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ENVIRONMENTAL FACTORS AFFECTING PERFORMANCE TRAITS OF CROSSBRED AND LOCAL DAIRY COWS AT MIRPUR AZAD JAMMU AND KASHMIR

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Data on about 3999 records from 1990 to 2003 collected at artificial insemination center Mirpur city were utilized for this study and analyzed using Harvey's Mixed Model Least Squares and Maximum Likelihood Computer Program to study the environmental sources of variation on some performance traits of Desi /local, F_1 (Holstein Friesian and Jersey X Desi), Holstein Friesian, Jersey and Sahiwal dairy cows of different genotype. The least squares means for number of services per conception, age at first service and gestation period were 1.07±0.18, 990.37±239.24 days and 280.84±0.35 days, respectively. The coefficient of variation for these traits was 24.31, 21.97 and 1.71 percent respectively. The least squares means for daily milk yield was 8.72±0.18 liters with 32.42 % coefficient of variation. The analysis of variance for age at first service revealed that year and genotype showed significant differences ($P< 0.05$), however, the season of birth had non-significant effect on age at first service. Moreover, data revealed that the year of service and genotype have significant ($P<0.01$) influence on number of services per conception during the study period, however, the season of service and parity showed non-significant difference. There was no significant difference due to age at service of the cows. The difference was non- significant in the number of services per conception due to increase in the age of cow. It was further observed that the gestation period in the present data set was significantly ($P<0.05$) different due to year / season of birth, genotype, parity and sex of the calf born. The variability in daily milk yield was significant ($P<0.05$) due to year of calving and genotype of animal, whereas, there was non significant difference in daily milk yield due to increase in the age of animal. The conception rate was variable in different year, season, genotype and parities. The mean conception rate during different season was 55.71 percent. It was the highest (79.63 %) during summer and lowest on autumn (43.40 %). Conception rate was 62.55, 61.55, 58.33, 58.14 and 59.07 percent, respectively in Desi, F1, Holstein Friesian, Jersey and Sahiwal cows. The calving rate was 70.55 percent of the pregnant cows. It varies in different seasons of the year ranging from 53.804 percent in summer to 91.73 percent in spring. The calving rate was higher in Holstein-Friesian (74.36 %) and lowest (60.00 %) in Sahiwal. It was 69.29 percent and 69.45 percent in Desi and F1 (crossbred), respectively.

Keywords: Environment, crossbred cows, Azad Kashmir

INTRODUCTION

Azad Jammu and Kashmir is covering an area of 13,297 squares kilometers. It is located in foothills of Himalayas; mainly hilly and mountainous characterized by deep ravines, rugged and undulating terrain. The livestock is primarily raised in small herds and it does not exceed more than four animals. The animals are pre-dominantly reared on mixed system of feeding (grazing and stall feeding) and they are contributing about 62% in the GDP of Azad Jammu and Kashmir (AJK) when compared with agriculture. There are 0.53 and 0.48 million dairy cows and buffaloes, respectively. The population of dairy cattle at Mirpur district was 93457 heads comprising 40.25 % cows and 59.75 % Buffaloes. The population was dominated by (47.83 %) nondescript and 23.83% Dhani, 17.41 % crossbred and followed by 2.41 percent Sahiwal cattle. The overall strength of dairy animals was 1.97 heads. The house holds preference for rearing milch animals was 54.48 % Buffaloes, 18.57 % cows and 26.96 % both cow and Buffaloes (Anon.1996).

In order to improve the diet and nutrition of farm families, and poverty alleviation by enhancing the income from increased sales of livestock products i.e. milk and meat, Artificial insemination activities were started during 1985 in AJK. The long term objective was to establish dairy cattle breed and enhance production potential of existing animals by crossing with improved exotic germ plasm, suitable to the variable climatic conditions in AJK. The study was aimed to evaluate the achievements and changes attained through cross breeding in the production potential of dairy cattle from Desi to improved exotic type. It is also envisaged to evaluate the environmental sources of variation for some performance traits of dairy cattle at Mirpur, AJK.

MATERIALS AND METHODS

Background and location

Mirpur city is surrounded by the Mangla Lake in the north and located at about 160 Kilometers East of Islamabad and its boundaries are joining with Jhelum and Gujar Khan Districts of Punjab. The average temperature was ranging from 26 to 48 C during April through September and it was 6 to 18 C during October to March in 1995 – 2000. The maximum temperature will be up to 48 C during June to mid August and minimum 4 C during December to February. The precipitation was maximum (530 mm) during May to August and minimum (95 mm) during September to November. The overall average precipitation was 940 mm during the year 1995 – 2000. Efforts have been made for improving the genetic potential of low producing dairy animals by introducing exotic genes through crossbreeding program in Azad Jammu and Kashmir. In 1985 artificial insemination (AI) activity was started initially at Muzaffarabad under a project PAK /03/013. Following the success of the project AJK Government requested UNDP to expand AI in whole of Azad Jammu & Kashmir. The project became in operation during January, 1989 and extended in December, 1992.

