ENVIRONMENTAL FACTORS AFFECTING MILK YIELD IN FRIESIAN COWS IN PUNJAB, PAKISTAN

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ABSTRACT

Data on 823 performance records of 537 Friesian cows maintained at the Livestock Experiment Station Bhunikey (Pattoki) District Kasur during the years from 1984 to 2001 were used to investigate various sources of variation for milk yield. The Harvey's least squares analysis was carried out. The least squares means for milk yield and lactation length were 3391.66 ± 137.97 kg and 278.40 ± 90.17 days, respectively. The two traits were significantly correlated with each other having a correlation coefficient of 0.61 ($P<0.01$). Lactation length and lactation number were significant ($P<0.01$) sources of variation for milk yield. The influence of year and season of calving on milk yield was also significant ($P<0.01$). The milk yield was the highest (3659.48 ± 153.47 kg) among the cows calving during autumn and the lowest (3249.36 ± 151.83 kg) among those calving during humid hot season. The cows calving during spring, winter and dry hot seasons yielded 3424.38 ± 188.16, 3345.91 ± 140.12 and 3279.18 ± 201.29 kg of milk, respectively.

Key words: Friesian cows, milk yield, season, parity.

INTRODUCTION

Out of 22.8 million heads of cattle population in Pakistan (Anonymous, 2002), about 72% are of nondescript type. These animals are late maturing and poor milk yielders. In order to upgrade their production potential, a cross breeding programme with exotic temperate dairy breeds was initiated in early seventies by importing frozen semen of Jersey and Friesian cattle. To cope with the demand of exotic cattle semen, a herd of 86 adult pregnant Friesian cows was imported from USA during 1985 for the production of genetically superior bulls to ensure the regular and adequate supply of semen for cross breeding in canal irrigated area of the Punjab and other provinces. About 5 to 6 generations of these imported cows have been produced in the sub-tropical environment of central Punjab.

A number of environmental factors like year and season of calving, length of lactation and parity (Javed *et al.*, 2000) are known to exert influence on the performance of dairy animals. As the Friesian breed is a temperate breed of cattle, the present study was planned to investigate the effect of various environmental factors on milk yield of this breed under sub-tropical conditions of central Punjab. The information so generated will be useful in formulating the future breeding programme for genetic improvement of our local non-descript cattle through cross breeding in canal irrigated area of the Punjab.

MATERIALS AND METHODS

The data on 823 performance records of 537 Friesian cows maintained at the Livestock Experiment Station Bhunikey (Pattoki) District Kasur during the period from 1984 to 2001 were utilized for the present study. A herd of 86 cows was imported from USA where they had completed their first lactation. Data on milk yield of individual cow during the years 1997 through 1999 were not available, partially because the individual recording system of milking machine was not in order. The data on animal identity, dates of birth of sire, dam, paternal grand sire and dam, milk yield, dates of calving and drying were collected. The data were analyzed to investigate various sources of variation for milk yield and lactation length. The year of calving was divided into five seasons namely winter (December to February), spring (March to April), dry hot (May to June), humid hot (July to September) and autumn (October to November), as described by Javed *et al.* (2002). The least squares analysis was performed to study the environmental effects on milk yield using Least Squares and Maximum Likelihood (LSMLMW)

computer software package (Harvey, 1990). The mathematical model assumed was:

$Y_{ijk} = \mu + F_j + \varepsilon_{ijk}$

Where:

Y_{ijk} = measurement of a particular trait
μ = population mean
F_j = effect of all fixed effects (year/season of calving, length of lactation, parity)
ε_{ijk} = random error with mean zero and variance σ^2_E

RESULTS AND DISCUSSION

Unadjusted and least squares means for milk yield were 3463.71 ± 1074.85 and 3391.66 ± 137.97 kg, respectively with 31.03% coefficient of variation (CV) in the present herd. The least square means for milk yield are presented in Table 1. Least squares means for milk yield showed much fluctuations in different years. The cows calved during the year 1984 produced maximum milk (6868.00 ± 234.46 kg). The milk yield dropped to 5454.93 ± 197.93 kg for the cows calved during 1985. Thereafter, a gradual decrease in milk yield was observed and milk yield averaged 3573.68 ± 192.69 kg during the year 1990. After a slight increase during 1991, a drop in milk yield was observed and it reached its minimum value (766.49 ± 552.46 kg) during the year 1998, when only four calvings occurred with complete lactation record. During the years 1999 through 2001, a gradual increase in milk yield was recorded with some fluctuations.

