Pakistan Vet. J., 25(2): 2005

PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF HOLSTEIN-FRIESIAN COWS IN PAKISTAN

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ABSTRACT

Productive and reproductive performance parameters of Holstein-Friesian cows kept at the Livestock Experiment Station, Bhunikey (Pattoki), District Kasur for the period from 1991 to 2000 were studied. The average values for age at maturity, age at first conception and age at first calving were 652.70 ± 6.98, 714.74 ± 9.72 and 987.87 ± 9.81 days, respectively and the differences of these parameters during different seasons of birth were statistically non-significant. The average calving to first insemination interval, service period and calving interval in these cows were 113.34 ± 3.45, 222.22 ± 6.87 and 505.02 ± 8.28 days, respectively. Effect of parity on these parameters was statistically non-significant. On the other hand, the effect of calving season on calving to first insemination interval, service period and calving interval was statistically significant ($P<0.05$). The cows calving during humid hot season showed significantly ($P<0.05$) lower calving to first insemination and calving interval as compared to those calving during winter and spring seasons. The cows calving during autumn and humid hot seasons showed significantly ($P<0.05$) lower service period as compared to those calving during winter and spring seasons. The average number of services per conception was 3.07 ± 0.10. The differences of the number of services per conception during 6^{th} lactation with those of 1^{st} and 8^{th} lactation were statistically significant ($P<0.05$). The average gestation period was 278.61 ± 0.29 days. Higher gestation period was observed in cows carrying male calves than cows carrying female calves and this difference was statistically non-significant. The average lactation length and dry period were 291.86 ± 6.55 and 224.99 ± 10.00 days, respectively, while the average lactation milk yield was 2772.76 ± 65.00 liters. The differences of lactation milk yield between 7^{th} and 3^{rd} lactation were statistically significant ($P<0.05$). Similarly, the lactation milk yield during 6^{th} lactation was significantly ($P<0.05$) lower from those of 3^{rd}, 4^{th} and 5^{th} lactations. The frequencies of calving during winter, spring, dry hot, humid hot and autumn seasons were 17.73, 16.35, 7.92, 35.45 and 22.55%, respectively.

Key words: Reproduction, production, Holstein-Friesian cows, performance.

INTRODUCTION

Out of 23.8 million heads of cattle population in Pakistan (Anonymous, 2004), about 70% are of non-descript type. These animals are late maturing and poor milk yielders. To upgrade their reproductive and productive potential, a cross breeding programme with exotic temperate breeds was initiated in early seventies by importing frozen semen of Jersey and Friesian bulls. During 1985, a herd of 86 adult pregnant Holstein-Friesian cows was imported from USA for the production of genetically superior bulls to ensure the regular and adequate supply of semen for cross breeding. About 5-6 generations of these imported cows have been produced in the subtropical environment of the Livestock Experiment Station, Bhunikey (Pattoki), District Kasur, Pakistan. Various parameters of reproductive and productive performance in imported Holstein-Friesian cows and their local born progenies have been studied for the period from 1985 to 1991 (Haq *et al*., 1993).

The present study was designed to evaluate and to compare various parameters of reproductive and productive performance in Holstein-Friesian cows being maintained at the Livestock Experiment Station, Bhunikey (Pattoki), District Kasur, Pakistan for the period from 1991 to 2000. The information thus obtained would further throw light on the adaptability of these cows under local conditions of Punjab.

MATERIALS AND METHODS

The data concerning reproductive and productive performance of Holstein-Friesian cows being maintained at the Livestock Experiment Station,

Bhunikey (Pattoki) District Kasur, Pakistan were collected for the period from 1991 to 2000. The parameters of reproductive and productive performance, i.e., age at maturity, age at first conception, age at first calving, calving to first insemination interval, services per conception, service period, gestation period, calving interval, lactation length, dry period, lactation milk yield and frequency of calving were studied. The data on age at maturity, age at first conception and age at first calving were split according to the season of birth, while data on calving to first insemination interval, service period and calving interval were grouped according to the season of calving. Similarly, the possible effects of parity on number of services per conception, calving to first insemination interval, service period and calving interval were also studied.

