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Factors influencing productive and reproductive performance of Sahiwal cattle maintained at organized farm conditions

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ABSTRACT

The effect of certain non-genetic factors, viz. season, period, age group and days open on the first lactation production and reproduction traits of Sahiwal cattle reared at organized farm under tropical condition was assessed. The records on first lactation production and reproduction performance of 961 Sahiwal cattle spread over a period of 47 years (1961–2007) were used for the study. The first lactation traits considered were age at first calving (AFC), first lactation 305-day or less milk yield (FL305DMY), first lactation length (FLL), first service period (FSP) and first dry period (FDP).The non-genetic factors incorporated in the model for AFC, FL305DMY, FLL, FSP and FDP accounted for 19.25, 21.25, 35.45, 07.09 and 21.12 per cent of total variation, respectively. Among the non-genetic factors, the period had highly significant effect on all the traits; while the age group had no effect on FL305DMY, FLL, FSP and FDP and the season had highly significant effect only on FDP. The days open had highly significant effect on FL305DMY, FLL and FDP. The overall least squares means for AFC, FL305DMY, FLL, FSP and FDP were 1117.02 days, 1759.86 kg, 303.46 days, 149.63 days and 163.75 days, respectively in Sahiwal cattle. It was concluded that the first lactation traits were highly influenced by the period of birth/ calving. It also reflected that the milch stock was maintained under comparatively favorable farm conditions and the fluctuations in extreme climatic conditions did not affect these traits in Sahiwal cattle.

Key words: Non-genetic factors, Production performance, Reproduction traits, Sahiwal cattle

The major constraint of dairying in tropical countries is sustaining the high milk yield of animals under harsh tropical climatic conditions. Sahiwal, one of the best dairy breeds of zebu cattle is known for its innate potential for higher milk production. In India, the number of this breed is gradually declining and hence, its conservation and multiplication is of paramount importance to preserve this valuable germplasm. To formulate an effective and suitable breeding strategy for this purpose, precise and accurate information on the first lactation production and reproduction performance is highly essential as selection is primarily done on the basis of first lactation economic traits. Variations in climatic conditions over the years influence the production and reproduction performance of the animals leading to alteration in the estimates of genetic parameters. The herd of Sahiwal cattle maintained at National Dairy Research Institute, Karnal is exposed to extreme climatic conditions throughout the year, which certainly affects the performance of cows. Considering the above facts, present investigation was undertaken to study the effect of certain non-genetic factors viz., season, period, age groups and days open on first lactation production and reproduction traits in Sahiwal cattle raised under organized tropical farm condition.

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MATERIALS AND METHODS

The present investigation was undertaken on the Sahiwal cows maintained at the cattle yard of National Dairy Research Institute, Karnal (Haryana), India. *Ad lib.* feeding of good quality green fodder throughout the year has been the policy of the farm. Silage and hay have also been used during lean periods. Concentrate was provided to cows as per their milk production and loose housing system was followed.

Data generation and standardization: The records on first lactation production and reproduction performance of 961 Sahiwal cattle spread over a period of 47 years (1961–2007) were used for the study. The first lactation traits considered were age at first calving (AFC), first lactation 305-day or less milk yield (FL305DMY), first lactation length (FLL), first service period (FSP) and first dry period (FDP). The records of animals with known pedigree and normal lactation were considered. The records of animals with less than 300 kg of milk production or less than 100 days of lactation length were also discarded. To ensure the normal distribution, the outliers were removed and data within the range of mean±2SD were only considered. For

genetic studies, sires having five or more daughters were only considered.

To study the effect of non-genetic factors, the data were classified according to season, period, age group and days open.The period was classified according to the year of birth for AFC and according to the year of calving for all other traits. According to the year of calving the total duration of the present study was divided into 16 periods of three consecutive year duration except the last period which was of two years. Each year was divided into four seasons namely winter (December-March), summer (April-June), rainy (July-September) and autumn (October-November). To study the differences due to age at first calving, the data were classified into ten groups at sixty days interval and to study the effect of service period or days open the data were classified into twelve groups.

