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Some Non-Genetic Factors affecting Milk Production of Friesian Herds

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Abstract

Records representing 3198 and 11100 Friesian cows from herds maintained at Egypt and Germany were analysed to determine the effects of parity, season and year of calving and farm on milk production. The least squares means of milk production was 2875 ± 15 and 6708 ± 14 kg in Egyptian and German Friesian herds, respectively. Least squares analysis of variance showed significant effects ($P<0.05$ & $P<0.01$) of all factors on milk production. Least squares analysis indicate that the winter and autumn seasons showed the highest milk yield producing cows, being 3052 and 2995 kg, respectively in Egypt, while in Germany, the autumn season had the highest milk production, while the lowest was in summer calvers, being 6903 and 6511 kg, respectively. It could be seen that there were significant differences between farms in Egypt as well as in German farms. German herds apparently had the highest milk production compared to the Egyptian Friesian herds.

1 Introduction

Milk yield is influenced by many environmental factors. It is therefore essential to consider environmental factors influencing milk production in the model . Milk production is affected by these factors in various ratios according to tropical or mild area conditions. We analysed two sets of different data in Egypt and Germany to show these effects. In this way it is possible to develop general management programs and to make suitable adjustments in the data to obtain precise estimates of genetic parameters which are needed for genetic evaluation of breeding animals. The present investigation was an attempt to study the effect of some non-genetic factors affecting milk production in different Friesian herds in Egypt and Germany.

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2 Materials and Methods

The data used in this study were taken from the milk records of Friesian cows in two locations. The first location was Sakha and El-Karada farms which are located in the northern part of the Nile-Delta, through the period 1970 to 1987. These herds belong to the Animal Production Research Institute, Ministry of Agriculture, Egypt. The nucleus of these herds was imported to Egypt from the Netherlands as pregnant heifers during the period from 1959 to 1961. Animals were fed on Egyptian clover (Trifolium alexandrinum) with wheat or rice straw from the beginning of December till the end of May. From the beginning of June till the end of November, animals were fed on a concentrate mixture, rice or wheat straw and limited amount of clover hay when available. Water was allowed to animals freely all the time.

The second location was Osnabrück where data was collected from **VIT** (Vereinigte Informationssysteme Tierhaltung, Verden) from 12 farms in Germany over a period from 1979 to 1990 (Table 1). The **VIT** is responsible for the estimation of the breeding values for different states in Germany. The data originated from different farms in one sub-region. The animals were fed concentrates in summer and autumn according to the performance in addition to the grassland. In the winter the animals were fed concentrates and conserved feed. The data were adjusted for herd-class before analysis.

On the basis of prevailing climatic conditions (Table 2), the year was classified into four seasons in Egypt, winter (December - February), spring (March - May), summer (June - August) and autumn (September - November) and into three seasons in Germany, winter (January - March), summer (April - August) and autumn and beginning of early winter (September - December). Each lactation was identified by the parity of cow from 1 to 5 in Egyptian herds and from 1 to 3 in German herds.

The effects of parity, season and year of calving and farm on milk production were examined using least square technique of fitting the constants (Harvey, 1990). The following mathematical model was used:

$$Y_{ijklm} = \mu + p_i + s_j + y_k + f_l + e_{ijklm}.$$

Where: Y_{ijklm} = the performance of observation; μ = the overall mean; p_i = is the effect of the dam's parity; s_j = the effect the season of calving; y_k = the effect of the year of calving; f_l = the effect of the farm and e_{ijklmn} = the random error. All effects in the model except error were treated as fixed.

Table 1: Number of observations, means, standard deviation (S.D) and coefficients of variability (C.V%) of unadjusted milk production in Friesian cows

Item	F^1	F^2
No. of records	3198	11100
Actual mean of milk production	2745	6513
S.D	765	1328
C.V%	27.87%	20.39%
year of calving	1970-1987	1979-1990
Parity	1-5	1-3
season of calving	4	3
Farms	2	12

F^1= Egyptian Friesian cows and F^2= German Friesian cows

Table 2: Average daily weather observations for different seasons in Egypt

Season	Air temperature		Humidity %		Rain
	Max.	Min.	7:30 AM	13:30 PM	mm/d
Winter	20	8.5	73.16	49.53	0.833
Spring	24.3	9.8	71.03	45.97	0.233
Summer	30.8	18.3	74.67	33.53	0.000
Autumn	29.8	15.4	75.16	49.60	0.020

3 Results and Discussion

The results of least squares means with standard errors are given in Tables (3) and (4), respectively, and those of analysis of variance is presented in Table (5). The overall mean for milk yield in the present study was 2875±15 kg for Friesian herds in Egypt. This is in agreement with that observed by Thorpe et al., (1994) in Kenya on Friesian cows (2826 kg) and was lower than reported by Visscher and Goddard (1995) on Friesian cows in Australia and Amin et al., (1996) on Hungarian Friesian cows, being 3979 and 4525 kg, respectively.