The results of analysis of variance for milk yield revealed that variability due to the year of calving was significant ($P<0.01$). There results are in conformity with those of Rege (1991) and Javed *et al.* (2002), who reported similar findings in Friesian (Kenya) and Jersey (Pakistan) breeds of cattle, respectively. The variation in milk yield observed in different years reflected the level of management, as well as environmental effects. The level of management is bound to vary according to the ability of farm manager, his efficiency in the supervision of the labour, system of crop husbandry, method and intensity of culling and use of financial resources (Khan, 1986).

The herd under study was imported from temperate zone (United States of America) and was kept in the subtropical environment of central Punjab, where ambient temperature often rises up to 45°C in summer months. Genotype X environment interaction is potentially extremely important in cattle breeding in the tropics. The animals of temperate regions maintained in tropical conditions cannot behave similarly in both the environments (Javed *et al.*, 2002). The import of temperate breeds to tropical environments is often trouble making. According to Payne and Hodges (1997), temperate type nucleus units of cattle

Table 1: The least squares means for milk yield of Friesion cows during different years and seasons of calving and parities

Year of calving	No. of records	L S Mean ± SE (Kg)	Season of calving	No. of records	L S Mean ± SE (Kg)
1984	34	6868.00 ± 234.46	Winter	277	3345.91 ± 140.12
1985	58	5454.93 ± 197.93	Spring	86	3424.38 ± 188.16
1986	61	3981.12 ± 203.98	Dry hot	54	3279.18 ± 201.29
1987	40	4021.13 ± 218.98	Humid hot	226	3249.36 ± 151.83
1988	47	3893.22 ± 199.04	Autumn	180	3659.48 ± 153.47
1989	42	3840.19 ± 208.22	Total	823	
1990	52	3573.68 ± 192.69			
1991	45	3746.73 ± 198.78	**Parity**		
1992	59	3083.89 ± 179.76	1	297	3116.48 ± 94.69
1993	58	3011.87 ± 176.33	2	228	3197.53 ± 110.40
1994	64	2792.56 ± 170.09	3	140	3658.52 ± 119.94
1995	69	2862.77 ± 172.18	4	89	3543.80 ± 141.57
1996	62	2498.15 ± 176.84	5	37	3539.92 ± 199.91
1997	11	2136.19 ± 351.33	6	20	2978.52 ± 259.27
1998	4	766.49 ± 552.46	7	10	3513.13 ± 355.71
1999	43	2946.08 ± 203.97	8	2	3585.41 ± 777.43
2000	55	3193.80 ± 186.89	Total	823	
2001	19	3061.27 ± 281.29			
Total	823				

established by governments where improved management was not given, the pure-bred imported cattle were often dying. The more tragic dimension to this practice arose when such cattle were introduced into farming systems where there were no options for changing the environment to level needed for animals of temperate breeds. Vaccaro (1979) also concluded that the performance of temperate dairy cattle in the tropical areas of Latin America was disastrous. Vaccaro (1990) further reviewed the survival rates of European breeds and there crosses with Zebu in the tropics and reported that pure-bred temperate cows suffered unacceptably high losses, were unable to replace themselves and were not a viable option. This indicated that the animals of temperate zone did not adapt to the harsh environments of tropics and could not perform satisfactorily.