To determine the effect of season of birth and/or calving on various parameters, the months of the year were grouped in five seasons (Thevamanoharan *et al*., 2001), as follows:

1.	Winter	December and January
2.	Spring	February, March and April
3.	Dry hot summer	May and June
4.	Humid hot summer	July, August and September
5.	Autumn	October and November

The arithmetic means, with standard error (± SE), for the above mentioned reproductive and productive parameters were calculated. Statistical analysis was done using analysis of variance technique and significant results were subjected to Duncan's multiple range test (Steel and Torrie, 1984).

RESULTS ANDS DISCUSSION

Age at maturity

The average age at maturity in 236 Holstein-Friesian heifers was 652.70 ± 6.98 days, ranging from 356 to 1077 days. Chaudhry and Ahmad (1994) recorded almost similar findings in crossbred heifers in Pakistan. Higher age at maturity (987.22 ± 14.77 days) was reported by Azam *et al*. (2001) in Bhagnari heifers in Pakistan. On the other hand, lower values (18.3 months) were reported by Ozbeyaz *et al*. (1996) in Swiss Brown heifers.

When the data were grouped to observe the effect of season of birth on age at maturity, the highest (674.67 ± 16.08 days) and the lowest (638.09 ± 14.07 days) values were observed in heifers born during humid hot and winter seasons, respectively (Table 1), the difference was non-significant. Similarly, Sattar *et al*. (2004) reported that the effect of season of birth on age at maturity was non-significant in Jersey heifers in Pakistan.

Age at first conception

The average age at first conception in 236 Holstein-Friesian heifers was 714.74 ± 9.72 days, ranging from 421 to 1819 days. Rafique *et al*. (2000) reported almost similar values in crossbred heifers in Pakistan. Higher age at first conception (828.5 ± 233.1 days) was reported by Chaudhry and Ahmad (1994) in crossbred heifers in Pakistan. On the other hand, Haq *et al*. (1993) recorded lower age at first conception (502.93 ± 11.71 days) in Holstein-Friesian heifers in Pakistan.

When the data were grouped to observe the effect of season of birth on age at first conception, the longest (733.58 ± 18.04 days) and the shortest (670.24 ± 20.74 days) values were observed in heifers born during humid hot and dry hot seasons, respectively, however, the difference was non-significant (Table 1). Similarly, Rafique *et al*. (2000) reported that the effect of season of birth on the age at first conception in crossbred heifers was non-significant.

Age at first calving

The average age at first calving in 190 Holstein-Friesian heifers was 987.87 ± 9.81 days, ranging from 701 to 1483 days. These findings are in line with those recorded by Njubi *et al*. (1992) in Jersey heifers in Kenya. Higher age at first calving (1017 ± 43.8 days) was reported by Morsy *et al*. (1986) in Friesian heifers. On the other hand, Juneja *et al*. (1991) and Haq *et al*. (1993) reported lesser age at first calving in Friesian heifers (822 and 787 days, respectively).

When the data were grouped to observe the effect of season of birth on age at first calving, the longest (1013.91 ± 21.45 days) and the shortest (939.36 ± 29.05 days) ages at first calving were observed in heifers born during humid hot and dry hot seasons, respectively, the difference was, however, non-significant (Table 1). Similarly, Haq *et al*. (1993) and Sattar *et al*. (2004) recorded non-significant effect of season of birth on age at first calving in Friesian and Jersey heifers in Pakistan, respectively.

