



Analysis of lactation specific demographic parameters of Tharparkar cattle

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Received: 26 December 2014; Accepted: 8 March 2015

ABSTRACT

The most important factor in milking herd is to maintain lactating cows in subsequent lactations, which depends upon stayability of lactating animals. Therefore a study on records of 168 Tharparkar females maintained during 1980–2010 at Livestock Research Centre, National Dairy Research Institute, Karnal (Haryana) were conducted to estimate the lactation specific demographic parameters. The results depicted that the survival and loss rates in first lactation were 70% and 30%, respectively. In fifth lactation survival rate was highest (76%) and disposal rates were the lowest (24%). There was no definite trend of survival and disposal rate across different lactations. Stayability results showed that the probability of an animal to survive in the herd decreased with the increasing number of lactations. The stayability for the first lactation was one whereas, the values revealed a consistent decline in subsequent lactations. Age distribution of cows present in the herd (p_x) for first lactation was 0.314 and 0.217, 0.154, 0.107, 0.069, 0.053, 0.034, 0.025, 0.015, 0.009, 0.003, 0.001 in subsequent lactations. Around one third of the total herd comprised of the first calvers (31%) and one fifth belongs to the females of second lactations (21.7%). Overall the herd of lactating cows comprised of 79.2% of animals in lactations up to fourth parity. Age distribution of cows left the herd (q_x) in first and subsequent lactations was 0.300 and 0.201, 0.167, 0.099, 0.053, 0.054, 0.029, 0.029, 0.016, 0.019, 0.005 and 0.005, respectively. From the results it could be concluded that the cows in first lactation was expected to remain in the herd for 2.24 lactations more. Expected herd life decreased with the increase in lactation order.

Key words: Expected herd life, Lactation demography, Stayability, Survival rate, Tharparkar

Tharparkar is an important milch breed of zebu cattle. Besides good milk production, males of this breed are also used for draught purpose under the hostile environment of desert areas. This breed is well adapted to sustain and perform well under the extremely hot climatic conditions. In India, these animals are found along the Indo-Pak border covering western Rajasthan and up to Rann of Kutch in Gujarat. Demographic analysis of a herd could provide useful information and act as a guide for sustainable livestock development. Lactation specific demographic parameters mainly include survival rate, disposal rate, stayability and age distribution of cows present in the herd (Kumar *et al.* 2013 and Upadhyay *et al.* 2014). Age distribution and herd life expectancy are of primary interest in dairy cattle production. Expected herd life (E_x) is important to develop breeding program for genetic improvement, formulation of strategies for culling and replacement, developing models to optimize culling and replacement rate to achieve better production and reproduction of animals. Information is scanty on these

aspects of Tharparkar cattle as there are a very few herds wherein Tharparkar cattle are being maintained in India. In view of the importance of Tharparkar breed of cattle, the present investigation was planned to study herd dynamics of Tharparkar cattle in an organised herd in India.

MATERIALS AND METHODS

The records on 168 Tharparkar females maintained during 1980–2010 at Livestock Research Centre, National Dairy Research Institute, Karnal (Haryana) were used to estimate the lactation specific demographic parameters i.e. survival rate, disposal rate, stayability, age distribution of cows present in the herd (p_x), age distribution of cows left the herd (q_x), and expected herd life (E_x).

Survival rate (P_x): It is the probability of a cow, assuming survive to lactation x , of surviving to lactation $x-1$ (Schons *et al.* 1985).

$$P_x = L_x/L_{x-1} = 1 - Q_x$$

Thus it is the probability of an animal being present to lactation x in the herd to the next lactation of $x+1$.

Loss rate (Q_x): It is the probability of a cow, assuming survival of lactation x , of dying or culling before lactation $x+1$ (Schons *et al.*, 1985).

$$Q_x = d_x/n_x = 1 - P_x$$

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where, d_x is no. of animals died or culled during lactation x and n_x is the number of animals present in the herd at the beginning of lactation x .

Stayability (L_x): This was calculated as the probability of a cow at first lactation present in herd to lactation x and estimated as number present at lactation x divided by the number alive at first lactation. The stayability at first lactation was taken as unity and hence $L_0=1.0$ (Schons *et al.* 1985).

$$L_x = n_x / n_0 = P_x L_{x-1}$$

where, n_x is no. surviving at lactation x and n_0 is no. of cows at first lactation.

Lactation specific herd structure: Greer *et al.* (1980) suggested the procedure of lactation specific herd structure and they used to estimate the following two parameters indicating the herd structure or age distribution of cows being lost from the herd and being present in the herd belonging to different lactations.

a) **Age specific distribution of cow (p_x):** It is probability of a cow remaining in the herd, comprised cows of all lactation, that are of each lactation and estimated as,

$$p_x = L_x / \sum L_x$$

b) **Disposed from herd (q_x):** It is the probability of cows being lost from the herd that are of each lactation and estimated as,

$$q_x = Q_x / L_x$$

Expected herd life (E_x): This is the number of additional lactation that an animal of lactation x is expected to remain in the herd. E_x more years and it was estimated as the sum of the probability of an animal of a given lactation remaining in the herd (P_x) through each succeeding lactation up to the last lactation. (Ahmed *et al.* 1992)

$$E_x = P_x + P_x P_{x+1} + P_x P_{x+1} P_{x+2} + \dots + P_x P_{x+1} P_{x+n}$$

RESULTS AND DISCUSSION

The results of demographic parameters are presented in Table 1.

