.* (2018) [31] and Gupta *et al.* (2019) [18], respectively. Whereas, the lower estimates of dry period was reported by Hussain *et al.* (2015) [19] in Tharparkar, Singh *et al.* (2011) [32] in Vrindavani cattle.

Parity of the animals had a non-significant effect on dry period. The animals in their second lactation had the longest dry period of 127.863 ± 3.89 days whereas it was shortest for animals in their sixth lactation and above. Sohal (2016) [34] in Rathi; Patel *et al.* (2000) [27] and Mishra *et al.* (2018) [25] in Tharparkar; Dongre *et al.* (2017) [14] in Deoni and Baranwal *et al.* (2018) [3] in Vrindavani cattle reported that parity had no effect on the dry period. Whereas Gahlot *et al.* (2000) [16] in Tharparkar; Gupta *et al.* (2019) [18] in Kankrej and Singh *et al.* (2014) [29] in Frieswal reported findings contrary to the study. In the Kankrej cattle under study, no effect of period of calving was observed on the dry period. Findings similar to the study were reported by Ekka *et al.* (2014) [15] in Kankrej; Patel *et al.* (2000) [27] in Tharparkar; Dahiya (2020) [10] in Hariana; Dangi *et al.* (2013) [12]; Sohal (2016) [34] in Rathi. Contrary findings were reported by Gupta *et al.* (2019) [18] in Kankrej; Nehra (2004) [26]; Singh *et al.* (2013) [33] in Rathi; Chand (2011) [6]; Hussain *et al.* (2015) [19]; Mishra *et al.* (2018) [25] in Tharparkar and Bagesar *et al.* (2019) [2] in Holdeo cattle.

Season of calving had non-significant effect on dry period in the study. Ekka *et al.* (2014) [15]; Gupta *et al.* (2019) [18] in Kankrej, Singh *et al.* (2013) [33] in Rathi, Patel *et al.* (2000) [27]; Hussain *et al.* (2015) [19] in Tharparkar and Bhutkar *et al.* (2014) [5] in Deoni reported similar findings. Results contrary to the study were observed by Gahlot *et al.* (2000) [16] in Tharparkar, Dangi *et al.* (2013) [12] and Sohal (2016) [34] in Rathi, Baranwal *et al.* (2018) [3] in Vrindavani, Singh and Singh (2018) [31] in Sahiwal.

3. Lactation Milk Yield (LMY)

The estimated average lactation milk yield in Kankrej cattle was 1499.066 ± 2.296 kg in the present investigation. The estimated least-squares mean for LMY was similar to the observation by Kumar (2012) in Rathi. Pareek *et al.* (2016) [35] in Kankrej; Singh *et al.* (2013) [33] and Sohal (2016) [34] in Rathi; Kishore (2012) [22] and Choudhary *et al.* (2019b) [9] in Tharparkar reported higher estimates of lactation milk yield. On the contrary Basak and Das (2019) in Deoni estimated lower value for the same.

Parity of the animal had non-significant effect on lactation milk yield of Kankrej cows under study. Patel *et al.* (2000) [27] in Tharparkar, Singh *et al.* (2014) [29] in Frieswal, Sohal (2016) [34] in Rathi and Dongre *et al.* (2017) [14] in Deoni breed reported non-significant effect. On the contrary Nehra (2004) [26] and Dangi *et al.* (2013) [12] in Rathi; Gahlot *et al.* (2000) [16]; Chand (2011) [6] in Tharparkar; Baranwal *et al.* (2018) [3] in Vrindavani and Basak and Das (2018) [4] in Deoni found a significant effect of parity on LMY.