Average of milk yield for German Friesian herds was 6708±14 kg. This value is higher than the average reported for Friesian cows by Geldermann et al., (1986), with German Friesian cows; Jariath et al., (1994) on Friesian cows in Florida, Amin et al., (1996) on Friesian in Hungary and Baffour-Awuah et al., (1996) with British Holstein Friesian cows, ranging from 3895 to 6078 kg, while it was lower than those reported by Misztal et al., (1992) and Dimov et al., (1992) with Holstein Friesian cows, being 9239 and 9478 kg, respectively.

Effect of parity (age at calving)

Lactation order had a highly significant (P<0.01) effect on Friesian milk production in both Egypt and Germany. R^2 was 0.11 and 0.14 for milk production in Egyptian and

Table 3: Least squares mean and their standard errors (S.E) of factors affecting milk production in Friesian cows in Egypt

Independent	No.	Milk yield(kg) Mean ± SE
Overall Mean	3198	2875 ± 15
Parity		
1	1096	2404 ± 21
2	934	2793 ± 22
3	629	2996 ± 27
4	348	3098 ± 37
5	191	3083 ± 50
Season of calving		
Winter	897	3052 ± 40
Spring	975	2742 ± 47
Summer	740	2706 ± 37
Autumn	586	2995 ± 47
Farm		
Sakha	1931	2986 ± 19
El-Karada	1267	2764 ± 21
Year of calving		
1970	200	2740 ± 49
1971	279	2796 ± 41
1972	342	2670 ± 37
1973	267	2693 ± 41
1974	213	2887 ± 45
1975	206	3114 ± 46
1976	165	3183 ± 51
1977	130	3363 ± 55
1978	145	3085 ± 55
1979	104	3199 ± 65
1980	117	2765 ± 63
1981	100	2528 ± 70
1982	120	3011 ± 60
1983	132	3007 ± 60
1984	141	2706 ± 57
1985	168	2841 ± 52
1986	199	2690 ± 48
1987	162	2469 ± 52

German Friesian herds, respectively (Table 5). The present results show that the milk yield increased with the increase of lactation orders (Tables 3, 4 and Figure 1). This is logically due to increase in body weight combined with advancing age and to the full development of the secretory tissue of the udder. The present results agree with those

Table 4: Least squares mean and their standard errors (S.E) of factors affecting milk production in Friesian cows in Germany

Independent	No.	Milk yield(kg) Mean ± SE
Overall Mean	11100	6708 ± 14
Parity		
1	3700	6136 ± 20
2	3700	6646 ± 20
3	3700	7342 ± 21
Season of calving		
Winter	2980	6710 ± 22
Summer	3392	6511 ± 21
Autumn	4728	6903 ± 19
Farm		
1	595	5439 ± 44
2	770	5735 ± 39
3	1107	5941 ± 32
4	1313	6097 ± 29
5	1740	6242 ± 26
6	1788	6602 ± 25
7	1274	6883 ± 30
8	909	7060 ± 35
9	741	7293 ± 40
10	492	7446 ± 49
11	287	7939 ± 65
12	84	7819 ± 118
Year of calving		
1979	839	6639 ± 40
1980	938	6717 ± 38
1981	933	6453 ± 38
1982	704	6775 ± 42
1983	1186	6658 ± 35
1984	1078	6605 ± 35
1985	929	6774 ± 37
1986	1100	6704 ± 34
1987	808	6719 ± 39
1988	1012	6799 ± 35
1989	876	6871 ± 37
1990	697	6782 ± 41

obtained by Mbap and Ngere (1989) and Ray et al., (1992), working on Friesian and Holstein Friesian cows.

The milk yield increased with advance of age until the highest production was attained at the third lactation, as reported by Adeneye *et al.*, (1977) on Jersey cows, on the fourth lactation (KHANNA AND BHAT 1972) with Sahiwal x Holstein Friesian cattle, and on the fifth lactation as reported by Alba and Kenndy (1985) working on Criolla and Jersey cows, and Rege (1991) on Holstein Friesian cows. In addition, parity accounted for 11.7% of the total variation in milk as reported by Betro and Granade (1982) working on Holstein Friesian x Zebu cattle.

The differences in the highest lactation yields observed in different lactation orders could possibly be due to differences in age at first calving and dry period. When heifers freshen at a later age they are nearer to maturity than when they calve at an earlier age. On the other hand, the animals which have a long dry period during the first two calving intervals, also have a chance to reach their mature body weight and maximum size at an earlier lactation than the others. Accordingly, they reach their maximum productivity at earlier parities.

Effect of season of calving

The effect of season of calving was highly significant ($P<0.01$) on milk production (Table 5) and R^2 was 0.02 and 0.01, respectively. In Egypt, winter and autumn season showed the highest yielding cows, being 3052 and 2995, respectively, (Tables 3, 4 and Figure 2). The high milk yield in winter and autumn calvers could be attributed to mild climatic conditions. This is the period of abundant green fodder supply and the animals which receive good management could be expected to respond well by expressing better production potentiality, while the decrease in their milk production, in summer and autumn, may be due to the decrease in adequate good quality feeds and the high temperature.

