



## Lactation wise performance of Sahiwal cattle at an organized herd of northern India

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### ABSTRACT

Performances of different production, reproduction traits and longevity up to sixth parity in Sahiwal cattle maintained at ICAR-National Dairy Research Institute over a period of 29 years (1988–2016) were assessed. Parity wise means along with standard errors of different traits were estimated up to sixth parity in Sahiwal cattle using Descriptive Statistics in SPSS software. 305 days milk yield, total milk yield, lactation length, wet average, peak yield, days to attain peak yield and dry period varied from 1,822.59 to 2,166.36 kg, 1,822.59 to 2259.86 kg, 268.95 to 303.02 days, 6.62 to 7.93 kg/day, 10.64 to 14.09 kg, 38.67 to 51.68 days and 118.11 to 142.05 days, respectively in different parities up to sixth parity in Sahiwal cattle. Average age at first service was 26.46 months in Sahiwal cattle. Age at calving, number of services per conception, conception rate, gestation period, calving to first insemination interval, service period, calving interval and pregnancy rate ranged from 37.70 to 105.59 months (1,131–3,168 days), 1.84–2.02, 66.19–70.07%, 286.76–287.97 days, 72.65–87.61 days, 113.48–150.48 days, 401.47–443.47 days and 38–44%, respectively in different parities. The average longevity ranged from 7.43 to 11.35 years (2,711.95–4,142.75 days) in Sahiwal cattle up to sixth parity. In the present study, milk yield increased up to third parity and declined in further parities. Highest test day milk yield was recorded in second test day in each lactation up to sixth parity while lowest was observed in last test day.

**Keywords:** Longevity, Performance, Production, Reproduction, Sahiwal cattle

India has about 2.4% of earth's land area and serves as home to 10.71% of world's livestock population. The country has 192.49 million (37.28%) cattle as per 20<sup>th</sup> All India Livestock Census (2019). Out of total cattle population, about 142.11 million are indigenous non-descript cattle. There are 50 registered breeds of cattle in India (NBAGR 2020). Sahiwal is one of the most imperative milch breeds of cattle originated in the Punjab region which lies beside the Indian-Pakistan boundary. In India, Sahiwal cattle are mostly found in Ferozepur and Amritsar districts of Punjab and Sri Ganganagar district of Rajasthan under field conditions. Furthermore, some organised farms in India are also maintaining Sahiwal animals. Sahiwal cattle are famous for higher milk production, substantial power of endurance for hot climate of sub-tropics, comparatively resistant to diseases and low maintenance cost. The population of Sahiwal cattle is about 4.88 million which is nearly 3.23% of total cattle and 12.87% of registered cattle breeds' population in India (Anonymous 2013).

The economics of any dairy enterprise is influenced by production, reproduction and health status of livestock. Lifetime performance and longevity of breeding stock is

highly desirable characteristic that immensely influences the overall profitability of dairy animals. The animals should not only be high producing but reproductively fit animals with long productive life are desired in order to make dairying a successful and profitable business. Further, the main criteria for evaluation of dairy animals at organized farms in India is based on 305 days milk yield which is less reliable and gives under and overestimation of certain factors (Bilal and Khan 2009). So, test day data can be utilized instead of using 305 days' milk yield for selection of superior animals. Data on milk constituents is also very important as milk pricing system is based on the percentage of fat in milk, therefore, higher milk fat yield fetches better economic returns to the farmers. Milk fat plays a substantial role in the nutritive value, flavor and physical properties of milk and milk products. Milk fat serves as a rich source of energy and moreover contains significant amounts of essential fatty acids (Linolenic and arachidonic acid). Milk fat has an important role in smooth texture and taste of milk products.

Parity wise trend and phenotypic performance of different production and reproduction traits in animals is important. It may help in deciding that up to which parity animals are beneficial to be kept at the farm. The present study was conducted to analyze parity wise data pertaining to production, reproduction traits and longevity in Sahiwal cattle.