The records (3991) from 1994-2003 kept at the artificial insemination center Mirpur City were used for the present study. The following information was available in the records maintained at the center: date of insemination (first and further), name and address of the owner, type of animal, estimated age of animal at the time of insemination, number of calving completed by the animal, number of doses (semen) used, daily milk yields (liters), pregnancy test results, date at calving and sex of the calf.

Estimation of environmental influence

The effect of the environmental factors such as year and season of service, breed (genetic group), age of animal at service and parity on number of services per conception, age at first service, gestation period and daily milk yield were studied / evaluated. In the view of the climatic circumstances, the year was divided into following four seasons: Winter 16 November to 15 February, Spring 16 February to 15 May, Summer 16 May to 15 August and Autumn 16 August to 15 November.

The data were analyzed by least squares analysis of variance technique by using Mixed Model Least Squares Maximum Likelihood (LSMLMW) computer program (Harvey, 1990). For the final analysis of the number of services per conception, age at first service, gestation period and daily milk yield the following statistical model was assumed: $Y_{ij} = \mu + F_i + \epsilon_{ij}$ Where, Yij is measurement on the particular trait, μ is the population mean, F_i is the effect of all fixed factors such as year (1 to 10), season (1 to 4), genetic group (1 to 4) and parity (1 to 9) with the restriction that ϵ_{ij} is equal to zero, ϵ_{ij} is the random error associated with each observed trait analyzed.

Conception rate

The cows were checked for conception (pregnancy test) about 60 days after insemination. In the present study about 2745 cows were tested for pregnancy and 1650 were found positive. The remaining cows (1246) were not reported for P-test and/or calving. The conception rate was calculated by:

$$\text{Conception Rate} = \frac{\text{Total number of cows detected pregnant}}{\text{Total number of cows tested for pregnancy}}$$

Calving rate

The calving rate was lower than the final conception rate and 3 percent abortions have been considered. A conception rate of 80 percent is considered a satisfactory. The calving rate was calculated as the percentage of cows calve live calves, out of the total number of cows detected pregnant. The formula being:

$$\text{Calving Rate} = \frac{\text{Total number of cows calved}}{\text{Total number of cows pregnant}} \times 100$$

RESULTS AND DISCUSSIONS

Breeding Frequency

The cows showing estrous (1994 to 2003) and brought for insemination at this center during 6th month (June) of the calendar year were 56.44 percent. They were showing heat symptoms as the day length started to increase during March (8.23 %) and reach to the maximum during June (12.95 %) and July (10.50 %). Monthly variation in the frequency of estrus at this center has been depicted in Figure 1. Moreover, study of seasonal variation revealed that the frequency of estrus was highest (33.2 %) during summer and lowest in winter (20.38 %). Seasonal variation for breeding frequency during 1994-2003 depicted in Figure 2.

The results of the present investigation are in line with Majeed et. al. (1961) and Khan (2002) they reported monthly insemination frequency in buffaloes and cows in heat, which were presented for insemination at various AI centers in Pakistan during 1955-60. Seasonal variation in the frequency of estrus in different seasons was in close agreement as reported by Ahmad et al. (1982) and Chaudhry and Rehman (1986).

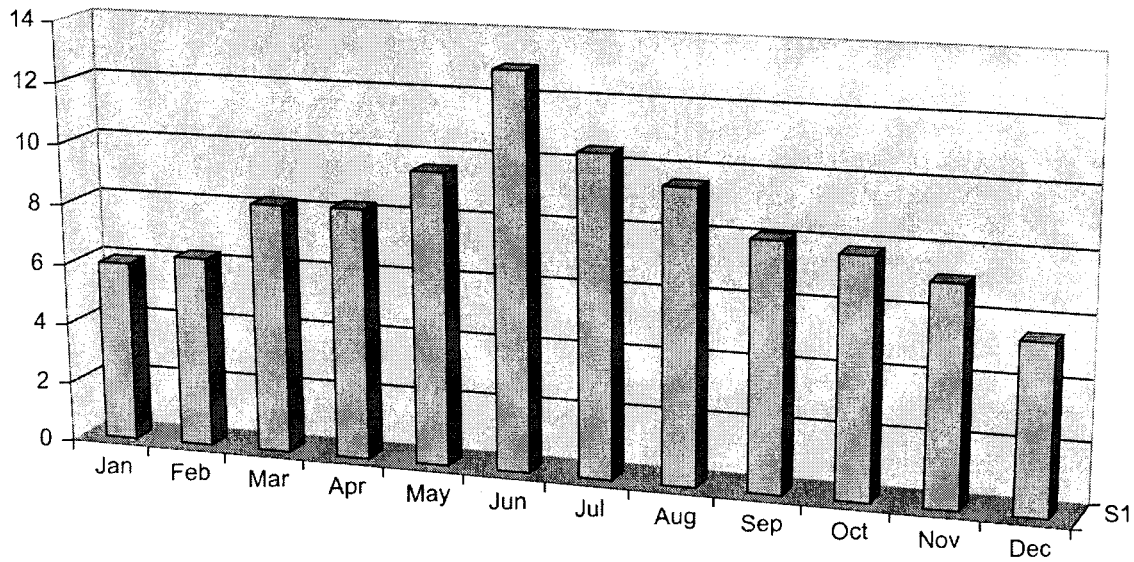

Figure 1. Month wise breeding frequency at AI center Mirpur (city) during 1994-2002