In Germany cows in the autumn season had the highest milk production (6903 kg). It may be due to the better climatic conditions, where the amount of feed intake, concentrates and feed utilization are generally increased. With a good management system the animals could be expected to respond well expressed by better production potentiality. The decrease in milk production in summer may be due to an increase in temperature and less feed concentrates. Ray et al., (1992) and Ptak et al., (1993) arrived at the same results of the significant effect of season of calving on milk production.

Rege (1991) in a study based on 31661 lactation records of Holstein Friesian cows in Kenya, found that cows calving during the long rains (March - May) had the best performance and highest milk yield, while the performance was lowest for cows calving in the short rains (October - December). The difference of season of calving may be attributed to humidity or climatic condition and availability of food and quality folder.

Effect of farm

Differences among farms were highly significant (Table 5) for Friesian cows in both Egypt and Germany. The present results indicated that Sakha farm showed significantly higher milk production than El-Karada farm (in Egypt), but in Germany , the highest milk production was observed on Farm 11, followed by each of 12, 10 and 9 farms. Farm 5, 6, 7 and 8 were intermediate, while the differences among other farms were small.

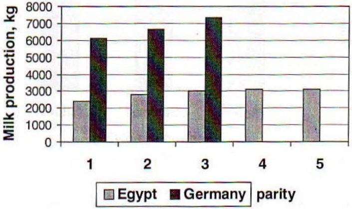

Figure 1: Milk production in different parities in Egyptian and German Friesian cows

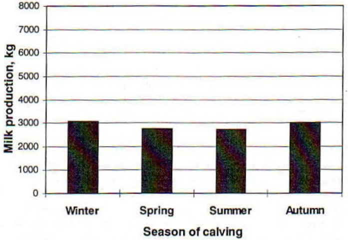

Figure 2: Milk production by season of calving in Egyptian Friesian cows

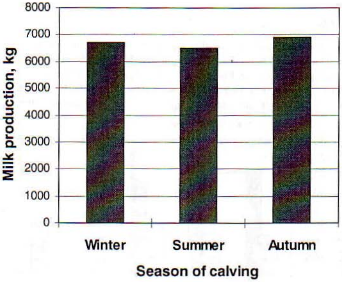

Figure 3: Milk production by season of calving in German Friesian cows

Table 5: F- ratio and coefficients of determinations of (R^2) for factors affecting milk production for Friesian cows in Egypt and Germany

	Friesian in Egypt			Friesian in Germany		
Sources	d.f	Milk yield		d.f	Milk yield	
		F	R^2		F	R^2
Parity	4	106.21**	0.11	2	1168.36**	0.14
Season of calving	3	77.21**	0.02	2	131.64**	0.01
Year of calving	17	1.69*	0.01	11	8.68**	0.01
Farm	1	20.26**	0.08	11	236.17**	0.16
Remainder	3172	0.78		11073	0.68	

* significant at ($P<0.05$). ** significant at ($P<0.01$)

The differences in milk production between farms might be due to differences in management practices. Okantah (1992) on Accra Plains cows and Ray et al., (1992) with Holstein cows, found that milk production was significantly affected by the herd. On the other hand, Amin et al., (1996) working on Holstein Friesian cows, found no significant effect of the herd on milk production. A close scrutiny of herd variation in agropastoralist herds should provide useful information for the improvement of productivity in the system.

Effect of year

Effects of the year of calving were significant ($P<0.05$ and $P<0.01$) on milk production for Friesian cows in Egypt and Germany as shown in Table (4). The present results showed that the highest milk yield production was in 1977 while the lowest was in 1987 in Egypt, while in Germany, the highest milk yield production was in 1989 and the lowest was in 1981 (Tables 3, 4).

The significant effect of year of calving on milk production was reported by Agymang et al., (1985); Khattab and Sultan, (1990); Djemali and Berger (1992) and Vaccaro et al., (1995) on different breeds of dairy cattle in different countries. In contrast, non-significant effect of year of calving on milk production was reported by Sharma et al., (1982), Johnson et al., (1987) and Amin et al., (1996).

Mohamed (1979) reported that year of calving accounted for 15.5% of the total variation on 305dMY. In addition, Copper and Hargrove (1982) using 15867 lactation records of Holstein Friesian cows, indicated that including the year of calving in the model of analysis for milk yield increased R^2 by 1% . Differences in all traits attributed to the year of calving effect were interpreted as may be due to climatic, feeding and managerial conditions which changed from one year to another.

Our results suggest that the season and year of calving, parity and farm factors are extrinsic to the animal. The significant variations in these factors can therefore be readily manipulated to improve production.

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