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## MATERIALS AND METHODS

**Data:** Data up to sixth parity vis-à-vis production, reproduction traits and longevity of Sahiwal cattle maintained at an organized herd of ICAR-National Dairy Research Institute, Karnal spread over a period of 29 years (1988–2016) were utilized in the present study. Livestock Farm of ICAR-NDRI is located at an altitude of 250 m above the mean sea level in Indo-Gangetic alluvial plains on 29° 42' N latitude and 72° 02' E longitude. Selective breeding under Progeny Testing Programme is followed for the genetic improvement of Sahiwal cattle at the farm.

Various production traits considered in this study were 305 days milk yield (305DMY), total lactation milk yield (TMY), lactation length (LL), wet average (WA), peak yield (PY), days to attain peak yield (DPY) and dry period (DP) in addition to test day traits. Test day milk yields (TDMY), test day fat yields (TDFY) and test day solid not fat yields (TDSNFY) were recorded at monthly intervals in each lactation. Test day fat yield and test day solid not fat yield were calculated by multiplying the fat % and solid not fat % with milk yield of particular test day which was further multiplied by 10 to get the results in gram. Reproduction traits considered in this study were age at first service (AFS), age at calving (AAC), number of services per conception (NSC), conception rate (CR), gestation period (GP), calving to first insemination (CFI), service period (SP), calving interval (CI), and pregnancy rate (PR). The longevity (LNG) of animal was calculated as the period from date of birth to date of disposal or death, expressed in years.

Firstly, data were subjected to editing and abnormal records (dystocia, still birth, premature birth etc.) were excluded from the present study. Animals having lactation length less than 100 days and less than 3 kg daily milk yield were also not considered. Data were then standardized using mean and standard deviation. A total of 386 first

lactation records were finally utilized in this study. Out of 386 Sahiwal animals in first lactation, only 16.84% (65 animals) completed six lactations. This is because only six parities were considered in this study as the number of animals in seventh parity was very less.

**Statistical analysis:** Parity wise means along with standard errors of different production, reproduction and longevity traits were estimated up to sixth parity in Sahiwal cattle using Descriptive Statistics in SPSS software.

## RESULTS AND DISCUSSION

**Performance of production traits in Sahiwal cattle:** The 305 days milk yield varied from 1,822.59 to 2,166.36 kg in different parities up to sixth parity in Sahiwal cattle, although total milk yield ranged from 1,822.59 to 2,259.86 kg (Table 1). Milk yield increased up to third parity and declined in further parities. The first lactation 305DMY observed in the present study was comparable with the 305DMY reported by Debbarma *et al.* (2010) and Gupta (2013) however, higher first lactation 305DMY was reported by Singh *et al.* (2005) in Sahiwal cattle. Kumar (2007) reported lower first lactation 305DMY as compared to the present findings. Second lactation milk yield was in correspondence with the report of Khanna and Bhat (1971) in Sahiwal cattle. Rehman and Khan (2012) and Gupta (2013) reported lower second lactation 305DMY as 1,495.9 and 1,895.65 kg, respectively. Higher second lactation milk yield was observed by Chopra *et al.* (1973) as 2,398 kg in Sahiwal cattle maintained at NDRI, Karnal. In present study, highest 305 days milk yield was 2,166.36 kg in the third parity. Similar milk yield in third lactation was observed by Gupta (2013) in Sahiwal cattle. The differences in the estimates of milk yield as compared to other workers could have been due to sampling variations, as many were based on small and different number of observations or herd-to-

Table 1. Parity wise means and standard errors of different production traits in Sahiwal cattle (Normalized data)

