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Abhishek Joshi
Department of Livestock Production and Management, C.V.S. & A.H., S.K. Nagar, Sardarkrushinagar Dantiwada Agricultural University, Dantiwada, Gujarat, India

MM Pawar
Department of Animal Nutrition, C.V.S. & A.H., S.K. Nagar, Sardarkrushinagar Dantiwada Agricultural University, Dantiwada, Gujarat, India

BK Ashwar
Department of Veterinary and Animal Husbandry Extension Education, C.V.S. & A.H., S.K. Nagar, Sardarkrushinagar Dantiwada Agricultural University, Dantiwada, Gujarat, India

VK Patel
Department of Livestock Production and Management, C.V.S. & A.H., S.K. Nagar, Sardarkrushinagar Dantiwada Agricultural University, Dantiwada, Gujarat, India

JB Patel
Department of Livestock Production and Management, C.V.S. & A.H., S.K. Nagar, Sardarkrushinagar Dantiwada Agricultural University, Dantiwada, Gujarat, India

Corresponding Author:
Abhishek Joshi
Department of Livestock Production and Management, C.V.S. & A.H., S.K. Nagar, Sardarkrushinagar Dantiwada Agricultural University, Dantiwada, Gujarat, India

Evaluation of factors affecting the productive herd life trait in Kankrej cattle at an organized farm

Abhishek Joshi, MM Pawar, BK Ashwar, VK Patel and JB Patel

Abstract
Information about these traits is essential for the formulation and implementation of breeding strategies for genetic improvement in dairy sectors. There is very little information available in the literature about these traits in Kankrej cattle. An analysis of 251 calving records of Kankrej cows collected at Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat over a period of 15 years, from 2001 to 2015, was conducted under similar management and feeding conditions. The mean for productive herd life was 1264.42 ± 1088.37 days, C.V. being 86.1 per cent. The least square mean for productive herd life was 1351.99 ± 114.55 days. The Productive herd life was significantly affected by period of first calving and first lactation milk yield in Kankrej cattle. Non significant effect of age at first calving and season of first calving were observed on productive herd life in Kankerj Cattle.

Keywords: Productive herd life, longevity, Kankrej, calf production

Introduction
Livestock has a multidimensional role in achieving national food security, employment generation, socio economic development of rural sector especially among the landless, small, marginal farmers and farm women. Milk production is the enterprise in which the small scale farmers can easily engage themselves in order to improve their livelihood. Regular income from selling of milk moves them from subsistence to a market based income. Cattle occupy an important place in the agricultural economy of India because of their adaptability to harsh climatic conditions, tolerance to tropical diseases and survival under poor feeding and management practices. Kankrej is an important dual purpose breed of the state which can thrive well in the semi-arid zone of Gujarat with extreme hot weather, minimum of feed, water and management. The importance of life time traits has got an economic bearing on the keeping of dairy animal. Dairy cattle have constantly improved although at a slow pace by selective breeding. The ultimate goal of animal breeder is to acquire maximum return per unit of input incurred during lifetime of a cow. A long productive herd life reduces the number and cost of herd replacement and increases the proportion of highly mature animals in the herd (Asker *et al.*, (1954) [4].

Materials and Methods
The relevant data for the present investigation generated over a period of 15 years (2001-2015) were collected from the history sheets and pedigree sheets maintained at Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat which was initially set up to evaluate production potential of Kankrej cattle, a native breed of Gujarat state.

a) Classification of Data
The data were classified according to period of first calving, season of first calving, age at first calving and first lactation milk yield in order to study effect of above mentioned factors on the productive herd life in Kankrej cattle.

- **Period of First Calving**

The data recorded over a period of 15 years (2001-2015) have been grouped into period of three years each assuming the differences between consequent years were insignificant and variation during the year follow a cyclic pattern. This data were divided into five periods as follows:

P1 2001-2003
P2 2004-2006
P3 2007-2009
P4 2010-2012
P5 2013-2015

- **Season of First Calving**

To evaluate the effect of season of first calving, the data were classified on the basis of temperature and availability of green fodder into three seasons as under:

S1 (summer) March to June
S2 (rainy) July to October
S3 (winter) November to February

- **Age at First Calving**

The age at first calving groups of Kankrej cattle were made by taking the class interval of 150 days of age at first calving. Animals were categorised into following 5 groups:

A1 Less than 1001 days
A2 1001 to 1150 days
A3 1151 to 1300 days
A4 1301 to 1450 days
A5 Above 1451 days

- **First Lactation Milk Yield**

The data were classified into seven groups on the basis of first lactation 305 days milk yield as follows:

L1 Less than 1001 kg
L2 1001 to 1400 kg
L3 1401 to 1800 kg
L4 1801 to 2200 kg
L5 2201 to 2600 kg
L6 2601 to 3000 kg
L7 Above 3000 kg

b) Productive Herd Life

It is defined as the number of days in milk from the date of first calving to the date of disposal.