Statistical analysis: The influence of various non-genetic factors on different first lactation production, reproduction and part lactation traits was studied by least squares analysis of variance for unequal non-orthogonal data using the technique described by Harvey (1966). The statistical model used for least squares analysis of variance for FL305DMY, FLL and FDP was as follows:

$$Y_{ijklm} = \mu + S_i + P_j + A_k + D_l + e_{ijklm}$$

where, Y_{ijklm}, trait under study viz., first lactation 305-day or less milk yield, first lactation length, first dry period etc; μ, overall mean; S_i, effect of i^{th} season; P_j, effect of j^{th} period; A_k, effect of k^{th} age group; D_l, effect of l^{th} days open; e_{ijklm}, random error, assumed to be normally and independently distributed with mean zero and constant variance *i.e.* NID $(0, \sigma_e^2)$.

For FSP except days open all the above factors were considered and for AFC only two non-genetic factors, viz. season and period of birth were considered. Duncan's multiple range test as modified by Kramer (1957) was used for testing the differences among least squares means (using the inverse coefficient matrix).

RESULTS AND DISCUSSION

Characteristics of the production and reproduction traits considered in the study are given in table-1. The averages for (raw data) AFC, FL305DMY, FLL, FSP and FDP were 1107.92 days, 1761.37 kg, 308.04 days, 149.71 days and 160.18 days, respectively. The coefficients of variation for these traits ranged from 12.82 (AFC) to 68.97 (FDP) per cent.

The least squares analysis of variance to study the effect of various non-genetic factors on different first lactation traits in Sahiwal cattle is presented in table-2 and the least squares means are presented in table –3. The non-genetic factors incorporated in the model for AFC, FL305DMY, FLL, FSP and FDP accounted for 19.25, 21.25, 35.45, 07.09 and 21.12 per cent of total variation, respectively. Among the non-genetic factors, the period had highly significant (P<0.01) effect on all the traits considered; while the age group had no effect on the FL305DMY, FLL, FSP and FDP. The season had highly significant (P<0.01) effect on FDP while it had no significant effect on all the other traits. The days open had highly significant (P<0.01) effect on FL305DMY, FLL and FDP.

Age at first calving: The overall least squares means for AFC in the present study was 1117.02±05.21 days. Various studies showed that the estimates of age at first calving in Sahiwal cattle ranged from 879.00±9.00 days (Bhatnagar and Sharma, 1976) to 1579.00 days (Mirza*et al.* 1985) and the estimate obtained was well within the range of the estimates reported by many earlier workers in Sahiwal cattle. The least squares analysis of variance revealed that the period of calving had highly significant (P<0.01) effect on AFC. The cows born during 1956–58 had maximum average AFC of 1300.72±22.14 days, while the cows born during 1983–85 had the lowest least squares mean of 1013.46±20.20 days (Table-3). This may be due to reason

Table 1. Characteristics of the production and reproduction traits in Sahiwal cattle (unadjusted records)

Traits	No.	Mean	Standard deviation	Coefficient of variation (%)	Minimum	Maximum
AFC	961	1107.92	142.05	12.82	787.00	1474.00
FL305DMY	676	1761.37	687.50	39.03	300.00	3178.90
FLL	664	308.04	93.28	30.28	100.00	544.00
FSP	770	149.71	94.28	62.97	45.00	436.00
FDP	689	160.18	110.48	68.97	50.00	456.00

Table 2. Least squares analysis of variance for different first lactation traits in Sahiwal cattle

Traits	Season	Period	Age groups	Days open	Error	R^2 - value (%)
AFC	6527.19	231733.78**	—	—	16618.07 (941)	19.25
FL305DMY	272855.72	3009069.50**	671654.25	1366112.90**	389735.38(637)	21.25
FLL	4215.21	43204.29**	5457.98	111684.34**	5646.65(625)	35.45
FSP	8347.62	27973.29**	3952.53	—	8475.04(742)	07.09
FDP	43455.52**	85961.75**	7040.19	26820.78**	10219.69(650)	21.12

Figures in parentheses indicate the degrees of freedom; ** - significant at 1% level (P< 0.01).

that feeding practices of young stock varied from period to period and the young stock raised during period of adequate nutrition grew faster than others. In agreement to the present findings, Banik (2004),Raja (2004), Kumar (2007), Sentitula (2007) and Manoj (2009) reported highly significant effect of period of birth on AFC. Even though no definite trend could be noticed, there was a decline in the AFC over the periods and the differences may be attributed to the differential culling levels on the basis of production and reproductive fitness and the variation in the feeding and management.