Trait	Parity					
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
305DMY (kg)	1822.59±39.30 (386)	2101.81±51.49 (285)	2166.36±60.39 (200)	2147.8±71.80 (137)	2083.55±84.73 (94)	2029.55±102.47 (65)
TMY (kg)	2006.72±51.00 (384)	2219.49±60.76 (284)	2259.86±68.72 (200)	2212.65±77.63 (137)	2161.85±96.24 (94)	2100.77±114.53 (65)
LL (days)	303.02±5.07 (386)	281.77±5.09 (281)	282.42±5.11 (197)	279.64±5.67 (137)	278.57±7.22 (94)	268.95±9.03 (64)
WA (kg/day)	6.62±0.11 (386)	7.87±0.14 (285)	7.93±0.17 (200)	7.90±0.20 (137)	7.67±0.23 (93)	7.70±0.27 (65)
PY (kg)	10.64±0.14 (386)	13.60±0.19 (285)	14.09±0.24 (200)	13.98±0.27 (137)	13.99±0.35 (94)	13.59±0.39 (65)
DPY (days)	51.68±1.13 (382)	41.44±1.10 (284)	38.67±1.35 (196)	40.79±1.56 (135)	40.65±1.83 (91)	39.25±2.49 (64)
DP (days)	133.12±5.50 (313)	142.05±6.87 (213)	133.88±7.73 (153)	118.11±8.41 (105)	125.99±10.89 (69)	135.39±14.40 (44)

Figures in parentheses represent number of observations.

herd differences or differences that have occurred in time depending on the period to which data were considered. First lactation total milk yield observed in this study was comparable to the total milk yields reported by Sentitula *et al.* (2008) and Singh and Singh (2016) in Sahiwal cattle, though, Dhawan *et al.* (2015) and Verma *et al.* (2016) reported lower values of first lactation total milk yield.

Lactation length was highest in first and lowest in sixth parity and varied from 268.95 to 303.02 days (Table 1). Similar first lactation length was reported by Singh *et al.* (2005) at Pantnagar in Sahiwal cattle. Dhawan *et al.* (2015) reported lower value of first lactation length while Kathiravan *et al.* (2009) observed higher lactation length in Sahiwal cattle. The wet average ranged from 6.62 to 7.93 kg/day with highest and lowest wet average in third and first parity, respectively. Dhawan *et al.* (2015) and Kumar *et al.* (2017) reported comparatively less milk yield per day of lactation length as  $5.34 \pm 0.08$  and  $5.49 \pm 0.47$  kg/day in Sahiwal cattle. In the present study, peak yield in Sahiwal cattle varied from 10.64 to 14.09 kg in different parities (Table 1). Highest peak yield was observed in third parity and lowest in first parity. Peak yield observed by several workers (Sharma *et al.* 2010, Dhawan *et al.* 2015) was comparatively less in Sahiwal cattle. Days to attain peak yield ranged from 38.67 to 51.68 days in different parities in the present study. Higher value (55 days) of days to attain peak yield as compared to the present study was observed

by Chakravarthi *et al.* (2017) in Sahiwal cows. Dry period was in the range of 118.11 to 142.05 days up to sixth lactation (Table 1). Lowest dry period was observed in fourth parity whereas highest was in second parity. Gaur and Raheja (1996) reported dry period within the observed range while other workers (Shah and Kumar 2010, Rehman and Khan 2012) reported higher dry period in Sahiwal cattle as compared to the present study.

Parity wise means along with standard errors of different test day milk yields in different parities is presented in Table 2. The average test day milk yields up to sixth parity in Sahiwal cattle is shown in Fig. 1. Test day milk yield

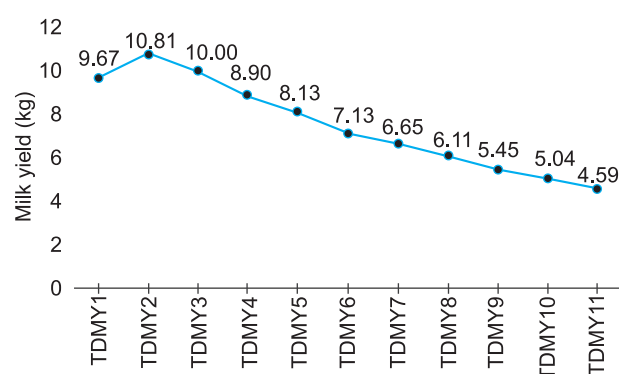


Fig. 1. Average test day milk yield up to sixth parity in Sahiwal cattle.