The least square analysis of variances were conducted to study the effect of period of first calving, season of first calving, age at first calving and first lactation 305 days milk production on productive herd life.

Results

a) Productive Herd Life (Days)

The mean for productive herd life was 1264.42 ± 1088.37 days, C.V. being 86.1 per cent (Table 1.1).

b) Least square mean and significance of fixed effect for productive herd life

The least square mean for productive herd life across the different non-genetic factors included in the study along with analysis of variance results are presented in Table 1.1a and 1.1b, respectively. The least square mean for productive herd life was 1351.99 ± 114.55 days.

a) Period of first calving

The productive herd life during P1, P2, P3, P4 and P5 periods were 1988.57 ± 168.45, 1491.15 ± 152.81, 1536.54 ± 164.62, 903.40 ± 163.97 and 840.27 ± 199.68 days, respectively. All the periods had significant effect on productive herd life except P1 and contributing 12.64 per cent to the total variability (Table 1.1b). Productive herd life was highest in P1 period (2001-2003) followed by P3, P2, P4 and P5.

b) Season of first calving

The productive herd life were 1281.49 ± 132.64 days for S1 season, 1302.38 ± 169.46 days for S2 season and 1472.10 ± 133.12days for S3 season (Table 1.1a). However, the difference between seasons was non-significant contributing only 0.58 per cent to the total variability (Table 1.1b).

c) Age at first calving

The least square mean for productive herd life ranged between 911.47 ± 158.25 days (A5 > 1450 days) to 1874.37 ± 365.75 (A1 < 1001 days). The difference between AFC groups were non-significant contributing only 2.75 per cent of the total variability (Table 1.1b).

d) First lactation milk yield

The productive herd life on the basis of FLMY group ranged between 443.24 ± 164.25 (L1 < 1001 Kg) to 2029.80 ± 202.33kg (L5 < 2201-2600 kg). The difference in productive herd life among different FLMY groups was significant. The productive herd life of FLMY group L5 (2201-2600 kg) was significantly higher as compared to FLMY group L7, L4, L6, L3, L2 and L1. The contribution of FLMY towards total variability was 19.63 per cent (Table 1.1b).

Table 1.1: Mean, standard deviation and C.V. (%) of productive herd life

Sr. No.	Traits	No. of Observations	Mean	S.E.	S.D.	C.V. (%)
1.	Productive herd life (days)	251	1264.42	68.70	1088.37	86.1

Table 1.1a: Least square mean and standard error for productive herd life (days) across different non genetic factors

Sr. No.	Parameter	No. of Observations	Mean ± S.E. (days)
1	Total	251	1351.99 ± 114.55
2	PFC	**	
2.1	P1 (2001-2003)	59	1988.57^{c} ± 168.45
2.2	P2 (2004-2006)	67	1491.15^{a} ± 152.81
2.3	P3 (2007-2009)	49	1536.54^{a} ± 164.62
2.4	P4 (2010-2012)	48	903.40^{b} ± 163.97
2.5	P5 (2013-2015)	28	840.27^{b} ± 199.68
3	SFC	Non-significant	
3.1	S1 (Summer) March to June	109	1281.49 ± 132.64
3.2	S2 (Rainy) July to October	47	1302.38 ± 169.46
3.3	S3 (Winter) November to February	95	1472.10 ± 133.12
4	AFC	Non-significant	
1.1	A1 (< 1001 days)	7	1874.37 ± 365.75
4.2	A2 (1001-1150 days)	43	1351.19 ± 161.16
4.3	A3 (1151-1300 days)	79	1341.03 ± 128.50
4.4	A4 (1301-1450 days)	69	1281.88 ± 140.52
4.5	A5 (> 1450 days)	53	911.47 ± 158.25
5	Flmy	**	
5.1	L1 (< 1001 kg)	38	443.24^{d} ± 164.25
5.2	L2 (1001-1400 kg)	34	721.15^{cd} ± 175.12
5.3	L3 (1401-1800 kg)	66	1290.97^{bc} ± 132.11
5.4	L4 (1801-2200 kg)	75	1634.06^{ab} ± 134.60
5.5	L5 (2201-2600 kg)	27	2029.80^{a} ± 202.33
5.6	L6 (2601-3000 kg)	7	1341.18^{abc} ± 356.63
5.7	L7 (> 3000 kg)	4	2000.51^{ab} ± 470.69