The effect of season of birth on AFC was statistically nonsignificant (Table 2). However, the cows born in rainy season had longest AFC of 1123.21±9.35 days, while the cows born in autumn season had lowest AFC of 1109.48±11.77 days (Table 3). Similar to these findings Mohanty (2001), Banik (2004), Raja (2004) and Manoj (2009) reported non-significant influence of season on AFC.The non-significant effect of season of birth could be due to the endurance of Sahiwal cattle to the hot tropical climatic conditions with respect to AFC.

First lactation 305-day or less milk yield (*FL305DMY*)*:* The overall average FL305DMY in the present study was 1759.86±43.65 kg (Table 3). This estimated value was near to the average values reported by Raja (2004) in Sahiwal cattle.The cows that calved in autumn season had the maximum FL305DMY of 1800.22±105.81 kg followed by the winter calvers (1797.54±46.71). On the contrary, animals calved during rainy season had the lowest FL305DMY of 1702.67±72.21 kg and may be attributed to the higher humidity and the incidence of different diseases. It may hence be deduced that the milch stock was maintained under comparatively favourable farm conditions during the hot summer, rainy season and extreme winter season. The non-significant effect of season of calving on FL305DMY was also reported by many workers (Naskar 2003, Raja 2004, Banik 2004, Sentitula 2007, Kumar 2007, Raja and Narula 2007, Manoj 2009). Contrary to the present findings, significant effect of season of calving on FL305DMY has been documented by Banik (2004), Rehman *et al.* (2008) and Dongre *et al.* (2013).

The FL305DMY of cows calved during different periods showed a wide variation and the effect of period was highly significant (P<0.01). The present finding was in accordance with the reports of Mohanty (2001), Banik (2004), Raja (2004), Dubey and Singh (2005), Kumar (2007), Sentitula (2007), Manoj (2009) and Dongre *et al.* (2013). It can be noticed from the Table 3 that there was no specific trend for this trait throughout the period of study and the average FL305DMY was highest (2221.87±112.45) for the animals calved during 1994–96 and lowest (1041.45±113.22) during 2000–02. The lowest FL305DMY for the animals calved in 2000–2002 was expected as the lactation length was also lowest (228.13±13.67) for the same period. The differences in FL305DMY over the periods may be attributed to the differential culling levels on the basis of production and difference in feeding and managemental practices besides the changing genetic structure of the population.

The least squares analysis revealed that the age group had no significant effect on the FL305DMY (Table 2). This finding was similar to the results reported by Mohanty (2001), Banik (2004) and Sentitula (2007) in Sahiwal cattle. However, Kumar (2007) and Manoj (2009) reported statistically highly significant (P<0.01) regression coefficient of FL305DMY on AFC in Sahiwal cattle and its crosses.

The results of the least squares analysis revealed statistically highly significant (P<0.01) effect of days open on FL305DMY (Table 2). Maximum average FL305DMY of 1994.71±112.22 kg was obtained for animals having days open between 136–150 days and the yield was minimum (1550.14±72.93 kg) for the animals having days open ≤ 60 days. From the Table 3 it can be inferred that the animals having shorter days open had lesser FL305DMY than the animals having longer days open and it may be due to the fact that early conceivers also dry early to facilitate the second calving and the late conceivers may be in milk for a comparatively longer period. The significant effect of days open on FL305DMY was also reported by Rehman *et al.* (2008).

First lactation length (*FLL*)*:* The least square estimate of overall population mean for FLL was 303.46±5.29 days (Table 3). The estimate was near to the values reported by Banik (2004) and Kumar (2007). However, present estimate was higher than the values reported by Mohanty (2001), Naskar (2003), Rehman *et al.* (2008) and Manoj (2009).

The results of the present study revealed that the influence of season of calving on FLL was statistically non-significant (Table 2). The animals that calved during autumn had shortest FLL of 292.11±12.78 days and the winter calvers had longest lactation length of 309.63±5.73 days. The non-significant effect of season of calving on FLL observed in the present study was in agreement with the findings of Banik (2004), Raja (2004), Dubey and Singh (2005), Bajetha (2006), Kumar (2007), Sentitula (2007), Raja and Narula (2007) and Manoj (2009). On the other hand, Mohanty (2001) and Kumar (2007) reported significant effect of season of calving on FLL.