Calving to first insemination interval

The average calving to first insemination interval for 508 records was 113.34 ± 3.45 days, ranging from 45 to 508 days. These findings are in line with those recorded by Rafique *et al*. (2000a) in crossbred cows in Pakistan. Chaudhry and Ahmad (1994) reported higher calving to first insemination interval in Sahiwal and crossbred cows (211.5 ± 132.2 and 154.8 ± 52.0 days,

Table 1: Effect of season of birth and calving on subsequent reproductive traits in Holstein-Friesian cows (mean ± SE)

Season	Effect of birth season			Effect of calving season		
	Age at maturity (days)	Age at first conception (days)	Age at first calving (days)	Calving to first insemination interval (days)	Service period (days)	Calving interval (days)
Winter	638.09 ± 14.07[a] (56)	724.11 ± 27.22[a] (56)	984.82 ± 20.36[a] (49)	136.34 ± 9.87[a] (83)	260.74 ± 17.33[a] (83)	545.84 ± 21.78[a] (56)
Spring	655.47 ± 14.57[a] (45)	691.07 ± 17.62[a] (45)	968.91 ± 20.04[a] (35)	124.32 ± 8.68[a] (79)	273.18 ± 17.29[a] (79)	550.33 ± 18.40[a] (60)
Dry hot	660.88 ± 23.70[a] (17)	670.24 ± 20.74[a] (17)	939.36 ± 29.05[a] (11)	113.45 ± 9.68[ab] (49)	239.37 ± 21.63[ab] (49)	511.66 ± 26.34[ab] (35)
Humid hot	674.67 ± 16.08[a] (57)	733.58 ± 18.04[a] (57)	1013.91± 21.45[a] (43)	96.08 ± 4.01[b] (182)	190.46 ± 10.35[c] (182)	473.24 ± 12.58[b] (135)
Autumn	641.26 ± 13.26[a] (61)	718.41 ± 17.35[a] (61)	992.25 ± 19.54[a] (52)	116.47 ± 9.04[ab] (115)	202.38 ± 15.33[bc] (115)	492.39 ± 19.88[ab] (75)
Overall mean	652.70 ± 6.98	714.74 ± 9.72	987.87 ± 9.81	113.34 ± 3.45	222.22 ± 6.87	505.02 ± 8.28

Values with different superscripts in the same column differ significantly (P<0.05) and values sharing at least one superscript in a same column differ non-significantly.
Number of available records is given in parenthesis.

respectively). On the other hand, Sattar *et al*. (2004) recorded lower value (86.65 ± 1.71 days) of calving to first insemination interval in Jersey cows in Pakistan. This variation might be due to differences in breed characteristics and fertility status of the breeding cows.

When the data were grouped to observe the effect of calving season on subsequent calving to first insemination interval, the highest (136.34 ± 9.87 days) and the lowest (96.08 ± 4.01 days) values were observed in cows that calved during winter and humid hot seasons, respectively. These values were significantly (P<0.05) lower for the cows calved during humid hot season than those calved during winter and spring seasons (Table 1).

When the data were grouped to observe the effect of parity on calving to first insemination interval, the longest (126.14 ± 6.75 days) and the shortest (62.67 ± 4.70 days) calving to first insemination intervals were observed during 2nd and 9th lactation, respectively, the difference was statistically non-significant (Table 2). However, the number of cows in 9th lactation (i.e. 3) was too small to draw any definite conclusion. But Rafique *et al*. (2000a) reported a significant effect of parity on calving to first insemination interval in crossbred cows in Pakistan.

Number of services per conception

The average number of services per conception for 554 records was 3.07 ± 0.10, ranging from 1 to 17. Almost similar findings (3.10 services per conception) were recorded by Saha and Parekh (1988) in crossbred cows in India. However, Mangurkar *et al*. (1987) and Garcia and Velez (1988) reported lower (1.50 and 1.80) number of services per conception in Friesian cows. These differences might be due to variations in the management, environment and fertility status of the breeding cows.

When the data were grouped to observe the effect of parity on the number of services per conception, the highest (3.85 ± 0.80) and the lowest (2.00 ± 0.63) values were observed in cows during 6th and 8th lactation, respectively (Table 2). The value was significantly higher (P<0.05) during 6th lactation than for 1st and 8th lactation. Ozbeyaz *et al*. (1996) reported that number of services per conception increased with age and parity in Swiss Brown cows.