Survival rate (P_x): The survival rate was highest in fifth lactation (76%). There was no definite trend of survival rate as well as disposal rate across different lactations. Survival rate in first lactation was 70%. Higher survival rates than present estimate were reported by Singh (2001) in Karan-Fries (72.07%), Abbas (2005) in Sahiwal cows (82%), Kumar *et al.* (2013) in Frieswal cows (76.1%) and Upadhyay *et al.* (2014) in Sahiwal cows (82%). Differences in survival rates could be attributed to differences in breed, culling policies, herd size and management practices in different herds.

Stayability (L_x): The results showed that the probability of an animal to survive in the herd decreased with the increasing lactation order. Stayability at the beginning of the first lactation was considered unity as a base. Kumar *et al.* (2012) estimated stayability in 4th, 8th and 11th lactations as 34.2, 1.9 and 0.2 % respectively in Frieswal cows and Upadhyay *et al.* (2014) obtained 42.1, 7.6 and 1.5 % respectively in the same lactations.

Age distribution of cows present in the herd (p_x): The age distribution of cows present in the herd (p_x) in first and subsequent lactations were 31.4, 21.7, 15.4, 10.7, 6.9, 5.3, 3.4, 2.5, 1.5, 0.9, 0.3 and 0.1%. Around 79.2% of total females pertained to first four lactations, comprising one-third of the total (31.4%) in the first lactation and 21.7 % of the females in second lactation in the herd. The herd was mostly constituted by the younger females. Reports of Greer *et al.* (1980), Nieuwhof *et al.* (1989), Mukherjee (1993), Singh (2001), Abbas (2005) and Singh *et al.* (2006) in Friesian cows revealed that about 80% of the total cows in the herd belonged to the first four lactations, whereas only 1.5% of cows in the herd were beyond ninth lactation. Kumar *et al.* (2013) in Frieswal cow reported 77.8% of total female present in the herd belonged to first three

Table 1. Lactation specific demographic parameters in Tharparkar cattle

Lactation No.	Total No. of cows	Loss rate (Q_x)	Survival rate (P_x)	Stayability (L_x)	Herd structure		Expected herd life (E_x) (Lact.)
					Present in herd (p_x)	Disposed from herd (q_x)	
1	168	0.30	0.70	1.00	0.314	0.300	2.24
2	116	0.29	0.71	0.69	0.217	0.201	2.19
3	82	0.34	0.66	0.49	0.154	0.167	2.09
4	54	0.31	0.69	0.32	0.107	0.099	2.17
5	37	0.24	0.76	0.22	0.069	0.053	2.15
6	28	0.32	0.68	0.17	0.053	0.054	1.83
7	19	0.26	0.74	0.11	0.034	0.029	1.69
8	14	0.36	0.64	0.08	0.025	0.029	1.28
9	9	0.33	0.67	0.05	0.015	0.016	1.01
10	6	0.66	0.34	0.03	0.009	0.019	0.51
11	2	0.5	0.5	0.01	0.003	0.005	0.50
12	1	1	0	0.005	0.001	0.005	0

lactations and Upadhyay (2014) in Sahiwal cows obtained 76% of females belong to first four lactations.

Age distribution of cows left the herd (q_x): It was found that the proportion of females being lost from the herd due to death and culling was 30% in first lactation and 20% in the second lactation and the probability of females lost from the herd was found to be 16.7% in third lactation and decreased up to fifth lactation. The pattern was irregular after fifth lactation. The probability of being lost was minimum in 11th and 12th lactation 5% in both the lactations. Tomar and Rawal (1994, 1996) observed that the proportion of cows being lost was 22% during or after first lactation, 21% in second and 15% in third lactation. Lathwal *et al.* (1995) and Arun (1999) reported that the proportions of cows being lost from the herd in first, second and third lactations were 29, 20 and 22 and 18, 12 and 0.9 % for Red Sindhi and Hariana breeds of cattle respectively. Singh (2001) reported higher estimates i.e. 27.9, 23.1 and 19.6 % of Karan-Fries cows being lost from herd during first, second and third lactations, respectively. Singh *et al.* (2006) reported that 23, 16 and 16 % Friesian cows left herd during first, second and third lactation respectively. Kumar *et al.* (2013) found that 23.9, 21.7 and 20.3 % Frieswal cows left the herd during first, second and third lactations, respectively and Upadhyay *et al.* (2014) obtained that 18, 22.2 and 17.8 % Sahiwal cows left the herd during same lactation.

Expected herd life (E_x): Expected herd life of subsequent lactations was 2.24, 2.19, 2.09, 2.17, 2.15, 1.83, 1.69, 1.28, 1.01, 0.51, 0.50, and 0 respectively. It decreased with the increasing lactations up to lactation third. It again increased in fourth lactation (2.17) and from this expected herd life was again continuously decreased with the advancing lactation. Higher values of expected herd life than the present estimate were reported by, Lathwal *et al.* (1995) for Red Sindhi (2.72 lactation), Tomar and Rawal (1996) for Tharparkar (2.38 lactations), Arun (1999) for Hariana cows (3.52 lactations); Shahi and Kumar (2012) and Upadhyay *et al.* (2014) obtained 3.14 lactation and 2.59 lactation respectively for Sahiwal cows. Kumar *et al.* (2013) obtained the lower value (2.05 lactation) for Frieswal cattle.

The overview of the results obtained that expected herd life (E_x) up to fifth parity was above 2 lactations and 79.2% of total females belong to first four lactation so, proper care

and management taken during four to five lactations to improve stayability. The probability of cows lost from the herd was 0.30 in first lactation therefore, 30% replacement are required to maintain proper herd size.

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