Period of calving had highly significant ($p \leq 0.01$) effect on the LMY of Kankrej animals under study. The average value for the trait was observed to be maximum (1696.289 ± 52.536 kg) in the third period, with similar value being reported in the first and second period of study. Similar results were observed by Dangi *et al.* (2013) [12] in Rathi, Gahlot *et al.* (2000) [16]; Chand (2011) [6]; Hussain *et al.* (2015) [19]; Choudhary *et al.*

(2019b) [9] in Tharparkar. Similarly Dangar and Vataliya (2015) [11] in Gir and Basak and Das (2018) [4] in Deoni reported a highly significant ($p \leq 0.01$) effect of period on the lactation milk yield. On the contrary, Nehra (2004) [26]; Singh *et al.* (2013) [33]; Sohal (2016) [34] in Rathi, Patel *et al.* (2000) [27] in Tharparkar and Verma *et al.* (2016) in Sahiwal found non-significant effect of period of calving on the trait.

Season of calving had a highly significant effect ($p \leq 0.01$) on lactation milk yield. A higher average yield (1673.351 ± 35.070 kg) was observed in animals which calved in season second as opposed to a lower average yield of 1306.013 ± 42.333 kg in animals which had their calving in season four. The similar findings were reported in study by Sohal (2016) [34] in Rathi; however, Chand (2011) [6]; Choudhary *et al.* (2019b) [9] in Tharparkar; Japheth *et al.* (2015) [20] in Karan Fries; Singh and Singh (2018) [31] in Sahiwal and Basak and Das (2018) [4] in Deoni reported significant ($p \leq 0.05$) effect of season of calving on LMY. Whereas, non-significant effect of season of calving was observed by Nehra (2004) [26]; Singh *et al.* (2013) [33] in Rathi; Hussain *et al.* (2015) [19] in Tharparkar; Dangar and Vataliya (2015) [11] in Gir cattle.

4. Calving Interval (CI)

The observed least-squares mean for calving interval was 406.94 ± 2.296 days which was similar to the findings of Mishra *et al.* (2018) [25] in Tharparkar who reported the average calving interval of 399.97 ± 2.44 days. Ekka *et al.* (2014) [15] and Singh *et al.* (2018) [31] in Kankrej observed a higher estimate of 465.57 ± 14.13 days and 434.24 ± 12.94 days respectively. Similarly, higher estimates were reported by Dangi *et al.* (2013) [12] and Sohal (2016) [34] in Rathi.

Parity of the animals had highly significant effect on calving interval ($p \leq 0.01$) in study. The average value for the trait decreased with the increasing lactation order and it was maximum (420.548 ± 4.014 days) for animals in their first parity and minimum (397.199 ± 5.177 days) for the animals in their sixth lactation and above. The similar findings were observed by Sohal (2016) [34] in Rathi. Whereas, Dangi *et al.* (2013) [12] in Rathi; Japheth *et al.* (2015) [20] in Karan Fries; Kishore *et al.* (2012) [22] in Tharparkar and Baranwal *et al.* (2018) [3] in Vrindavani breed of cattle observed a significant effect of parity on the trait. Nehra (2004) [26]; Singh *et al.* (2013) [33] in Rathi; Dongre *et al.* (2017) [14]; Basak and Das (2018) [4] in Deoni and Choudhary *et al.* (2019a) [8] in Tharparkar observed a non-significant effect of parity on the calving interval in their studies, which was contrary to the findings.

Calving interval of the Kankrej cattle in study was significantly affected by the period of calving. Animals in first period had a lower average value for the CI (401.847 ± 2.993). Dangi *et al.* (2013) [12] in Rathi; Patel *et al.* (2000) [27]; Chand (2011) [6]; Hussain *et al.* (2015) [19]; Kishore *et al.* (2012) [22] in Tharparkar were observed the similar findings. However, Sohal (2016) [34] in Rathi; Mishra *et al.* (2018) [25] in Tharparkar and Basak and Das (2018) [4] in Deoni breeds of cattle reported a highly significant ($p \leq 0.01$) effect of period of calving on the trait. Ekka *et al.* (2014) [15] in Kankrej; Singh *et al.* (2013) [33]; Rathi; Chigale *et al.* (2016) [7] in Red Sindhi; Choudhary *et al.* (2019a) [8] in Tharparkar and Ratwan *et al.* (2019) [29] in Sahiwal reported contrary findings.