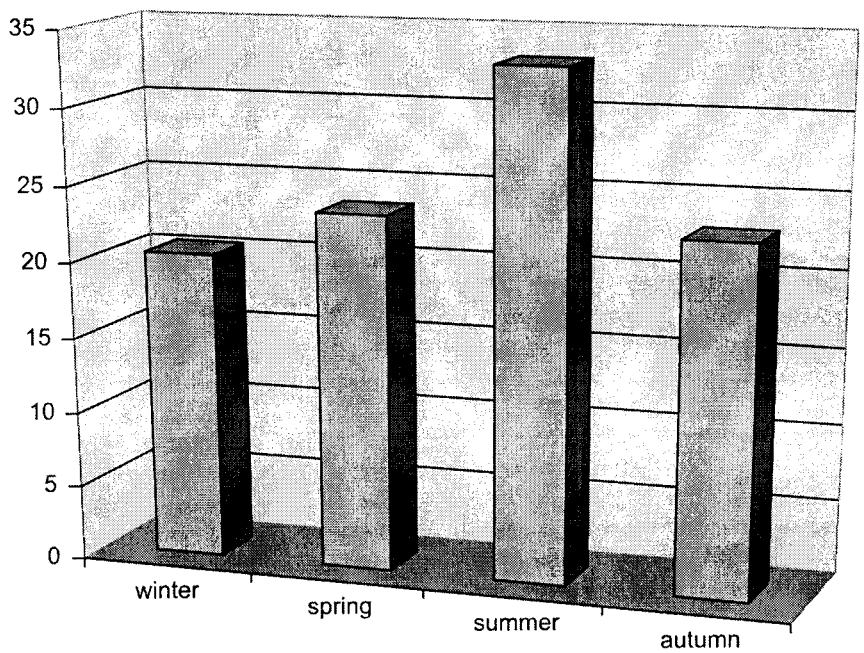

Figure 2. Season wise breeding frequency at AI center Mirpur(city) during 1994-2003

The available evidence indicates that the changes in the daily amount of light to which the animals are exposed are responsible for initiating the breeding activity in most of the species. The observed trends suggested that increased length of day or increased temperature might beneficially influence reproduction in cattle. In fact, the variation in fertility level seem to vary directly with the length of daylight, the hours of sunshine, and the outside temperature, there being a lag of sometime before the maximum effect was reached (Khan, 2002). However, Xi et al., (2003) analyzed data on breeding records of dairy cattle farm of Fenghuang-Shan and reported that high temperature was the most important factor affecting fertilization in warm months, but neither did conception rate decline immediately with the increased temperature in June, nor did it increase immediately with the increased air temperature in September.

Age at first service

The analysis of variance for the age at first service revealed that year and genotype have significant differences (P<0.05), however, the season of birth had non-significant effect on age at first service in the present data set (Table 1).

Least squares means for age at first service was 990.79±17.23 days which were not different from that of unadjusted mean (1008.37±239.24 days) and showing 21.97% coefficient variation. The age at first service was minimum (818.68±69.10 days) during 2003 and maximum (1081.63±25.19 days) during 1997 (Table 2).

The least squares means for the age at first service as obtained in the present study are consistent with the values reported in the literature by some workers (Tahir et al., 1983; Azam et al., 2001; Khan and Ayaz, 2002 and Qureshi et al., 2002) they reported that age at first service ranged from 524 to 1827 days. Tahir et. al. (1983) reported that age at first service in Sahiwal x Jersey and Red Sindhi cows was 1020+11 days and 1041.36±11.26 days, respectively. Azam et al (2001) reported that the age at puberty in Bhagnari heifers averaged 987.22±14.77 days and the range was 524 to 1827 days. Khan and Ayaz (2002) reported that average age at maturity was 732 days (24 months) and it ranged from 305 days to 1464 days in crossbred (Desi x Jersey) cows in AJK. Moreover, Qureshi et al. (2002) reported that overall age at puberty was 745.3±51.0 days and ranged from 420 to 1110 days. Age at puberty of the local cows was 878.7 days and it was 610.3 days in Holstein-Friesian crossbred cows. The crossbred cows showed the shortest age at puberty in rain fed area, followed by irrigated and hilly areas.

The least squares means for age at first service was lower (977.55±22.28 days) in Autumn and Summer born heifers than those which born during Winter and Spring (Table 3). These values were partially confirmed by Azam et. al. (2001) who reported that age at first service for Bhagnari heifers averaged 987.22±14.77 days, the range was 524 to 1827 days. The winter born heifers showed significantly lower age at puberty than those born in other seasons. The effect of season of birth was non-significant, however, contrary to the present study, Rafique et al., (2000) observed that the season of birth had significant (P<0.05) effect on age at maturity in Holstein Friesian x Sahiwal crossbreds.

The average age at first service was lower (873.32±19.37 days) in F1 crosses followed by Holstein-Friesian and Jersey (Table 4). It was highest (1068.54±13.10 days) in local Desi heifers followed by Sahiwal. The age at first service was decreased due to introduction of the exotic blood in dairy cattle.