The effect of period of calving on FLL was statistically highly significant (P<0.01). The average FLL was highest (365.89±27.36 days) for the period 1979–81 and lowest (228.13±13.67 days) for the period 2000–02 (Table 3). Most of the workers (Raja 2004, Banik 2004, Manoj 2009) reported highly significant effect of period of calving on FLL in Sahiwal cattle; while Mohanty (2001) reported non-significant influence of period of calving on this trait.

The effect of age groups on the FLL was found to be statistically non-significant (Table 2). It was apparent from the results that there was no wide variation in FLL among different age groups. The non-significant effect of AFC on FLL in Sahiwal cattle was also reported by Kumar (2007), Sentitula (2007) and Manoj (2009). However, Banik (2004) reported statistically significant (P<0.05) regression of FLL on AFC in Sahiwal and its crosses.

Table 3. Least squares means for different first lactation production and reproduction traits in Sahiwal cattle

	Age at first calving		First lactation 305-day or less milk yield		First lactation length		First service period		First dry period	
	No.	Mean±SE	No.	Mean±SE	No.	Mean±SE	No.	Mean±SE	No.	Mean±SE
Overall	961	1117.02±05.21	676	1759.86±43.65	664	303.46±5.29	770	149.63±5.25	689	163.75±6.77
Season of birth/calving										
Winter	413	1120.60±6.77	319	1797.54±46.71	312	309.63±5.73	379	140.73±5.77	340	158.56^{b}±7.39
Summer	204	1114.77±9.49	225	1739.01±51.13	223	309.35±6.17	239	152.68±6.59	223	142.37^{a}±8.23
Rainy	214	1123.21±9.35	91	1702.67±72.21	88	302.77±8.79	99	151.50±9.86	83	150.81^{ab}±12.10
Autumn	130	1109.48±11.77	41	1800.22±105.81	41	292.11±12.78	53	153.63±13.39	43	203.27^{c}±16.56
Period of birth/calving										
1956–58/ 1961–63	34	1300.72^{h}±22.14	82	1889.91^{fg}±75.74	81	326.82^{hi}±9.12	75	170.23^{f}±11.01	56	133.97^{bc}±14.37
1959–61/ 1964–66	91	1082.16^{de}±13.73	60	1752.51^{de}±85.67	57	309.36^{def}±10.55	62	204.22^{g}±11.88	55	165.61^{d}±14.42
1962–64/1967–69	71	1133.65^{f}±15.38	39	1801.49^{ef}±109.01	31	339.43^{j}±14.57	40	195.93^{g}±15.25	38	120.74^{ab}±17.72
1965–67/1970–72	85	1194.46^{g}±14.01	73	1891.91^{fg}±81.20	72	335.81^{ij}±9.88	79	172.12^{f}±11.05	72	127.80^{abc}±13.26
1968–70/1973–75	57	1145.75^{f}±17.23	53	1868.33^{fg}±96.99	53	322.38^{gh}±11.67	59	134.96^{bcd}±12.90	56	133.13^{bc}±15.12
1971–73/1976–78	78	1033.55^{b}±14.74	8	1388.89^{b}±227.03	7	273.46^{b}±29.22	12	149.69^{e}±27.10	11	211.37^{f}±31.57
1974–76/1979–81	11	1202.44^{g}±39.09	8	1885.52^{fg}±227.21	8	365.89^{k}±27.36	8	165.07^{f}±33.13	8	113.96^{a}±36.85
1977–79/1982–84	22	1202.66^{g}±27.61	34	1773.84^{de}±114.75	34	312.91^{efg}±13.81	35	132.15^{bc}±16.18	30	130.47^{bc}±19.75
1980–82/1985–87	37	1096.71^{e}±21.52	29	1915.57^{g}±122.54	30	315.00^{fg}±14.55	33	136.93^{cde}±16.59	28	138.88^{c}±20.07
1983–85/1988–90	41	1013.46^{a}±20.20	34	1949.86^{g}±117.82	36	294.68^{c}±13.87	35	104.75^{a}±16.42	34	131.14^{bc}±18.94
1986–88/1991–93	45	1054.78^{c}±19.35	34	2170.61^{h}±114.60	34	302.44^{cde}±13.87	37	123.11^{b}±15.82	39	161.61^{d}±17.48