Calving interval of Kankrej cattle under study was not affected by the season of calving. Ekka *et al.* (2014) [15] in Kankrej; Chand (2011) [6]; Hussain *et al.* (2015) [19]; Kishore

et al. (2012) [22]; Mishra et al. (2018) [25]; Choudhary et al. (2019a) [8] in Tharparkar reported similar findings. Whereas, the effect of season of calving on CI was observed to be highly significant ($p < 0.01$) by Sohal (2016) [34] in Rathi and significant by Dangi et al. (2013) [12] in Rathi and Bagesar et al. (2018) [2] in Holdeo cattle.

Table 1 (a): Least-squares analysis for overall lactation traits in Kankrej cattle

	LL (days)	DP (days)
Overall mean	222.291±2.244 (832)	124.429±1.767 (500)
Parity	**	NS
L1	235.721 ^b ±4.554 (165)	127.096±3.929 (100)
L2	214.856 ^a ±4.369(178)	127.863±3.890 (94)
L3	223.150 ^{ab} ±4.464(151)	125.743±3.597 (100)
L4	223.374 ^{ab} ±4.372(138)	126.660±3.682 (80)
L5	221.022 ^a ±5.258(101)	120.279±4.431 (61)
L6	215.624 ^a ±5.037(99)	118.936±4.148 (65)
Period	**	NS
P1	217.575 ^a ±3.017 (418)	121.757±2.595 (252)
P2	213.767 ^a ±2.885 (331)	129.448±2.669 (174)
P3	235.531 ^b ±5.614 (83)	122.083±4.065 (74)
Season	**	NS
S1(Winter)	224.089 ^b ±2.911(350)	125.409±2.319 (217)
S2(Summer)	232.050 ^b ±3.586(196)	120.161±2.943 (122)
S3(Rainy)	222.085 ^b ±4.282(143)	121.640±3.680 (81)
S4(Autumn)	210.940 ^a ±4.416(143)	130.507±3.823 (80)

(** - Highly significant ($p < 0.01$); * - Significant ($P < 0.05$); NS – Non significant, The number in parenthesis is the number of observations)

Table 1 (b): Least-squares analysis for overall lactation traits in Kankrej cattle

	LMY (kg)	CI (days)
Overall mean	1499.066±2.296 (870)	406.94±2.296 (530)
Parity	NS	**
L1	1513.614±42.846(188)	420.548 ^b ±4.014(143)
L2	1461.329±41.847(185)	415.924 ^{ab} ±4.352(111)
L3	1457.817±43.247(153)	405.762 ^{ab} ±4.324(101)
L4	1487.499±42.857(137)	403.942 ^{ab} ±4.525(84)
L5	1573.722±51.488(102)	398.444 ^{ab} ±5.863(53)
L6	1500.416±48.250(105)	397.199 ^a ±5.177(58)
Period	**	*
P1	1406.641 ^a ±29.212(444)	401.847 ^a ±2.993 (292)
P2	1394.268 ^a ±28.272(334)	412.473 ^b ±2.842 (207)
P3	1696.289 ^b ±52.536(92)	406.589 ^{ab} ±5.763 (51)
Season	**	NS
S1(Winter)	1506.013 ^b ±27.587(378)	409.405±2.782 (263)
S2(Summer)	1673.351 ^c ±35.070(197)	403.480±4.010 (100)
S3(Rainy)	1510.889 ^b ±41.354(147)	413.494±4.216 (92)
S4(Autumn)	1306.013 ^a ±42.333(148)	401.501±4.308 (95)

(** - Highly significant ($p < 0.01$); * - Significant ($p < 0.05$); NS – Non significant, The number in parenthesis is the number of observations)

Lifetime performance traits

The lifetime traits were studied for the effects of various non-genetic factors such as season of calving and period of calving, using least squares analysis technique. The results of least-squares analysis for lifetime production in Kankrej has been presented in the Table 2 and 3.