Number of services per conception

The data revealed that year of insemination and genotype have significant (P<0.01) influence on number of services per conception, however, the season of service and parity showed non-significant difference. The regression age of the cow on number of services per conception was non significant (Table 1).

The overall least squares means for number of services per conception was 1.07± 0.02, however, it ranged from 1.03±0.02 to 1.11±0.02 during 2001 through 1995 and 2002 (Table 2). The present estimates of number of services per conception was (1.07±0.2) not in agreement with the higher values reported in the literature. The values for number of services reported were below two (40 %), below three (53 %) and more than three (8 %) for various genotypes of cattle in Pakistan and India.

The results about the significant difference due to year of service on number of services per conception were consistent with the findings of various workers (Raheja et al. 1989; Ponce and Guzman, 1991; Ahmad, 1998 and Javed (1999) they reported a significant influence of year on the number of services per conception in Holstein Friesian, Red Sindhi and Sahiwal cows, respectively. However, Singh et al. (1990) and Chaudhry et al., (1996) did not found influence of year on services per conception in Sahiwal cows contrary to the present findings.

The number of services per conception during winter and autumn was higher (1.07±0.02) than summer and spring (1.06±0.02) in the present study (Table 3), however, contrary to the present findings Chaudhry et al. (1996) reported that the number of services per conception was lowest (1.80 ±0.18) for cows calving in winter season and it was highest (2.38 ±0.18) for the cows calving during autumn season. Moreover, Singh et al. (1990) and Ahmad (1998) reported that season of calving had non significant influence which was consistent with the present findings, whereas, Ray et al. (1992), Chaudhry and Shafique, (1994) and Javed (1999) reported that season of calving had a significant effect on number of services per conception in Holstein Friesian, Cholistani purebreds and its 50 percent cross with Holstein Friesian.

The least squares means for number of services per conception was higher in Jersey and lowest in Desi cows. Moreover, the F1 cross and Sahiwal were showing consistent number of services per conception (Table 4). However, the number of services per conception was close to the findings of Anand and Balaine (1981), Parekh and Touchbery (1982), Chaudhary (1986) and Ahmad (1998) they reported number of services per conception ranging from 1.15 to 1.70, 1.38±1.81 to 3.0±2.23, 1.75 and 1.63±0.07, respectively in various grades of dairy cattle.

Table 1. Analysis of variance for some performance traits in dairy cattle

Sources of Variation	Age at First Service (days)	Number of services per conception	Gestation period (days)	Daily milk yield (kg)
Least squares means	990.79±17.23 (816)	1.07±0.18 (3967)	280.84±0.35 (1164)	8.72±0.18 (3149)
Unadjusted means	1008.37±239.24	1.07±0.26	280.54±5.76	7.38±3.23
Year	5.31**	5.430**	14.96**	8.99**
Season	1.08^{NS}	0.15^{NS}	76.40**	1.31^{NS}
Genotype	20.76**	3.39**	2.57*	613.47**
Parity		0.64^{NS}	11.31**	2.22*
Sex			56.83**	
Regression				
Age		1.57^{NS}		1.70^{NS}
Total Reduction	8.90		24.57**	
Mu-ym	1.04		0.70^{NS}	
Remainder	49086.85	0.07	22.92	5.73

**=Significant (P<0.01) *=Significant (P<0.05) NS=Non-significant

Table 2. Least squares means and standard deviations during various years for some performance traits in dairy cattle

Year	Age at first service (days)	No. of services per conception	Conception rate (percent)	Calving rate (percent)	Gestation period (days)	Daily milk yield (kg)
1994	912.60±43.49	1.04±0.03	70.46	91.94	284.24±0.90	9.67+0.34
1995	952.46±28.52	1.11±0.02	62.79	45.06	284.05±0.54	9.39+0.22
1996	983.57±25.06	1.10±0.02	67.67	65.61	279.05±0.50	8.39+0.22
1997	1081.63±25.19	1.09±0.02	72.16	65.35	279.85±0.46	8.55+0.21
1998	993.69±26.82	1.05±0.02	73.87	96.70	279.63±0.48	8.87+0.22
1999	991.35±26.25	1.05±0.02	72.31	69.79	280.12±0.47	8.82+0.22
2000	1043.10±30.16	1.04±0.02	57.88	92.41	279.31±0.51	8.32+0.22
2001	1069.49±29.73	1.03±0.02	47.37	59.22	279.06±0.53	8.59+0.22
2002	1061.30±30.05	1.11±0.02	40.00	67.02	282.22±0.91	8.11+0.21
2003	818.68±69.10	1.06±0.04	72.73	43.75	280.84±0.35	8.57+0.38
Overall	990.79±17.23	1.07±0.02	60.17	70.85	280.84±0.35	8.72+0.18

Table 3. Least squares means and standard deviations during various seasons for some performance traits

Seasons	Age at first service (days)	Number of services per conception	Conception rate (percent)	Calving rate (percent)	Gestation period (days)	Daily milk yield (kg)
Winter	996.33±23.89	1.07±0.02	61.65	73.62	284.58±0.43	8.71+0.20
Spring	1011.16±22.17	1.06±0.02	63.18	73.28	280.60±0.44	8.87+0.20
Summer	978.11±20.43	1.06±0.02	59.08	70.40	279.93±0.42	8.69+0.19
Autumn	977.55±22.28	1.07±0.02	57.29	66.49	278.24±0.44	8.63+0.11
Overall	909.79±17.23	1.07±0.02	60.17	70.85	280.84±0.35	8.72+0.18