Service period

The average service period for 508 records in Holstein-Friesian cows was 222.22 ± 6.87 days, ranging from 46 to 828 days. Similarly, Mustafa *et al*. (2003) reported 235.87 ± 14.05 days service period in Red Sindhi heifers in Pakistan. Gogoi *et al*. (1993) reported longer service period (280 days) in Jersey cows in India, while Juneja *et al*. (1991) and Haq *et al*, (1993) reported shorter (156 and 161 days) service period in Friesian cows in India and Pakistan, respectively.

When the data were grouped according to the season of calving, the longest (273.18 ± 17.29 days) and shortest (190.46 ± 10.35 days) service periods were observed in cows previously calved during spring and humid hot seasons, respectively (Table 1). The service period of cows previously calved during humid hot season was significantly (P<0.05) lower as compared to those of winter, spring and dry hot season calvers. Similarly, the service period of cows previously calved during autumn was also significantly (P<0.05) lower when compared with that of winter and spring seasons. Ozcelik and Arpacik (1996) reported significantly longer service period in spring and summer than autumn and winter in Holstein cows in Turkey. The variations in service period might be due to differences in the management, environment and fertility status of the breeding cows.

When the data were grouped to observe the effect of parity on service period, the longest (242.75 ± 12.33 days) and the shortest (62.67 ± 4.70 days) service periods were observed in cows during 2nd and 9th lactation, respectively, the difference was statistically non-significant (Table 2). However, Rafique *et al*. (2000a) reported significant effect of parity on service period in crossbred cows.

Gestation period

The average gestation period for 581 records was 278.61 ± 0.29 days, ranging from 260 to 300 days. Haq *et al*. (1993) reported similar findings in Holstein-Friesian cows. Dutta *et al*. (1989) reported longer gestation period (281.9 ± 1.5 days) in Jersey cows in India. But Juneja *et al*. (1991) reported shorter gestation period (266 ± 47.7 days) in Friesian cows in India. In the present study, higher gestation period (279.04 ± 0.41 days) was observed in cows carrying male calves than those carrying female calves (278.19 ± 0.42 days) and this difference was statistically non-significant. Similar findings were made by Haq *et al*. (1993) and Sattar *et al*. (2004) in Friesian and Jersey cows, respectively.

In the present study, the frequencies of calving during winter, spring, dry hot, humid hot and autumn seasons in Holstein-Friesian cows were 17.73, 16.35, 7.92, 35.45 and 22.55%, respectively. These findings are also in line with those reported by Sattar *et al*. (2004) in Jersey cows.

Calving interval

The average calving interval for 361 records was 505.02 ± 8.28 days, ranging from 317 to 1098 days. Morsy *et al*. (1986) recorded almost similar (522 ± 39.9 days) values in Friesian cows. But Juneja *et al*. (1991) reported shorter (417 days) calving interval in Friesian cows in India.

When the data were grouped to observe the effect of calving season on subsequent calving interval, the longest (550.33 ± 18.40 days) and the shortest (473.24 ± 12.58 days) calving intervals were observed in cows calved during spring and humid hot seasons, respectively (Table 1). The calving interval of the cows previously calved during humid hot season was significantly (P<0.05) lower as compared with those of winter and spring season calvers. Jahageerdar *et al*. (1996) reported non-significant effect of calving season on calving interval in Holstein-Friesian cows. The difference of this study with those reported by other workers might be due to differences in the management and environment.

When the data were grouped according to the parity, the longest (521.96 ± 23.09 days) and shortest (331.00 ± 1.00 days) calving intervals were observed in cows during 4th and 9th lactation, respectively (Table 2), the differences was statistically non-significant. Ozbeyaz *et al*. (1996) reported that the length of calving interval increased with parity in Swiss Brown Cattle. Sattar *et al*. (2004) also reported significant effect of parity on calving interval in Jersey cows.