Table 2. Parity wise means and standard errors of test day milk yields (TDMY) in Sahiwal cattle (Normalized data)

TDMY (kg)	Parity					
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
TDMY1	6.73±0.19 (224)	10.24±0.25 (165)	10.41±0.32 (110)	10.12±0.38 (79)	10.38±0.47 (53)	10.18±0.52 (42)
TDMY2	8.29±0.17 (349)	11.05±0.21 (267)	11.47±0.28 (191)	11.48±0.31 (133)	11.15±0.40 (91)	11.44±0.47 (62)
TDMY3	8.04±0.16 (368)	10.19±0.20 (276)	10.40±0.26 (191)	10.43±0.31 (129)	10.37±0.39 (90)	10.55±0.43 (61)
TDMY4	7.64±0.15 (357)	9.09±0.21 (274)	9.41±0.24 (187)	9.56±0.32 (128)	8.98±0.37 (91)	8.72±0.42 (62)
TDMY5	7.19±0.15 (346)	8.34±0.20 (260)	8.37±0.22 (188)	8.68±0.28 (123)	8.30±0.34 (89)	7.90±0.42 (60)
TDMY6	6.75±0.13 (335)	7.47±0.19 (251)	7.13±0.23 (183)	7.65±0.29 (122)	6.90±0.36 (84)	6.88±0.40 (56)
TDMY7	6.48±0.14 (308)	6.90±0.19 (234)	6.94±0.22 (166)	6.73±0.28 (116)	6.38±0.33 (77)	6.47±0.37 (51)
TDMY8	6.21±0.15 (289)	6.28±0.19 (209)	6.27±0.22 (148)	5.97±0.26 (107)	6.21±0.34 (68)	5.70±0.39 (46)
TDMY9	6.07±0.15 (246)	5.50±0.21 (175)	5.68±0.21 (135)	5.28±0.25 (83)	5.59±0.35 (59)	4.60±0.36 (34)
TDMY10	5.73±0.15 (198)	5.31±0.23 (127)	5.06±0.22 (102)	5.13±0.32 (58)	4.86±0.41 (48)	4.17±0.40 (24)
TDMY11	5.27±0.17 (142)	4.77±0.29 (83)	4.16±0.23 (60)	4.72±0.39 (41)	4.67±0.40 (23)	3.93±0.60 (14)

Figures in parentheses represent number of observations.

Table 3. Parity wise means and standard errors of test day fat yields (TDFY) in Sahiwal cattle (Normalized data)

TDFY (g)	Parity					
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
TDFY1	327.58±9.45 (224)	494.85±13.98 (165)	507.49±18.68 (110)	489.43±20.52 (79)	496.15±23.39 (53)	492.43±28.19 (42)
TDFY2	392.18±8.23 (349)	523.58±10.68 (267)	536.67±14.05 (191)	539.52±15.93 (133)	518.01±20.20 (91)	555.97±26.62 (62)
TDFY3	379.65±7.73 (368)	478.23±10.01 (276)	494.16±13.35 (191)	488.90±15.94 (129)	472.98±18.09 (90)	489.00±22.80 (61)
TDFY4	343.80±7.23 (357)	432.91±10.44 (274)	447.92±12.57 (187)	438.78±14.46 (128)	416.53±17.67 (91)	399.37±20.03 (62)
TDFY5	334.65±7.15 (346)	397.47±10.01 (260)	399.59±11.21 (188)	407.79±13.70 (123)	379.09±16.00 (89)	370.88±19.93 (60)
TDFY6	319.36±6.68 (335)	357.76±9.41 (251)	341.51±11.62 (183)	367.36±15.33 (122)	323.41±17.13 (84)	321.01±19.93 (56)
TDFY7	308.18±6.93 (308)	327.67±9.02 (234)	331.01±10.70 (166)	317.73±14.00 (116)	303.25±15.48 (77)	308.01±19.59 (51)
TDFY8	300.24±7.66 (289)	301.54±9.36 (209)	299.12±11.00 (148)	285.29±13.31 (107)	288.81±15.41 (68)	266.95±18.64 (46)
TDFY9	295.90±7.98 (246)	268.50±10.60 (175)	279.89±11.42 (135)	250.67±12.58 (83)	265.46±17.91 (59)	212.15±17.51 (34)
TDFY10	275.82±8.00 (198)	257.26±11.87 (127)	243.92±10.75 (102)	248.69±16.98 (58)	233.38±20.86 (48)	200.12±22.10 (24)
TDFY11	255.62±9.08 (142)	228.41±14.32 (83)	201.30±11.81 (60)	233.95±23.01 (41)	230.62±21.35 (23)	186.95±30.48 (14)