Lifetime milk yield as total milk yield up to 5 lactations (LTMY5)

The estimated least squares mean for LTMY5 was 6940.83±299.53kg in present investigation. In the present study it was observed that the season of calving had non-significant effect on lifetime milk yield upto 5 lactations of the animal, the animals born in summer season had highest

lifetime milk yield upto 5 lactations of 7337.44±657.86kg than animals born in winter, rainy and autumn season with LTMY5 observed as 6896.72±286.84, 7172.52±538.11 and 6356.66±585.04kg, respectively (Table 2). In this study period of calving had highly significant effect on LTMY5 of animals, animals born during the period of 2014-2017 had the highest LTMY of 7618.02±669.42 kg compared to the animals born during the periods of 2012 and 2013, with LTMY5 of 6003.98±289.93 and 7200.51±387.96 kg respectively.

Table 2: Least-squares analysis for lifetime lactation traits upto 5 lactation in Kankrej cattle

	No. of Observations	Mean ± S.E.
Overall	142	6940.839±299.539
Season NS		
Winter	90	6896.725±286.848
Summer	11	7337.443±657.862
Rainy	22	7172.520±538.112
Autumn	19	6356.666±585.047
Period **		
2012	75	6003.981 ^a ±289.939
2013	55	7200.510 ^{ab} ±387.963
2014-2017	12	7618.024 ^b ±669.421

2. Lifetime milk yield as total milk yield upto 7 lactations (LTMY7)

The estimated least squares mean for LTMY7 was 10530.929±765.164 kg in present investigation. In the present study it was observed that the season of calving had non-significant effect on lifetime milk yield upto 7 lactations of the animal, the animals born in summer season had highest lifetime milk yield upto 7 lactations of 12486.906±1903.403kg than animals born in winter, rainy and autumn season with LTMY7 observed as 9805.730±631.657, 10171.936±1179.745 and 9659.143±1736.217 kg, respectively (Table 3). In this study period of calving had significant effect on LTMY7 of animals. The animals born in 2013 had highest lifetime milk yield upto 7 lactations of 11757.446±1121.616kg than animals born in 2012 with LTMY7 observed as 9304.411±749.304 kg.

Table 3: Least-squares analysis for lifetime lactation traits upto 7 lactations in Kankrej cattle

	No. of Observations	Mean ± S.E.
Overall	43	10530.929±765.164
Season NS		
Winter	27	9805.730±631.657
Summer	3	12486.906±1903.403
Rainy	9	10171.936±1179.745
Autumn	4	9659.143±1736.217
Period *		
2012	28	9304.411 ^a ±749.304
2013	15	11757.446 ^b ±1121.616

In Tharparkar cattle, Gupta and Gurnani (1984) [17] reported that the six years, eight years and ten years aged animals produced lifetime milk yield of 5585.77 ± 93.23 kg, 9589.30 ± 153.34 kg and 14029.62 ± 220.34 kg, respectively.

Khan et al. (2013) reported that lifetime milk yield upto 4 and 5 lactation as LTMY4 = 4410.305±0.596 kg and LTMY5 = 7987.560 kg respectively in Vrindavani cattle.

Dash et al., studied that overall least-squares means for LT2 (kg), LT3 (kg), LT4 (kg), LT5 (kg) were found 7907.57±121.21, 12714.68±226.90, 17720.46±338.52 and 22282.97±529.00 respectively in Karan Fries cattle.

Conclusion

A significant effect of period of calving on production traits indicated that there was difference in managemental practices at different time interval. A significant effect of season of calving on production traits suggested that Kankrej cows in the study were susceptible to the seasonal fluctuations of temperature, rainfall etc. and hence for getting the optimum production, provisions for the same should be made.

Authors' contribution

The data on overall and lifetime lactation production traits were collected by author 1 under the supervision of author 2. The data were compiled and analyzed by author 1. The manuscript was prepared by author 1 under guidance of author 2 and 3. All the authors read and approved the final manuscript.

Acknowledgements

The authors are thankful to the Director of Research, RAJUVAS, Bikaner and Dean, CVAS, Bikaner to provide the facility for research.

Competing interests

The authors declare that they have no competing interests.

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