Lactation length

The average lactation length for 294 records was 291.86 ± 6.55 days. Alim (1985) reported almost similar findings (293 ± 3 days) in Friesian cows in Libya. Juneja *et al*. (1991) recorded longer (344 days) lactation length in Friesian cows in India. But Sattar *et al*. (2004a) reported shorter (247.33 days) lactation length in Jersey cows in Pakistan.

When the data were grouped according to the parity, the longest (319.21 ± 12.29 days) and shortest (220.00 ± 32.77 days) lactation lengths were observed in cows during 1st and 7th lactation, respectively (Table 2). The lactation length during 1st, 3rd and 5th lactations were significantly (P<0.05) longer when compared with that of 7th lactation. But Sattar *et al*. (2004a) reported non-significant effect of parity on lactation length in Jersey cows in Pakistan.

Dry period

The average dry period for 298 records in Holstein-Friesian cows was 224.99 ± 10.00 days. Gogoi *et al*. (1993) reported longer (233.5 days) dry period in Jersey cows, while Juneja *et al*. (1991) and Sattar *et al*. (2004a) reported shorter (76.2 and 192.48 days) dry period in Friesian and Jersey cows in India and Pakistan, respectively**.**

When the data were grouped according to the parity, the longest (288.88 ± 79.70 days) and shortest (194.84 ± 30.65 days) dry periods were observed in cows during 6th and 4th lactation, respectively (Table 2), the difference was statistically non-significant. Similarly, Sattar *et al*. (2004a) reported non-significant effect of parity on dry period in Jersey cows in Pakistan.

Lactation milk yield

The average lactation milk yield for 499 records in Holstein-Friesian cows was 2772.76 ± 65.00 liters.

Table 2: Effect of parity on different reproductive and productive traits in Holstein-Friesian cows (mean ± SE)

Lactation #	Calving to first insemination period (days)	Services per concepti on (No.)	Service Period (days)	Calving interval (days)	Lactation length (days)	Dry period (days)	Lactation milk yield (liters)
1	83.69 ± 9.34^{a} (13)	2.24 ± 0.12^{b} (230)	177.85 ± 29.37^{a} (13)	456.85 ± 28.92^{a} (13)	319.21 ± 12.29^{a} (119)	228.36 ± 17.55^{a} (117)	2641.79 ± 105.60^{bcd} (173)
2	126.14 ± 6.75^{a} (161)	3.21 ± 0.18^{ab} (176)	242.75 ± 12.33^{a} (161)	521.48 ± 13.32^{a} (143)	256.98 ± 10.48^{cd} (87)	223.53 ± 15.68^{a} (88)	2712.89 ± 124.87^{bcd} (141)
3	109.47 ± 7.70^{a} (106)	2.84 ± 0.22^{ab} (115)	206.70 ± 14.28^{a} (106)	487.51 ± 15.14^{a} (98)	305.17 ± 11.77^{ab} (46)	225.46 ± 25.36^{a} (48)	3192.23 ± 150.93^{ab} (86)
4	117.60 ± 13.63^{a} (55)	3.32 ± 0.30^{ab} (63)	240.53 ± 22.31^{a} (55)	521.96 ± 23.09^{a} (51)	279.52 ± 16.84^{ad} (23)	194.84 ± 30.65^{a} (25)	3007.65 ± 201.07^{bc} (52)
5	100.00 ± 10.25^{a} (23)	3.42 ± 0.44^{ab} (26)	223.48 ± 28.90^{a} (23)	489.10 ± 30.26^{a} (20)	303.71 ± 24.30^{abc} (7)	218.88 ± 71.90^{a} (8)	2973.11 ± 378.53^{bc} (19)
6	105.37 ± 13.92^{a} (19)	3.85 ± 0.80^{a} (20)	238.74 ± 47.03^{a} (19)	505.59 ± 46.01^{a} (17)	248.88 ± 28.68^{bd} (8)	288.88 ± 79.70^{a} (8)	1907.78 ± 305.40^{d} (18)
7	96.21 ± 11.28^{a} (14)	2.93 ± 0.69^{ab} (14)	212.57 ± 51.20^{a} (14)	511.58 ± 58.83^{a} (12)	220.00 ± 32.77^{d} (4)	226.00 ± 75.06^{a} (4)	2230.10 ± 476.68^{cd} (10)
8	78.29 ± 8.16^{a} (7)	2.00 ± 0.63^{b} (6)	151.71 ± 44.13^{a} (7)	445.40 ± 55.14^{a} (5)	---	---	---
9	62.67 ± 4.70^{a} (3)	---	62.67 ± 4.70^{a} (3)	331.00 ± 1.00^{a} (2)	---	---	---
*	113.34 ± 3.45	3.07 ± 0.10	222.22 ± 6.87	505.02 ± 8.28	291.86 ± 6.55	224.99 ± 10.00	2772.76 ± 65.00