Figures in parentheses represent number of observations.

increased with the advancement of lactations (Table 2). It was highest during third or fourth lactation and further declined in fifth and sixth lactations. Highest test day milk yield was recorded in TD2 in each lactation up to sixth parity while lowest was observed in TD11. Highest test day milk yield observed was 8.29, 11.05, 11.47, 11.48, 11.15 and 11.44 kg, respectively up to sixth parity in Sahiwal cattle. The reason for more test day milk yield in 6<sup>th</sup> parity may be either due to less influence of environment during sixth lactation or less number of observations available in 6<sup>th</sup> parity. Test day milk yield declined gradually after TD2 in each lactation. Gupta (2013) and Prakash (2015) analyzed Sahiwal data up to third lactation and they reported similar test day milk yields. However, Ilatsia *et al.* (2007) and Debbarma *et al.* (2010) reported lower test day milk yields than present yields in Sahiwal cattle.

Parity wise means and standard errors of different test day fat yields in different parities is presented in Table 3. Similar trend like test day milk yield was observed in test day fat yields also. Second test day in each lactation had the highest fat yield in Sahiwal cattle. Highest fat yields observed were 392.18, 523.58, 536.67, 539.52, 518.01 and 555.97 g, respectively from first to sixth lactation. Very scanty literature was available on test day fat yield in cattle. Costa *et al.* (2009) reported average test day fat yield as 0.79±0.24 kg, 0.90±0.30 kg and 0.96±0.32 kg for first, second and third lactation, respectively in Brazilian Holstein cattle.

Test day solid not fat yields also followed the similar trend like test day milk yield and test day fat yield. Parity wise means along with standard errors of test day fat yields are presented in Table 4. Highest SNF yield was observed in TD2 in different parities. Highest SNF yield as observed in different parities were 734.57, 978.76, 1014.19, 1015.32, 989.47 and 1016.83 g, respectively from first to sixth lactation in Sahiwal cattle. Literature was scanned for test day solid not fat yield in cattle but no report was available.

*Performance of reproduction traits and longevity in Sahiwal cattle:* Parity wise means and standard errors of various reproduction traits and longevity are presented in Table 5. Age at first service is the period from birth of animal to the first service. Average age at first service was 26.46 months in Sahiwal cattle in this study. Higher age at first service varying from 29.16 to 34.13 months for the same breed was reported in NDRI annual reports (2011–12 to 2016–17). In the present study, age at calving up to sixth parity varied from 37.70 to 105.59 months (1,131 to 3,168 days). The observed age at first calving was in close agreement with the findings of Sentitula (2007) and Raja (2010). On the other hand, Rehman *et al.* (2008) and Shah and Kumar (2010) reported higher age at first calving in Sahiwal cattle maintained at different herds. The number of services per conception ranged from 1.84 to 2.02 in different parities in Sahiwal cattle. The value of NSC (1.90±0.12) as reported by Majid *et al.* (1995) in Sahiwal