Table 1.1b: Least square analysis for productive herd life

Source of Variation	d.f.	MS	R^2
PFC	4	9531050**	12.64
SFC	2	704098	0.58
AFC	4	875654	2.75
Flmy	6	9868937**	19.63

**Significant at $p<0.01$

Discussion

1. Productive herd life

The least square mean value for productive herd life of Kankrej cow was found 1351.99 ± 114.55 days in the present study. Similar result was reported by Hibner and Krzywda (1981) [23] in Poland Black and White Lowland cattle.

However, the productive herd life obtained in this investigation was lower than that of by Alim (1957) [2] in buffalo (4.65 lactation), Kohli and Suri (1957) [26] in Hariana (6.4 years), Youssef and Asker (1959) [68] in Egyptian buffaloes (5.1 lactation), Singh and Sinha (1960) [56] in Tharparkar (5.5 years), Evans *et al.* (1964) [18] in Holstein Friesian (1526 days), Singh *et al*. (1964) [59] in Hariana (4.94 years), Aroeira *et al.* (1977) [3] in Gir (55.47 months) and Nellore (59.45 months), Tomar and Basu [64] (1981) in Murrah buffalo (4.54 years), Matharu and Gill (1981) [36] in Sahiwal (1951 days) and Holstein Friesian x Sahiwal (2206 days), Patel *et al*. (1982) [40] in Kankrej cow (4.58 years) at Chharodi farm, Hegade and Bhatnagar (1985) [22] in Brown Swiss x Zebu (1623.80 days), Reddy and Basu (1985) [45] in Sahiwal cross bred (1913 days) and Holstein Friesian cross bred (1799 days), Schons *et al.* (1985) [53] in Angus beef cow (4.46 years), Muresan *et al.* (1986) [38] in Holstein Friesian (3084 days), Tiwana *et al.* (1986) [63] in Elite buffalo (4416 days), Zakhariev and Petkove (1986) [69] in Holstein Friesian (1747 days), El-Arian and Tripathi (1988) [17] in Murrah buffalo at farm one (1515.69 days) and two (2255.17 days), Petrovic (1988) [41] Holstein Friesian (1590 days), Ponce de Leon and Guzman (1988) [42] in Holstein Friesian (45 months), Reddy and Nagarcenkar (1988) [46] in Sahiwal (4.95 years), Singh *et al.* (1988) [55] in Sahiwal (4.95 years) and Sahiwal x crossbred (5.5 years), Tanida *et al.*(1988) [62] in Angus and Hereford, Bailey (1991) [6] in Hereford (4.21 years), Roy and Tripathi (1990) [50] in Holstein Friesian x Sahiwal/Tharparkar (1543.02 days), Trautman *et al*. (1990) [66] in Simmental (5.5 years), Juma *et al.* (1991) [25] in Iraqi buffalo (5.5 years), Kriventsov and Lvanov (1991) [27] in Black Pied (52.6 months) and Ayrshire (63.2 months), Rehout *et al.* (1992) [47] in cows (2923 days), Rao (1993) [44] in Jersey x Desi Village cows (6.3 years) and organised (5.7 years), Mahdy (1994a) [33] in Egyptian buffaloes (47.27 months) and Holstein Friesian (52.9 months), Kumar (1997) [28] in crossbred cattle (2135.46 days), Singh *et al*. (1997) [54] in Rathi (1940.55 days) and Red Dane x Rathi (2390.34 days), Chaudhari and Fulsoundar (1999) [12] in Kankrej (1811.31 days), Bhattacharjya *et al.* (2000) [10] in Tharparkar (4.38 lactation), Gahlot *et al*. (2001) [19] in Tharparkar (5.14 years), Dalal *et al.* (2002) [13] in Hariana (4.46 years), Singh *et al*. (2002) [60] in Holstein Friesian (1439.32 days), Dubey and Singh (2005) [15] in Sahiwal and cross bred (1776.20 days), Goshu (2005) [20] in Friesian Boran crossbred (1301 days), Ram and Goswami (2005) [43] in Tharparkar (4.38 years), Kumar (2007) [29] in Hariana (5.38 years), Abbas and Sachdeva (2008) [1] in Sahiwal (1418.66 days), Kumar *et al.* (2009) [31] in Hariana (5.38 years), Jakhar *et al.* (2010) [24] in Hariana (4.38 years), Singh *et al*. (2011) [61] in Sahiwal (1872.28 days), Goshu *et al.* (2014) [21] in Holstein Friesian (1638 days), Kumar *et al.* (2014) [30] in Frieswal (3.81 years), Updahyay *et al.* (2015) [67] in Sahiwal (1666.66 days).