1989–91/1994–96	48	1056.55^{c}±18.79	35	2221.87^{h}±112.45	33	320.80^{fgh}±13.94	40	143.31^{cde}±15.03	34	142.45^{c}±18.16
1992–94/1997–99	50	1087.82^{de}±18.26	37	1550.66^{c}±110.21	38	271.18^{b}±13.08	43	146.93^{de}±14.57	41	224.92^{f}±16.79
1995–97/2000–02	47	1089.61^{de}±18.97	35	1041.45^{a}±113.22	35	228.13^{a}±13.67	48	131.70^{bc}±14.09	49	248.10^{g}±15.81
1998–00/2003–05	68	1144.10^{f}±15.86	46	1350.42^{b}±100.65	48	236.17^{a}±11.90	72	142.76^{cde}±11.74	69	242.58^{g}±13.76
2001–03/2006–07	109	1076.01^{d}±12.56	69	1704.91^{d}±83.28	67	300.96^{cd}±10.15	92	140.31^{cde}±10.36	69	193.32^{e}±13.70
2004–06	67	1074.83^{d}±15.94	-	-	-	-	-	-	-	-
Age groups										
≤ 900 days	-	-	38	1615.66±114.34	37	296.55±13.86	44	136.04±15.20	40	186.14±17.90
901–960 days	-	-	60	1792.35±92.37	57	316.82±11.36	69	156.03±12.20	61	167.08±14.63
961–1020 days	-	-	70	1604.75±83.91	71	303.27±10.06	80	162.59±11.20	72	154.17±13.40
1021–1080 days	-	-	118	1728.59±69.26	123	297.93±8.25	149	149.82±8.87	135	159.78±10.66
1081–1140 days	-	-	120	1690.55±69.51	116	290.89±8.40	137	147.10±9.07	123	170.21±10.99
1141–1200 days	-	-	77	1691.36±83.50	77	294.30±10.04	89	156.84±10.58	80	168.83±13.10
1201–1260 days	-	-	51	1799.27±96.28	47	301.60±11.95	53	156.36±13.41	49	163.12±15.53
1261–1320 days	-	-	50	1966.35±98.79	47	321.08±12.32	51	144.65±13.94	46	137.69±16.54
1321–1380 days	-	-	32	1797.10±117.76	30	302.03±14.73	35	144.64±16.15	30	167.08±19.50
> 1380 days	-	-	60	1912.65±88.64	59	310.16±10.76	63	142.26±12.37	53	163.45±15.07
Days open										
≤ 60 days	-	-	99	1550.14^{a}±72.93	100	260.49^{a}±8.78	-	-	110	148.94^{bc}±11.23
61–75 days	-	-	71	1590.20^{a}±82.22	69	260.01^{a}±10.02	-	-	84	156.29^{cde}±12.37
76–90 days	-	-	58	1559.81^{a}±89.24	61	254.79^{a}±10.54	-	-	57	155.99^{cde}±14.47
91–105 days	-	-	65	1733.52^{bc}±83.96	68	280.74^{b}±9.95	-	-	67	130.14^{a}±13.38
106–120 days	-	-	42	1743.13^{bc}±101.67	44	298.92^{c}±12.04	-	-	42	167.61^{def}±16.71
121–135 days	-	-	36	1693.03±109.25^{b}	36	278.58^{b}±13.19	-	-	34	152.61^{bcd}±18.01
136–150 days	-	-	35	1994.71^{f}±112.22	35	336.63^{f}±13.51	-	-	38	139.42^{ab}±17.52
151–165 days	-	-	27	1906.28^{ef}±127.09	27	319.59^{d}±15.32	-	-	30	170.56^{efg}±19.54
166–180 days	-	-	22	1761.23^{bc}±139.80	23	324.15^{de}±16.57	-	-	26	174.75^{fgh}±20.81
181–195 days	-	-	16	1859.57^{de}±162.22	16	324.17^{de}±19.55	-	-	19	184.99^{ghi}±24.06
196–210 days	-	-	20	1808.25^{cd}±150.01	21	333.76^{ef}±17.69	-	-	18	188.61^{hi}±25.12
> 210 days	-	-	185	1918.44^{ef}±56.38	164	369.72^{g}±7.16	-	-	164	195.13^{i}±09.57

Means bearing same superscript did not differ significantly.

The effect of days open was highly significant (P<0.01) on FLL. From the table 3 it was noticed that the least squares means of FLL was minimum for animals having lower days open and vice versa. It was inferred that the FLL consistently increased as the days open increased and it seemed that the animals conceived earlier had dried earlier due to the physiological changes during pregnancy as compared to the animals conceived later having longer days open.