The milk yield was the highest (3659.48 ± 153.47 kg) among the cows calving during autumn and the lowest (3249.36 ± 151.83 kg) among those calving during humid hot season (Table 1). The maximum number of calvings (33.7%) were recorded in winter, followed by humid hot season in which 27.5% of cows calved. The calvings were the lowest (6.6%) during dry hot, while during spring and autumn seasons these were 10.4 and 21.8%, respectively. Although the cows continued breeding throughout the year, yet about 66% of them calved during winter, spring and autumn seasons when the ambient temperature was mild.

The least squares analysis revealed that season of calving had a significant ($P< 0.01$) effect on lactation milk yield. Murdia and Tripathi (1991) and Javed *et al.* (2002) also reported similar findings in Jersey cattle in India and Pakistan, respectively. However, Panneerselvam *et al.* (1990), Rege (1991) and Ahmad (1998) reported a non-significant effect of season of calving on milk yield in Tharparkar (India), Friesian (Kenya) and Red Sindhi (Pakistan) cows, respectively.

Seasonal variation in animal performance in tropics is expected to be primarily a manifestation of variation in feed quality and quantity (Javed *et al.*, 2000). The present results suggested that milk yield was sensitive to seasonal variation. Generally, the cows calving in autumn produced the maximum milk, apparently due to low environmental temperature and availability of good quality fodder. The animals that calved in spring were next in order of merit. The cows calving in dry hot and humid hot seasons were the poorest producers. The cows calving during summer season would have gone through the last trimester of the gestation period during the scarcity period of fodder and severe dry and humid hot season and were immediately confronted with the dry and second scarcity of fodder period (November-December) as they approached peak lactation.

Thermal stress may also explain seasonal variation in performance in the region where the present herd was being maintained, dry months are invariably the hottest months. Thus, a combination of nutritional inadequacy and thermal stress may well explain the seasonal variation in performance of the Friesian cows. This is even more likely given that ambient temperatures around $40^{o}C$ or even higher are not uncommon in this region and dry periods longer than three months often occur. These results indicate that calving in summer months is undesirable. Efforts should be diverted to the conservation of feed and feed supplements during the scarcity periods, in addition to provision of shade for reducing the thermal stress. Moreover, breeding should be in a way that most calvings occur in autumn, winter or spring seasons. This may eliminate seasonal and nutritional stress on Friesian cows.

The least squares analysis revealed that parity also had a significant effect ($P<0.01$) on milk yield. The trend of milk yield associated with parity followed a well-established pattern (Wood, 1969) and peak lactation and subsequent fall was similar to the pattern observed in Jersey cows in Pakistani environment (Javed *et al.*, 2002).

Milk yield was 3116.48 ± 94.69 kg in the first lactation. The lactation milk yield peaked in third lactation (3658.52 ± 119.94 kg). It is evident that milk yield remained fairly constant from third to fifth lactation. Thereafter, there was a decline in sixth lactation with an increase in later lactations. This discrepancy may be due to the small data for sixth and seventh lactation and high standard error is an indication of that.

The unadjusted mean for milk yield was 3463.71 ± 1074.85 kg, with 31.03% CV. The lactation length averaged 278.40 ± 90.17 days. The correlation between lactation length and milk yield was 0.61, indicating a high relationship between the two traits. The least squares analysis of variance for milk yield revealed that regression of lactation milk yield on lactation length was significant ($P<0.01$). There was an increase of 12.93 ± 0.45 kg in milk yield with each day increase in the lactation length. Khan *et al.* (1991) and Javed *et al.* (2002) have reported similar findings in Friesian and Jersey cattle respectively, in Pakistan.

Although, milk yield increased with increase in lactation length, yet it did not seem advantageous to have lactations exceeding one year. The daily milk yield in the later stages of lactation decreases and hence affects the lifetime production. Moreover, longer lactations prolong the calving interval, thereby decreasing the number of calves that could be obtained during the life span of a cow. Therefore, attempts

should be made to select cows on the regularity in breeding so that they should produce calves each year with a lactation period of about ten months.

The import of temperate breeds in tropics is not a viable option if proper and improved management is not provided. The improvement of our indigenous cattle breeds can be brought about through selection and use of selected breeding bulls through progeny testing or animal model evaluations.

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