On the contrary, productive herd life in the present study was found higher as compared to findings of Basu and Ghai (1980) [7] in Murrah (3.23 lactation), Patel *et al.* (1982) [40] Kankrej at Anand farm (3.45 years), Basu *et al*. (1983) [8] in Tharparkar (3.68 lactation), Bergner (1985) [9] in cows (2.75 lactation), Mangurkar *et al.* (1986) [35] in Holsetin Friesian (40.20 months) and Jersey (39.47 months), Nieuwhof *et al.* (1989) [39] in Holstein Friesian (4.21 years) and Jersey (3.3 years), Rogers *et al.* (1991) [49] in Jersey (2.91 years), Singh and Tomar (1991) [58] in Karan Fries (1048 days), Tomar *et al.* (1995) [65] in Red Sindhi (3.32 lactation), Mukherjee and Tomar (1996) [37] in Brown Swiss cross (3.2 years), Chaudhari and Fulsoundar (1999) [12] in Jersey x Kankrej (1315.64 days), Atrey *et al.* (2005) [5] in Frieswal (3.57 days).

It has been observed that a long productive herd life is normally beneficial and also allows selection of more offspring for the better producing animals. In Zebu cattle, the average productive herd life has been found to be longer (4 to 8 years) than in exotic breeds of cattle (2.9 to 5.2 years) as evident from the various reports reviewed in Figure 5.2.

The differences in productive herd life obtained by different workers may be due to effect of managerial practices, location differences and many more genetic and non-genetic factors affecting the trait.

a. Effect of period of first calving on productive herd life

In the present study productive herd life was found significantly influenced by period of first calving in Kankrej cattle. Present study which is in agreement with the findings of Basu *et al*. (1983) [8] in Tharparkar, Hegade and Bhatnagar (1985) [22] in Brown Swiss x Zebu, Butte and Deshpande (1987) [11] Holstein Friesian x Sahiwal, Ponce de Leon and Guzman (1988) [42] in Holstein Friesian, Tanida *et al*. (1988) [62] in Angus and Hereford, Singh and Tomar (1989) [57] in Karan Fries, Mahdy (1994b) in Holstein Friesian, Singh *et al*. (1997) [54] in Red Dane x Rathi, Gahlot *et al.* (2001) [19] in Tharparkar, Atrey *et al*. (2005) [5] Frieswal, Dubey and Singh (2005) [15] in Sahiwal and crossbred, Goshu (2005) [20] in Friesian Boran crossbred, Ram and Goswami (2005) [43] in Tharparkar, Kumar (2007) [29] in Hariana, Kumar *et al*. (2009) [31] in Hariana, Jakhar *et al.* (2010) [24] in Hariana, Singh *et al.* (2011) [61] in Sahiwal, Kumar *et al.* (2014) [30] in Frieswal, Upadhyay *et al*. (2015) [67] in Sahiwal.

On the other hand non-significant effect of period of first calving on productive herd life was observed by Singh *et al*. (1997) [54] in Rathi, Kumar (1997) [28] in cross bred cattle, Abbas and Sachdeva (2008) [1] in Sahiwal.