Table 4. Least squares means and standard deviations for some performance traits in various genotypes of dairy cattle

Genotypes	Age at first service (days)	Number of services per conception	Conception rate (percent)	Calving rate (percent)	Gestation period (days)	Daily milk yield (kg)
Desi	1068.54±13.10	1.04±0.02	59.69	43.21	280.77±0.26	5.19+0.17
Crossbred	873.32±19.37	1.07±0.02	54.48	69.97	280.62±0.33	9.47+0.18
Friesian	984.06±19.08	1.05±0.02	66.52	74.73	281.66±0.32	9.52+0.19
Jersey	986.13±54.01	1.10±0.04	62.00	67.64	279.65±1.09	10.18+0.38
Sahiwal	1041.88±51.99	1.07±0.03	57.38	65.71	281.48±1.07	9.26+0.33
Overall	909.79±17.23	1.07±0.02	60.17	70.85	280.84±0.35	8.72+0.18

The number of services per conception for various parities was ranging from 1.00+0.09 in 9th and 1.11+00.2 in 2nd calving and showing no specific trend (Table 5). Since, higher number of services per conception was reported by Raheja et al., (1989), Ponce and Guzman (1991), Ahmad (1998), Chaudhry and Shafique, (1994) and Javed (1999) in Friesian, Holstein, Red Sindhi and Sahiwal breeds of dairy cattle, respectively which were not in conformity with the findings of the present results about different genotypes. Chaudhry et al. (1996) reported that the effect of breed group parity was non-significant which was in agreement with the results of the present study.

a positive and significant correlation between service period and number of services per conception. Bulls with low fertility may be responsible for a disproportionately large number of services per conception.

Conception rate

The overall mean for the conception rate was 60.17 % (Table 1). Conception rate does not show consistent trend. Conception rate for various years (Table 2) was showing variable trend and it was minimum (40.00%) during 2002 and maximum (73.87%) during 1998 and followed by 72.73% during 2003.

Table 5. Least squares means and standard deviations for some performance traits in various parities of dairy cattle

Parities	Number of services per conception	Conception rate (percent)	Calving rate (percent)	Gestation Period (days)	Daily Milk Yield (kg)
1	1.09±0.02	67.88	79.39	281.90±0.40	8.17±0.21
2	1.11±0.02	59.02	75.00	280.43±0.55	8.52±0.12
3	1.08±0.01	57.10	69.95	280.33±0.43	8.78±0.12
4	1.09±0.01	59.12	65.68	279.70±0.42	8.96±0.15
5	1.07±0.02	60.05	69.42	282.67±0.50	9.13±0.24
6	1.06±0.03	46.34	66.67	279.99±0.75	9.14±0.43
7	1.05±0.05	65.71	30.44	-	7.57±0.73
8	1.08±0.09	-	-	-	9.54±0.87
Overall	1.07±0.02	60.17	70.85	280.84±0.35	8.72±0.18

In dairy animal services per conception, intervals from calving to first service to conception are the most important factors affecting the calving interval. The number of services per conception by artificial insemination depends on various factors, like quality of semen, state of reproductive system of the female, efficient heat detection, time of insemination, skill of the inseminators and other management factors. There is

The conception rate was far below than the required standards of 80 percent. Average conception rate as obtained in the present study was consistent with various workers (Cahudhary, 1986; Subbotin and Sokovskaya, 1999; Logar et al., 2000; Ozturker et al., 2001; Khan and Ayaz, 2002; Xi et al., 2003) they reported that conception rate was ranging from 48.1 % to 75.00 %. However, Chaudhary (1986) reported that

the conception rate was 51 percent in Jersey/ Brown Swiss and 47 percent in Friesian half breds in India which was close to the present values. Khan and Ayaz (2002) reported that an overall conception rate was 54.50 percent during 1978-98 in the Azad Jammu and Kashmir which was in line with the present study.

Conception rate was 61.65, 63.18, 59.08 and 57.29 % for winter, spring summer and autumn, respectively (Table 3). Conception rate as obtained in the present study was partially consistent with Subbotin and Sokolovskaya (1999) and Xi et al., (2003) they reported that the conception rate was lower in relatively warm months (July, August and September) ranged from 48.1 to 51.9 percent compared with 58.1 to 68.5 percent in other months. High temperature is most important factor affecting fertilization in warm months, but neither conception rate decline immediately with the increased temperature in June, nor it increase immediately with the increased air temperature in September.

Conception rate was high in Holstein Friesian (66.52 %) and followed by Jersey (62.00 %). The conception was 54.48, 57.38 and 59.69 % for F1 (crossbred), Desi and Sahiwal respectively (Table 4). The findings of Subbotin and Sokolovskaya (1999) and Bakir and Cetin (2003) are partially in agreement with the present study who reported that pregnancy rate at first insemination was 59.60 percent in Turkey. Moreover, the effects of lactation number, calving season and age on all characteristics were not significant.