First service period (*FSP*)*:* The overall least squares mean for FSP was found to be 149.63±5.25 days (Table 3). This estimate was near to the estimates reported by Mohanty (2001), Banik (2004) and Raja (2004) in Sahiwal cattle. Contrary to the present findings, Rehman *et al.*(2008) reported higher average FSP in Sahiwal cattle. However, lower estimates of average FSP were also reported by Naskar (2003) and Manoj (2009). The variation in FSP reported by different workers may be due to variation in the managemental efficiency in estrus detection and timely breeding followed in different herds.

The results of the present study revealed that the season of calving had statistically nonsignificant influence on the FSP (Table 2). Most of the workers (Mohanty 2001, Raja 2004, Dubey and Singh 2005. Sentitula 2007, Manoj 2009) also reported nonsignificant influence of season of calving on FSP. Contrary to these findings, significant influence of season of calving was reported by Banik (2004), Kumar (2007) and Rehman *et al.* (2008). The animals calved in autumn had maximum FSP of 153.63±13.39 days; whereas winter calvers had lowest FSP of 140.73±5.77 days (Table 3).

The period of calving had statistically highly significant influence (P<0.01) on FSP. The cows calved during period 1988–90 had the lowest service period, while the cows calved during the period 1964–66 had the longest FSP. The highly significant effect of period of calving on FSP was also reported by Banik (2004), Raja (2004), Dubey and Singh (2005), Kumar (2007), Sentitula (2007) and Manoj (2009). On the other hand, non-significant influence of period of calving on FSP was documented by Mohanty (2001) and Bajetha (2006). The average FSP during period 1982–2007 was comparatively lower than the population average indicating overall improvement in the feeding, breeding, and reproductive managemental conditions besides the change in the genetic structure of the population over the years.

The analysis on the effect of age groups on the FSP was statistically non-significant. On the other hand, Banik (2004) and Kumar (2007) reported highly significant (P<0.01) regression of FSP on AFC in Sahiwal cattle. Animals in the first age group (≤ 900 days) had the minimum FSP of 136.04±15.20 days, indicating that these animals are reproductively sound enough to conceive earlier than the animals in other age groups.

First dry period (*FDP*)*:* The least squares overall mean FDP was 163.75±6.77 days (Table 3). This average was near to the estimates reported by Naskar (2003) and Banik (2004). However, this estimate was lower than the estimates reported by Mohanty (2001) and Kumar (2007) while higher than the value reported by Raja (2004). The variation in average FDP reported by different workers is justified as this trait is mostly determined by the feeding, breeding and managemental practices followed at a dairy farm.

The influence of season of calving on FDP was highly significant (P<0.01). The cows that calved during summer had the lowest dry period of 142.37±8.23 days and were not significantly different from the cows that calved in rainy season (Table 3).The cows that calved in autumn season had the longest average dry period of 203.27±16.56 days, which was significantly different from the mean over other seasons. The significant effect of season of calving on FDP was also reported by earlier workers (Mohanty 2001, Rehman *et al.* 2008).

The least squares analysis of variance revealed that the period of calving had highly significant (P<0.01) effect on FDP (Table 2). Similar to this finding, many workers (Raja 2004, Banik 2004, Kumar 2007, Sentitula 2007) reported highly significant influence of period of calving on FDP. However, non-significant influence of season of calving on this trait was observed by Mohanty (2001) and Bajetha (2006). The FDP was shortest for the period 1979–1981 and longest for the period 2000–2002. This was attributed to the fact that FLL was highest for the period 1979–1981 and shortest for the period 2000–2002. From the Table 3 it was observed that the FDP was comparatively lower than the average of the herd for the period from 1967–1975. The effect of age groups on the FDP was nonsignificant (Table 2). This result was in accordance with the results of Banik (2004), Kumar (2007) and Sentitula (2007), who reported that the regression of FDP on AFC was nonsignificant in Sahiwal and its crosses.

The results of the least squares analysis revealed that the days open had highly significant (P<0.01) effect on the FDP. From the Table 3, it may be noticed that the FDP was longest (195.13±9.57 days) for those animals having longest days open (>210days). Those animals conceived between 91–105 days after calving had the shortest FDP of 130.14±13.38 days. It may also be inferred that the FDP was lesser than the herd average if the average days open is lesser than 150 days and the FDP increased as the days open increased.

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