Table 4. Parity wise means and standard errors of test day solid not fat yields (TDSNFY) in Sahiwal cattle (Normalized data)

TDSNFY (g)	Parity					
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
TDSNFY1	598.33±16.37 (224)	910.26±22.98 (165)	926.99±29.20 (110)	898.81±34.68 (79)	918.11±41.69 (53)	903.53±46.49 (42)
TDSNFY2	734.57±14.68 (349)	978.76±18.48 (267)	1014.19±24.98 (191)	1015.32±27.64 (133)	989.47±35.99 (91)	1016.83±42.46 (62)
TDSNFY3	712.80±13.86 (368)	903.67±18.11 (276)	920.44±23.27 (191)	919.64±28.17 (129)	913.31±34.45 (90)	932.73±38.68 (61)
TDSNFY4	677.39±13.24 (357)	806.04±18.18 (274)	833.54±21.27 (187)	845.41±28.08 (128)	792.36±32.58 (91)	769.25±37.12 (62)
TDSNFY5	660.55±27.99 (346)	740.67±17.76 (260)	741.74±19.66 (188)	767.42±24.59 (123)	732.58±29.77 (89)	702.40±37.42 (60)
TDSNFY6	598.59±11.81 (335)	663.62±16.83 (251)	630.90±20.27 (183)	678.76±25.64 (122)	610.36±31.74 (84)	608.82±35.69 (56)
TDSNFY7	574.92±12.54 (308)	611.07±16.45 (234)	615.71±19.25 (166)	594.07±24.52 (116)	566.48±29.04 (77)	572.63±33.36 (51)
TDSNFY8	551.27±13.05 (289)	557.60±16.91 (209)	556.82±19.90 (148)	528.36±22.82 (107)	551.09±30.28 (68)	502.00±34.04 (46)
TDSNFY9	539.76±13.70 (246)	490.05±18.47 (175)	505.00±18.49 (135)	469.08±22.04 (83)	496.47±31.02 (59)	408.17±32.22 (34)
TDSNFY10	508.52±13.69 (198)	472.45±20.95 (127)	448.46±19.52 (102)	455.01±28.57 (58)	434.79±37.38 (48)	368.52±35.70 (24)
TDSNFY11	467.38±15.29 (142)	424.48±25.84 (83)	368.70±21.08 (60)	418.19±35.54 (41)	417.88±36.32 (23)	351.95±54.43 (14)

Figures in parentheses represent number of observations.

Table 5. Parity wise means and standard errors of different reproduction and longevity traits in Sahiwal cattle (Normalized data)

Trait	Parity					
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
AFS (months)	26.46±0.19 (358)	—	—	—	—	—
AAC (months)	37.70±0.26 (382)	52.27±0.39 (281)	66.73±0.60 (198)	79.87±0.83 (135)	92.07±0.96 (94)	105.59±1.03 (65)
NSC	1.86±0.07 (268)	1.91±0.09 (193)	2.02±0.11 (129)	1.84±0.11 (91)	1.92±0.13 (64)	1.97±0.20 (35)
CR (%)	69.95±1.88 (268)	70.07±2.24 (193)	66.19±2.77 (129)	69.19±3.11 (91)	67.24±3.87 (64)	67.42±5.32 (35)
GP (days)	287.22±0.35 (281)	286.76±0.43 (198)	287.15±0.54 (136)	287.20±0.61 (92)	287.94±0.65 (65)	286.97±0.87 (35)
CFI (days)	85.56±2.65 (279)	87.61±3.26 (203)	81.08±3.30 (145)	79.85±4.17 (104)	81.83±5.36 (69)	72.65±4.53 (41)
SP (days)	150.48±6.40 (294)	138.23±6.44 (209)	144.83±8.51 (152)	115.61±6.75 (103)	113.48±6.24 (69)	123.31±12.99 (42)
CI (days)	443.47±6.93 (293)	424.73±6.55 (206)	428.18±8.19 (149)	403.81±7.12 (103)	401.47±6.37 (68)	408.84±12.76 (43)
PR	0.38±0.02 (284)	0.39±0.02 (202)	0.39±0.03 (149)	0.42±0.03 (101)	0.38±0.03 (69)	0.44±0.06 (41)
LNG (years)	7.43±0.15 (312)	8.08±0.16 (248)	8.99±0.17 (181)	9.80±0.19 (125)	10.50±0.24 (87)	11.35±0.30 (59)