Conception rate from 1st to 7^{th} calving was not showing consistent trend for various calvings at Mirpur during the study period (1994 – 2003). The conception rate was highest (67.88 %) in first calving and lowest (46.34 %) in 6^{th} calving (Table 5). Alvarez et al., (2003) reported that conception and pregnancy rate had no significant effect among breeds, age, parity, postpartum period and lactating cows with or with out their calves.

In order to achieve better conception rate, the quality of semen, proper stage of estrus and deposition of semen i.e. role of inseminator are the most important factors. The effect of insemination dose and season of breeding on conception rate was studied in field conditions by Tahir et. al. (1984). Alvarez et al., (2003) reported that conception and pregnancy rate had no significant effect among breeds, age, parity, postpartum period and lactating cows with or with out their calves. The overall conception rate was 33.5 percent. In addition to variations in the temperature, humidity etc in different seasons of the year, the quality and quantity of various feeds is also a manifestation of the seasonal effects. Significant relationship is known to exist between the climatic conditions and feed intake in cattle.

Calving rate

The overall average for calving rate from1162 calving was 70.85% and was not showing specific trend over the years 1994 to 2003 (Table 1 & 2). It was ranging from 43.75% during 2003 to 96.70% during 1998. The calving rate was well above the required standards of 80% during 1994, 1998 and 2000. It was below 50% during the years 1995 and 2003.

Average calving rate as obtained in the present study was close to Bakir and Cetin (2003) they reported that calving rate was ranging from 66 to 86.7%. On the contrary, high calving rate was recorded by Lademanne and Schoeman (1994) which was not in agreement with that of present study. Lademanne and Schoeman (1994) and Bakir and Cetin (2003) they recorded calving rate more than 80% in various crossbred dairy cows of the Africander, Hereford, Bonsmara and Simmental breeds and of Hereford X Africander, Simmental X Africander and Simmental X (Hereford X Africander cows).

Maximum number of calving was in Summer followed by spring and it was minimum during Winter and Autumn (Table 3). Calving rate was showing decreasing trend from Winter through Autumn. Means for the calving rate in various genotypes is given in Table 4 and it was maximum in Holstein Friesian (74.732%) followed by F1 crossbreds (69.21%) and Desi (69.21%) cows. Mean calving rate in Jersey cows was 67.74% and it was minimum (65.71%) in Sahiwal cows (Table 4). However, DeRouen et al., (1991), Madibela et al.,(2001) Fall et al., (1999) and Xi et al., (2001) reported lower to high (14.0% to 68.5%) calving rate and the values obtained in the present study lies within this range.

The calving rate was lower (30.44%) for 7^{th} calving and highest (79.39%) for 1^{st} calving during the period from1994 to 2003 (Table 5). The calving rate was increasing upto 3^{rd} calving and showing decrease in the 4^{th} calving. It again increases in 5th calving and decreases in 7^{th} calving (Table 5). However, Bakir and Cetin (2003) reported that the calving rate was 85.30%. However, the effects of calving number, calving season and age on all characteristics were not significant. Fall et al. (1999) and Madibela et al. (2001) reported lower calving rate (25, 53, 57 and 40%) for various groups, however, mean calving rate of Tswana cows (68.2%) tended to be higher than that of Simmental crosses (62.5%) and peak calving (52.3%) occurred between October and January, 15.3% of cows calved between May and June. Correlation of monthly calving and monthly rainfall was computed and there was no difference in calving interval and days open (Madibela et al., 2001).

Gestation period

The analysis of variance revealed that gestation period in the present set of data was significantly (P<0.05) different due to year / season of birth, genotype, parity and sex of the calf born (Table 1).

The least squares mean for gestation period as obtained from the present data set was 280.84±0.35 days (Table 2) and was ranged from 279.47±0.50 days during 1997 to 284.05 days during 1995. The least squares mean for gestation period were substantiated by Tahir et al., (1984) who reported that the gestation period was 280.0±11.7 days, 280.47±1.53 days and 280.84±0.94 days, respectively in 25, 50 and 75 % Friesian crosses with non-descript dairy cattle. However, some others (Chaudhary and Rehman, 1986; Tahir et al., 1984; Azam et al., 2001) reported higher average for gestation period than the present study, the range being 281.0±0.53 to 287.50±8.1 days in various purebred and crossbred dairy cattle.

The least squares mean for gestation period was lower during autumn and followed by summer calvers (Table 3). The percentage of calving was also highest during summer. The mean length of gestation for different genotypes was given in Table 4 and it was ranging from 279.65+1.09 days in Jersey to 280.62+0.33 days in F1 (HF X Desi and Jersey x Desi) crosses. Gestation period is more or less a constant parameter of reproductive efficiency, which is genetically determined for each species. Bhalla et al., (1968) reported gestation period for 51 calving in Sahiwal cows, which averaged 282 days, with a range of 268 to 295 days, which is partially in line with the present study.

The least squares means for gestation period during various parities are given in Table 5 and ranging from 279.70+0.42 days for 4th parity and 282.67+0.50 days for 5th parity. There was no specific trend in the gestation period due to parity. The least squares means of gestation period for male and female calves born to the cow was 281.92+0.38 days and 279.76+0.38 days.

