



Studies on Some Reproduction and First Lactation Milk Yield Traits in Sahiwal and Crossbred Cattle

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Abstract

The present study was undertaken in Sahiwal and crossbred cattle for studying the performance of these groups of cattle for Age at First Calving (AFC), first lactation 305 day milk yield (FL305DMY), First Lactation Length (FLL) and First Lactation Peak Yield (FLPY). The effect of sire, genetic group, season, period of calving and age at first calving on these traits were also studied. In case of Sahiwal the means along with standard errors of AFC, FL305DMY, FLL and FLPY were observed as 1445.34 ± 30.77 days, 1716.04 ± 78.47 kg, 248.45 ± 9.84 days, and 8.84 ± 0.15 kg, respectively. The corresponding values in crossbred cattle were found as 1376.15 ± 24.19 days, 2657.69 ± 63.18 kg, 283.93 ± 4.94 days and $13.18 \text{ kg} \pm 0.12 \text{ kg}$. The sire and period did significantly influence the first lactation production and first lactation milk yield traits. As is obvious, the genetic group significantly affected the first lactation 305 day milk yield, first lactation length and first lactation peak yield. Season did influence the age at first calving and first lactation peak yield.

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Introduction

India is bestowed with a rich diversity of cattle breeds that are well adapted to the local climatic conditions. India has 193.46 million cattle. Of this, 142.106 million are indigenous and 51.36 million are crossbreds. The cattle genetic resources are represented by 43 well recognized breeds (NBAGR, Karnal). Sahiwal is a well known milch breed of cattle kept by many farmers and dairy owners in India and has been estimated as 0.48 million. The breeding tract of this breed is in Montgomery district in Pakistan. Small herd of Sahiwal cattle are found along the Indo-

Pak borders of Ferozpur and Amritsar districts of Punjab and Sri Ganganagar district in Rajasthan. It is also found in some areas of UP and Chhattisgarh. However, this breed is also maintained at some government dairy farms and institutional farms. This dairy breed has higher demand among the indigenous breeds. The crossbred cattle constitute mainly the exotic breed as Holstein Friesian, Jersey or Red Danish with the local breed or non-descript inheritance. Therefore, it is imperative that the existing crossbred population as well as population of indigenous cat-



tle need to be evaluated for their performance/genetic worth and proper mating system and selection programmes be carried out. In view of the above, a study was undertaken using the data maintained at Instructional Dairy Farm, G.B.P.U.A. & T, Pantnagar on Sahiwal and crossbred cattle to know the performance of various reproduction and first lactation milk yield traits viz. Age at First Calving (AFC), first lactation 305 day milk yield (FL305DMY), First Lactation Length (FLL) and First Lactation Peak Yield (FLPY) and the effect of genetic (sire and genetic group) and non-genetic (period and season) factors on these traits in Sahiwal and crossbred cattle.

Materials and methods

The data maintained at the university farm and spread over 40 years from 1977-2016 in case of crossbred cattle and 30 years from 1987-2016 in case of Sahiwal cattle were used consisting 166 Sahiwal and 719 crossbred cattle, for studying the AFC, FL305DMY, FLL and FLPY traits. The data were grouped into five groups considering consecutive eight years in a group in case of crossbreds. The data on Sahiwal cattle were classified into three periods considering consecutive ten years as one period. Three seasons were considered as: Summer (March-June), Rainy (July-October) and Winter (November-February). The data were analyzed according to Mixed Model Likelihood Programme (Harvey, 1990).

The Instructional Dairy Farm, Nagla of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) lies between 28° 52' to 28° 25' North latitude and 78° 58' to 79° 42' East longitude. The climate of the farm is subtropical in nature. The minimum temperature remains about 3°C in winter and maximum temperature as 40°C in summer season. The annual rain fall is around 1300 to 1400 mm; most of the rain fall is received in June to September months. The loose and open housing system was being practiced. The prophylactic vaccination schedule for Foot and Mouth Disease (FMD), Hemorrhagic Septicemia (HS) and Black Quarter (BQ) is followed along with the practice of regular deworming. Balanced ration was provided to animals as per NRC nutrient requirement. The crossbred cattle maintained at this farm were having exotic inheritance (Holstein Friesian, Jersey and Red Dane as the exotic cattle) less than 50% and more than 50% reaching to the level of 75%. These cows were crossed in later years with the semen from sires having 50% Holstein Friesian (HF) and 50% Sahiwal. The F₁ were inter-se mated to produce F₂ generation. The cows having exotic inheritance level near about 75% were crossed using the semen from Sahiwal sire.

Results and discussion

The least squares means for Age at First Calving (AFC), first lactation 305 day milk yield (FL305DMY), First Lactation Length (FLL) and First Lactation Peak Yield (FLPY) in Sahiwal and crossbred cattle are presented in Table 1. The factors affecting these traits are given in the Table 2.