* = Overall mean

Values with different superscripts in the same column differ significantly (P<0.05) and values sharing at least one superscript in a same column differ non-significantly.

Number of available records is given in parenthesis.

Ramachandraiah *et al*. (1990) reported almost similar value (2824 ± 38.5 kg) in Jersey cows in India. Juneja *et al*. (1991) and Haq *et al*. (1993) reported higher lactation milk yield (3592 and 3643 kg) in Friesian cows in India and Pakistan, respectively. But Hyder and Ullah (2002) and Sattar *et al*. (2004a) recorded lower (2493.51 and 1592.21 litres) lactation milk yield for Holstein-Friesian and Jersey cows respectively, in Pakistan. The variations in lactation milk yield might be due to differences in the breed, management and environmental status.

When the data were grouped to observe the effect of parity on lactation milk yield, the highest (3192.23 ± 150.93 litres) and the lowest (1907.78 ± 305.40 litres) values were observed in cows during 3rd and 6th lactation, respectively (Table 2). The lactation milk yield during 7th lactation was significantly (P<0.05) lower when compared with that of 3rd lactation. The lactation milk yield during 6th lactation was also significantly (P<0.05) lower as compared to that of 3rd, 4th and 5th lactations. Similarly, Sattar *et al*., (2004a) reported significant (P<0.05) effect of parity on lactation milk yield in Jersey cows in Pakistan.

The present study was conducted for the period from 1991 to 2000 at the Livestock Experiment Station, Bhunikey (Pattoki), while Haq *et al*. (1993) conducted a similar study on the same Holstein-Friesian herd for the period from 1985 to 1991. The comparative performance is shown in Table 3. It is evident from the results of both the studies that the reproductive and productive performance of Holstein-Friesian herd at Bhunikey is declining gradually, indicating that the managemental practices at the farm need to be improved for better reproductive and productive performance of the herd.

Acknowledgements

Acknowledgements are due to Dr. Khalid Javed for his valuable technical assistance in the analysis of data and Mr. Muhammad Ramzan for his help during the project.

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Table 3: Comparative reproductive and productive performance (mean ± SE) of Holstein-Friesian cows during 1985-1991 and 1991-2000 at the Livestock Experiment Station, Bhunikey (Pattoki), District Kasur, Pakistan

Reproductive/productive performance parameters	Study period	
	1985-1991*	1991-2000**
Age at maturity (days)	----	652.70 ± 6.98
Age at first conception (days)	502.93 ± 11.71	714.74 ± 9.72
Age at first calving (days)	787.38 ± 13.61	987.87 ± 9.81
Calving to first insemination interval (days)	----	113.34 ± 3.45
Number of services per conception	1.76 ± 0.10	3.07 ± 0.10
Service period (days)	161.48 ± 14.45	222.22 ± 6.87
Gestation period (days)	278.65 ± 0.78	278.61 ± 0.29
Calving interval (days)	443.77 ± 18.67	505.02 ± 8.28
Lactation length (days)	----	291.86 ± 6.55
Dry period (days)	192.71 ± 18.14	224.99 ± 10.00
Lactation milk yield (litres)	3643.28 ± 121.26	2772.76 ± 65.00

* = Haq *et al.* (1993) ** = Current study

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