The significant effect of period is the reflection of improvement in herd due to selection and also may be due to improvement in management practices over the period.

b. Effect of season of first calving on productive herd life

In the present investigation, a non-significant effect of season of first calving on productive herd life of Kankrej cattle was observed. The main reason for this is that indigenous breeds were found more adapted to Indian climatic conditions in comparison to crossbred and exotic cattle breeds. Due to this reason, Kankrej breed was found more adapted to semi-arid climatic condition of north Gujarat. Similar results were reported by Hegade and Bhatnagar (1985) [22] in Brown Swiss x Zebu, Butte and Deshpande (1987) [11] Holstein Friesian x Sahiwal, Kumar and Reddy (1989) [32] in Karan Swiss, Kumar (1997) [28] in crossbred, Dubey and Singh (2005) [15] in Sahiwal and crossbred, Goshu (2005) [20] in Friesian Boran crossbred, Ram and Goswami (2005) [43] in Tharparkar, Singh *et al.* (2011) [61] in Sahiwal, Goshu *et al.* (2014) [21] in Holstein Friesian.

However, significant effect of season of first calving on productive herd life was observed by Ponce de Leon and

Guzman (1988) [42] Holstein Friesian, Mahdy (1994b) [34] in Holstein Friesian, Gahlot *et al.* (2001) [19] in Tharparkar, Updahyay *et al.* (2015) [67] in Sahiwal.

c. Effect of age at first calving on productive herd life

The age at first calving was found non-significant effect on productive herd life in the present study of Kankrej cattle. Similar results were reported by Alim (1957) [2] in Buffalo, Mahdy (1994a) in Egyptian buffalo [33], Bhattacharjya *et al.* (2000) [10] in Tharparkar, Ram and Goswami (2005) [43] in Tharparkar, Abbas and Sachdeva (2008) [1] in Sahiwal, Kumar *et al.* (2009) [31] in Hariana, Updahyay *et al.* (2015) [67] in Sahiwal.

Significant effect of age at first calving on productive herd life was also reported by Singh and Sinha (1960) [56] in Tharparakar, Aroeira *et al.* (1977) [3] in Gir and Nellore, Hibner and Krzywda (1981) [23] in Polish Black and White Lowland cattle, Muresan *et al.* (1986) [38] in Holstein Friesian, Dentine *et al.* (1987) [14] in Holstein Friesian, Durocq *et al.* (1988) [16] in dairy cow, Ponce de Leon and Guzman (1988) [42] Holstein Friesian, Sahota and Gill (1990) [52] in Sahiwal, Rogers *et al.* (1991) [49] in Jersey, Gahlot *et al.* (2001) [19] in Tharparkar, Atrey *et al.* (2005) [5] in Frieswal, Kumar (2007) [29] in Hariana, Jakhar *et al.* (2010) [24] in Hariana, Kumar *et al.* (2014) [30] in Frieswal, Goshu *et al.* (2014) [21] in Holstein Friesian.

d. Effect of first lactation milk yield on productive herd life

The statistical analysis of the data indicated that the first lactation milk yield had significant effect on productive herd life of Kankrej cattle. The main reason for this is that animals with low milk production had been culled as a policy matter.

The result of present study is in close agreement with the finding of Hibner and Krzywda (1981) [23] in Poland Black and White Lowland cattle, Durocq *et al.* (1988) [16] in dairy cows, Sahota and Gill (1990) [52] in Sahiwal, Rogers *et al.* (1991) [49] in Jersey, Rizzi *et al.* (1993) [48] in Italian Friesian, Mahdy (1994b) [34] in Holstein Friesian, Ruize *et al.* (1994) [51] in Holstein Friesian, Atrey *et al.* (2005) [5] in Frieswal, Ram and Goswami (2005) [43] in Tharparkar, Kumar (2007) [29] in Hariana, Abbas and Sachdeva (2008) [1] in Sahiwal, Kumar *et al.* (2009) [31] in Hariana, Goshu *et al.* (2014) [21] in Holstein Friesian, Upadhyay *et al.* (2015) [67] in Sahiwal.

On the other hand, non-significant effect of first lactation milk yield on productive herd life was reported by Mahdy (1994a) in Egyptian buffaloes.

Conclusion

It may be concluded from the present investigation that period of first calving and first lactation milk yield play a very important role for the productive herd life.

Developing breeding and management strategies to reduce the incidence of disposal can also benefit from knowledge of various genetic and non-genetic factors.

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