The 1.5% gestation was between 250 and 270 days, 13.92% was between 271 and 290 days while 81.02% up to 290 days length (Figure 3). The remaining gestation period (3.93%) was more than 291 days. The frequency distribution of the gestation period was not in line with Azam et al., (2001) who reported that 4.11% gestation length was between 250 and 270 days, for 94.1% it was between 271 and 290 days while the remaining 1.52% it was more than 291 days (Figure 3).

Daily milk yield

The analysis of variance revealed that variability in daily milk yield due to year of calving and genotype of the animal was significant (P<0.01), however, the differences in daily milk yield was also significant (P<0.05) due to parity of the animal (Table 1). There was no significant difference in daily milk yield due to season of calving and increase in the age of the animal.

The results of the present study was consistent with those who reported significant effect of year of calving on milk yield in different breeds of dairy cattle (Ahmad et al., 1978a; Verneque et al. 1987; Santos et al., 1990; Khan et al., 1991; Rege et al., 1992; Gandhi et al., 1995; Gaur and Raheja, 1996; Talbott et al., 1997, Dahhlin et al., 1998; Javed, 1999). Ahmad et al. (1978a) they reported that year of calving had significant effect on milk yield in different dairy herds maintained in India and Pakistan. However, findings of the present study were not consistent with those reported by Bhambure and Dave (1989), Dhumal et al., (1989) and Ahmad (1998) they reported that milk yield was not significantly affected by the year of calving variation in milk yield observed over the years reflects the level of management as well as environmental effects. The level of management is bound to vary according to the ability of the farm manager, his efficiency in the supervision, his system of fodder production, method and intensity of culling (Ashfaq and Mason, 1954).

The overall least squares mean for daily milk yield was 8.72+0.18 kg and it ranged from 8.11+0.21 kg during 2002 to 9.65+0.34 during 1994 (Table 2). The least squares means about the daily milk yield as obtained in the present study was partially in line with Ahmad (1978a), Qureshi et al., (2002) and Rizzi et al., (2002) reported that average milk yield was ranging from 2.69+3.2 to 14.2+4.8 kg per day.

The maximum (32.45%) number of calving were recorded in summer and followed by spring 23.56% of the cows calved. The calving were lowest (21.31%) during winter and it was 22.67% during autumn (Table 3). The finding about the frequency of calving was in line with Javed (1999). The trend of daily milk yield may signify the availability of green fodder during the spring season. With the start of summer season fall in daily milk yield may be due to decrease in green fodder sources, which may be at its peak during winter of the year.

The least squares means for daily milk yield showed significant differences due to various genotypes (Table 1). Daily milk yield was highest in Jersey (10.174+0.379 kg) followed by Sahiwal and F1 (HF x Desi and Jersey x Desi) which are seem to be in competition (Table 4). The daily milk yield was lowest for the Desi / local (5.193+0.172 kg) cattle. Daily milk yield showed increasing trend up to, 6th calving and then decrease in 7th with increase in 8th calving (Table 5). The least

squares means for daily milk yield showed significant ($P<0.05$) difference due to number of calving. Chaudhry et al. (1996) reported that the effect of breed group, parity and calving year was non-significant which was not in line with the present study.

REFERENCES

Ahmad, Z., M.D. Ahmad, S.H. Hanjra and R.A. Gill. 1978. Influence of year and season of calving on milk production in Sahiwal cows. Pakistan J. Agric. Sci. 15: 107.

Ahmad, B. 1998. Productive and reproductive performance of Red Sindhi cattle under hot humid environment of Balochistan province of Pakistan. M.Sc. (Hon.) Thesis, Univ. of Agric., Faisalabad (Pakistan).

Alvarez, R.H., A.C. Martinez, J.B.P. de Carvalho, J.R.P. Arcaro, R.M.L. Pires and C.A. de Olivera. 2003. Efficiency of the Ovsynch treatment associated to fixed-time artificial insemination in Bos taurus and Bos Indicus herds. Brazil. Pesquisa Agropecuaria Brasileira. 38: 2,317.

Anonymous. 1996. Livestock Census of Azad Jammu and Kashmir. Planning and development division. Muzaffarabd.

Azam, M., R.A. Chaudhry, N. Ahmad and I.H. Khan. 2001. Studies on the reproductive efficiency of Bhagnari cattle in Baluchistan. Pak Vet. J. 21(1): 1.

Bakir, G. and M. Ccetin. 2003. Breeding characteristics and milk yield traits of Holstein cattle in Reyhanli Agricultural Facility. Turkey. Turk-Veterinerlik-ve-Hayvancilik-Dergisi. 27: 1,173.

Chaudhary, M.Z. and K. Rehman. 1986. Study on the reproductive performance and breeding behavior of Cholistani strain of dairy cows. 2nd Ann. Report. Livestock Production Research Institute, Bahadurnagar, Okara (Pakistan).

Chaudhary, M.Z. and M.A. Chaudhry. 1983. Comparative study of 10 Cholistani and 10 Sahiwal cows for their milk production. 4th Ann. Report. Livestock Production Research Institute, Bahadurnagar, Okara (Pakistan).