Age at first calving (AFC)

Means and factors affecting age at first calving

The least squares mean of age at first calving was observed as 1445.34 ± 30.77 days in Sahiwal. However, Singh *et al.* [16] and Raja [13] found lower value of AFC (around 1100 days). Nandagawali *et al.*, [11] reported higher value of age at first calving (days) in Sahiwal cattle. The higher value of AFC may be due to differences in herd size and varied managerial conditions

at different farms. The least squares mean of age at first calving was observed as 1376.15 ± 24.19 days in crossbred cattle, which was in close agreement with the report of Yadav *et al.* [19]. The lower value of age at first calving was reported by Ambhore *et al.* [1] in crossbred cattle. However, Banerjee and Banerjee [3] reported higher value of AFC in crossbred cattle.

The effect of genetic group / breed was found to be non-significant on the age at first calving, which was in accordance with the findings of Shahi and Kumar [14,15]. However, Upadhyay *et al.* [18] observed significant effect of genetic group on AFC.

The effect due to sire was found to be significant on age at first calving in Sahiwal and crossbred cattle, which was in agreement with the report of Banerjee and Banerjee [3] and Shahi and Kumar [14]. However, Kuralkar *et al.* [9] reported non-significant effect of sire on AFC. These findings indicate that different sires that were used for breeding purpose in the herd, they had significant effect on the age at first calving.

The effect due to season of calving was also found to be significant on the AFC in Sahiwal and crossbred. It indicates that season of calving did influence AFC as the animals were raised on the fodder which may not be available in enough amount throughout the year and hence affected the age at first calving. The (Season 1) summer calvers had lowest value of AFC (1363.26 ± 16.91) than the (Season 2) rainy (1450.82 ± 19.9) and (Season 3) winter (1418.15 ± 17.32) calvers.

The effect due to the period of calving was found to be highly significant on the age at first calving in Sahiwal and crossbred cattle, which was in conformity with the finding of Yazdani *et al.* [20]. However, Yazdani *et al.* [20] did not found any effect of period of calving on the AFC in Sahiwal and crossbred cattle. The least squares means revealed that the period-5 had highest AFC (1464.56 ± 73.36) and period-1 (1329.92 ± 45.27) had lowest AFC, however the differences observed were significant. It indicated that genetic makeup of the herd and management practices over the periods have changed significantly.

Means and factors affecting first lactation 305-day milk yield (FL305DMY)

The least squares mean of FL305DMY was observed as 1716.04 ± 78.47 kg in Sahiwal cattle. Similar result was found by Raja [13] in Sahiwal cattle. The least squares mean of FL305DMY was observed as 2657.69 ± 63.18 kg in crossbred cattle, which was in conformity with the finding of Ambhore *et al.* [1] in different grades of crossbred cattle.

The effect of genetic group /breeds was found significant on the first lactation 305 day milk yields. The least squares means revealed that Sahiwal (G1) group had lower FL305DMY than crossbred (G2) group. Kiran *et al.* [7], Narang *et al.* [12] and Upadhyay *et al.* [18] reported the significant effect of genetic group on the FL305DMY.

The effect due to the sire was found to be significant on the first lactation 305-day milk yields in Sahiwal and crossbred cattle indicating the genetic variability in the herd. Kuralkar *et al.* [9] reported non-significant effect of sire on FL305DMY. The effect due to the season of calving was found to be non-significant on 305-day milk yields in Sahiwal and crossbred cattle. Singh *et al.* [16] also found the effect of season on 305-day milk yield. However, Mishra and Prasad [10] found significant effect of season on FL305DMY. The least squares means revealed that (season 1) summer calvers had highest value of FL305DMY (2162.42 ±

46.95) followed by the (Season 3) winter (2236.57 ± 47.86) and (Season 2) rainy (2161.62 ± 53.7) calvers. This imply that summer calvers will have plenty of fodder to feed them when they are in inclination phase of lactation curve and cows that calved in other season, may does not have plenty of fodder resulting in reduced FL305DMY, however, the effect of season was not significant.

The effect due to the period was found to be significant on 305-day milk yields in Sahiwal and crossbred cattle. The least squares means revealed that period-3 had highest FL305DMY (2254.48 ± 112.95) and period-5 (2007.16 ± 180.6) had lowest FL305DMY. Significant effect of period indicated differences in managemental practices over the year, as well as the set of sires used and exercise of differential culling over different years.

Means and factors affecting first lactation length (FLL)

The least squares mean of first lactation length was observed as 248.45 ± 9.84 days. However, Singh *et al.* (16) reported the FLL around 300 days in Sahiwal Cattle. The least squares mean of first lactation length was observed as 283.93 ± 4.94 days in cross bred cattle.

The effect due to the genetic group/breeds was found to be significant on the FLL which agreed with the findings of Kiran *et al.* [7]. The effect due to sire was found to be highly significant on the first lactation length in Sahiwal and crossbred cattle indicating presence of genetic variability in the herd. The effect due season of calving was found to be non-significant on FLL. The effect due to the period was found to be significant on FLL in Sahiwal and crossbred cattle. The least square means revealed that period-5 (297.41 ± 14.58) had highest and period-2 (233.29 ± 10.83) had lowest FLL.