Figures in parentheses represent number of observations.



cattle was in conformity with the value observed in the present study. Conception rate varied from 66.19 to 70.07% in different parities in present study. Comparatively lower values of conception rates were reported in the Sahiwal cattle as per NDRI annual reports (2011–12 to 2016–17). Higher conception rate obtained in the present study may be due to reason that editing of data was done and only normal animals were considered for the study. Animals which did not conceive on insemination were not taken into consideration.

Gestation period refers to the duration of pregnancy. The gestation period in Sahiwal cattle varied from 286.76 to 287.97 days in different parities in the present study. Scanty literature was available for gestation period in Sahiwal cattle. Gestation period in Sahiwal cattle was reported as 285 days (Anonymous 2018). However, Norman *et al.* (2009) observed similar gestation period in different breeds of cattle. Kumar *et al.* (2016) reported average gestation length as  $280 \pm 0.25$  days in Jersey crossbred cattle which was lower as compared to the present gestation period. The period from calving to first insemination was in the range of 72.65 to 87.61 days in different parities of Sahiwal cattle in present study. Several workers (Divya 2012, Dash 2014) reported similar findings of CFI in HF and HF crossbred cattle, though, Sattar *et al.* (2006) and Tadesse *et al.* (2010) in HF cattle and Meera (2017) in Karan Fries cattle observed higher CFI. Service period is the time from date of calving to date of successful conception. In the present study, service period up to sixth lactation varied from 113.48 (5<sup>th</sup> parity) to 150.48 days (1<sup>st</sup> parity) in Sahiwal cattle. Service period as reported by Sentitula (2007) and Rehman and Khan (2012) were comparable to present findings but Kathiravan *et al.* (2009) observed higher service period in Sahiwal cattle. Calving interval is the period between two successive calving. Calving interval of Sahiwal cattle ranged from 401.47 to 443.47 days in the present study. Highest and lowest calving interval was observed in first and fifth parity, respectively. The calving intervals observed were in conformity with those observed by Ilatsia *et al.* (2007) and Raja and Narula (2008), but higher calving intervals was reported by Shah and Kumar (2010). Pregnancy rate may be defined as the percentage of non-pregnant cows that become pregnant during each 21-day period. It is a direct measure on how quickly the cows become pregnant again after calving. The pregnancy rates of Sahiwal cattle were observed as 38%, 39%, 39%, 42%, 38% and 44%, respectively from first to sixth parity. Literature was not available for pregnancy rate in Sahiwal cattle however, the findings were similar to the pregnancy rate reported by Divya (2012) and Dash (2014) in HF crossbred cattle. The average longevity ranged from 7.43 to 11.35 years (2711.95 to 4142.75 days) in Sahiwal cattle in different parities (Table 5). The present study revealed that first lactation animals stayed in the herd up to 7.43 years while animals completing six parities were in the herd for 11.35 years. Kumar (2007) had earlier reported lesser herd life

considering different lactations as compared to the present study in Sahiwal cattle.

In conclusion, present study showed that milk yield increased up to third parity and declined in further parities in Sahiwal cattle. Second test day in each lactation up to sixth parity had the highest milk yield while lowest was observed in last test day (i.e. TD11). Similar trend like test day milk yield was observed in test day fat and test day solid not fat yields. First lactation Sahiwal animals stayed in the herd up to 7.43 years while animals completing six parities were in the herd for 11.35 years.

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