Chaudhary, M.Z. 1986. Problems of reproduction in crossbred dairy cattle. In: Proceedings of National Workshop on Dairy cattle crossbreed and maintenance of exotic dairy cattle in Pakistan. July 13-15. NARC, Islamabad.

Chaudhary, M.Z. and M. Shafiq. 1994. Factors affecting productive and reproductive traits in Cholistani cows. 15th Ann. Report. Livestock Production Research Institute, Bahadurnagar, Okara (Pakistan).

Chaudhary, M.Z., M.Rafiq and MA Amar. 1996. Performance of various genetic groups of Holstein-Friesian crossbreeds. 17th Ann. Report. (1995-96). Livestock Production Research Institute, Bahadurnagar, Okara (Pakistan).

Dahlin, A., U.N. Khan, A.H. Zafar, M. Saleem, M.A. Chaudhry and J. Philipsson. 1998. Genetic and environmental causes of variation in milk production traits of Sahiwal cattle in Pakistan. J. Anim. Sci. 66: 307.

Harvey, W.H. 1990. Mixed Model Least Squares and Maximum Likelihood Computer Program (LSMLMW) PC-1 version. Page 20.

Javed, K. 1999. Genetic and phenotypic aspects of some performance traits of purebred herd of Sahiwal cattle in Pakistan. PhD. thesis, Department of Animal Breeding and Genetics, University of Agriculture, Faisalabad, Pakistan.

Khan, M.D. and M.M. Ayaz. 2002. Productive and reproductive performance of Desi x Jersey crossbred cows in Azad Kashmir. National Conference on factors limiting Dairy Production in Pakistan. Held on 8-9 April at University of Agric., Faisalabad, Pakistan.

Khan, M.A. 2002. Reproductive efficiency of farm animals in the tropics. Animal Agriculture Bureau (AAB) Rawalapindi, Pakistan.

Khan, U.N., W.H. Pirzada, A. Ali and A. Razzaq. 1991. Effect of non-genetic factors on milk yield of Holstein cows in Pakistan. Pak. J. Agric. Res. 12: 141.

Majeed, M., A.G.K. Garlic and I.R. Khan. 1961. Seasonal trends in frequency of estrous of buffaloes and cows. Agriculture Pakistan, XII (2): 181.

Logar-A., A. Oresnik and M. Kovac. 2000. Fertility and milk yield of cows in Bohinj area. Zbornik-Biotehniske – Fakultete – Univerze – v - Ljubljani. Kmetijstvo. 76(2): 119.

Madibela, O.R., W.S. Boitumalo and B. Kiflewahid. 2001. Reproductive performance of Tswana and Simmental x Tswana crosses in smallholder farms in Botswana. Gaborone, Botswana. Livestock Res. Rural Dev. 13:5,1.

Ponce, D.L.R. and G. Guzman. 1991. Heritabilities and factors affecting longevity and lifetime reproductive performance in Holstein cows. Cuban J. Agric. Sci. 25: 237.

Qureshi, M.S., J.M. Khan, I. . Khan, R.A. Chaudhry, K. Ashraf and B.D. Khan. 2002. Improvement in economic traits of local cattle through crossbreeding with Holstein Friesian semen. Pak. Vet. J. 22: 1, 21.

Rafique, M., K.R. Chohan and Q.Z. Chaudhry. 2000. Factors affecting age at maturity and age at first conception in Holstein Friesian x Sahiwal crossbreds. Pak. Vet. J. 20(1): 4.

Raheja, K.L., E.B. Burnside and L.R. Shaeffer. 1989. Heifer fertility and its relationship with cow fertility and production traits in Holstein dairy cattle. J. Dairy Sci. 72: 2665.

Rizzi-R., A. Bagnato, F. Cerutti and J.C. Alvarez. 2002. Lifetime performances in Carora and Holstein cows in Venezuela. J. Anim. Breed.Gen.119: 2, 83.

Singh, V.P., R.V. Singh, C.V. Singh and S.P. Singh. 1990. Genetic studies on reproductive efficiency traits in Sahiwal and in crosses with Jersey and Red Dane. Indian J. Anim. Sci. 60: 90.

Subbotin, A.D. and I.I. Sokolovskaya. 1999. Insemination of cows in relations to season of the year and ovulation characteristics. Zootekhniya No. 11, 27-30.

Tahir, M., N.N. Ahmed, S.I.H. Shah and T. Hussain. 1983. Comparative study on age and body weight at maturity and at first calving of pure and crossbred Sahiwal heifers under sub-tropical environmental conditions. Pak. Vet. J. 3(2): 76.

Tahir, M., M.R. Qureshi and W. Ahmad. 1989. Some of the environmental factors influencing milk yield in Sahiwal cows. Pak. Vet. J. 9: 173.

Talbott, C.W., M.Z. Chaudhry, R.E. McDowell and B.T. McDenial. 1997. Potential to increase milk yield in tropical countries with indigenous dairy cattle. The Sahiwal Model. J.Anim. Plant Sci. 7(1-2): 1.

Xi, X.D., L. Ma, G.Q. Zhou, C.L. Chen and G.M. Wei. 2003. Fertility of Holstein cows in Chengdu. Asian-Austral. J. Anim. Sci. 16: 2,185.