Means and factors affecting first lactation peak yield (FLPY)

The least squares mean of first lactation peak yield was observed as 8.84 ± 0.15 kg in Sahiwal cattle which was in accordance with the report of Chawla and Mishra [4]. However, Amita *et al.* [2] reported the mean FLPY lower than the results of this study. The least squares mean of first lactation peak yield was observed as 13.1 ± 0.12 kg. The effect of season of calving on FLPY was found to be significant in Sahiwal and crossbred cattle. Dhaka *et al.* [5] reported the no significant effect of season on the FLPY. The least squares means revealed that that (season 3) winter calvers had highest values of Peak yield (12.54 ± 0.09 kg) followed by (Season 1) summer (9.44 ± 0.09 kg) and (season 2) rainy (9.01 ± 0.1 kg) calvers. These results implies that winter season calvers had plenty of green fodder and cooler environment that was good for cows to attain high peak yield in winter than the cows calved on the other season.

The effect of period of calving on FLPY was found to be significant in Sahiwal and crossbred cattle. Similar finding was reported by Dhaka *et al.* [5]. The least square means revealed that period-3 (13.43 ± 0.22 kg) had highest and period-1 (9.52 ± 0.3 kg) had lowest FLPY. The differences during different periods may be due to selection of good sires and technology such as artificial insemination helping in dissemination of superior bull's character in herd along with the managemental changes that could have contributed significantly to higher FLPY over a period.

Table 1: Least squares means (\pm S.E.) of various reproduction and first lactation milk yield traits on overall basis (Sahiwal and crossbred cattle)

Source of variation	No of observations	AFC (Days)	FL305DMY (kg)	FLL (days)	FLPY (kg)
Overall mean	965	1410.74 ± 13.43	2186.87 ± 39.69	265.64 ± 2.91	10.92 ± 0.08
Genetic group					
G1 (Sahiwal)	166	1445.34 ± 30.77	1716.04 ± 78.47	248.45 ± 9.84	8.84 ± 0.15
G2 (Crossbreds)	799	1376.15 ± 24.19	2657.69 ± 63.18	283.93 ± 4.94	13.18 ± 0.12
Period					
P1(1977-1984)	155	1461.28 ± 61.85	2104.72 ± 152.81	245.32 ± 12.32	9.52 ± 0.3
P2(1985-1992)	234	1423.85 ± 54.36	2213.48 ± 134.62	233.29 ± 10.83	10.67 ± 0.27
P3(1993-2000)	255	1329.92 ± 45.27	2254.48 ± 112.95	260.82 ± 9.06	13.43 ± 0.22
P4(2001-2008)	152	1374.12 ± 64.62	2118.49 ± 159.4	291.42 ± 12.86	10.47 ± 0.32
P5(2009-2016)	169	1464.56 ± 73.36	2007.16 ± 180.6	297.41 ± 14.58	11.27 ± 0.36
Season					
S1(March- June)	372	1363.26 ± 16.91	2162.42 ± 46.95	260.14 ± 3.55	9.44 ± 0.09
S2(July- October)	228	1450.82 ± 19.9	2161.62 ± 53.7	257.74 ± 4.13	9.01 ± 0.1
S3(November -February)	365	1418.15 ± 17.32	2236.57 ± 47.86	276.07 ± 3.63	12.54 ± 0.09

Table 2: Least squares analysis of variance showing mean square values for various reproduction and first lactation milk yields traits on overall basis

Source of variation	d.f.	AFC	FL305DMY	FLL	FLPY
Sire	77	78512.15*	638109.16*	3549.84*	2.39*
Genetic group	1	127032.89	23471746.59*	14551.61*	41.96**
Period	4	154699.30**	213114.59*	1077.14*	0.72*
Season	2	548157.31*	577290.24	4018.57	1.88*
Regression AFC			87542.96	712.392	0.56
Error	880	62131.14	370590.26	2437.98	1.47

**P<0.01, * P<0.05

AFC- Age at First Calving, FL305DMY- First Lactation 305 Day Milk Yield, FLL- First Lactation Length, FLPY-First Lactation Peak Yield

Conclusion

The average value for AFC, FL305DMY, FLL and FLPY were observed as 1445.34 ± 30.77 days, 1716.04 ± 78.47 kg, 248.45 ± 9.84 days, and 8.84 ± 0.15 kg, respectively in case of Sahiwal cattle. These corresponding figures for crossbred cattle were found as 1376.15 ± 24.19 days, 2657.69 ± 63.18 kg, 283.93 ± 4.94 days and 13.18 kg ± 0.12. The lower AFC and higher FL305DMY, FLL and FLPY were found in case of crossbreds than the Sahiwal breed of cattle. The FLL, FL305DMY and FLPY varied according to genetic group, sire and period of calving. The FLPY and AFC were influenced by season of calving.

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