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Phenotypic and Genetic Parameters of some Productive Traits in a Herd of Friesian Cattle at the Tahreer Province.

M.T. Ragab [1], A.S. Abdel-Aziz, and H.M. Morad.
Dept. of Animal Porduction, Faculty of Agric., University of Cairo.

A total number of 2631 normal lactations ranging from the first to the fourth lactation produced by 1126 Freisian cows at the Tahreer Province, Egypt, were used to obtain pheuotypic and genetic parameters for some productive characters. The over-all averages of the 70-days, 305-days, and total milk yield were 790 kgs, 2804 kg, and 3055 kg, respectively. Results showed that in all cases, milk yield increased from the first to the fourth lactation. The rate of increase was more pronounced from the 1*st* to the 2*nd* lactation. The mean lactation period, preceeding dry period and calving interval during the first four lactations were 332 days, 132 days, and 464 days, respectively. Estimates of heritability were obtained only for the first lactation characters and were calculated over-all and within years. The discrepency between the estimates obtained by the two methods were due to the inflation of the sire components of variance by fractions of the year-to-year variation. Among the estimates of heritability of the milk production traits calculated within years, the 70-days milk yield gave the higest estimate (0.39). The estimate of heritability of the lactation period calculated within years was 0.54 while both the proceeding dry period and the calving interval gave zero estimates.

The importation of the Friesian cattle into Egypt started in limited numbers in the early thirties of this century in an attempt to improve milk production. Following this trend, the Tahreer Province imported large number of Dutch and Danish Friesian hiefers and cows which amounted to 1442 heads during the period from 1954 to 1964.

Many studies were made out to investigate the economic characteristics of the Freisian Cattle in Egypt (Sidky, 1950 ; El-Itriby and Asker, 1958; Ragab and Askar, 1959 ; Ragab and Sourour, 1963 ; and Fahmy *et al.*, 1963). The results aimed in general at the possibilities of breeding this breed successfully under the local conditions. As far as breeding Friesians locally, more phenotypic and geretic knowledge are still needed. Therefore, this work was carried out with the purpose of increasing such knowledge. Actually, the information drawn from the data which were obtained from a large and intergrated economic unit dealing with animal production, would certainly help decision

(1) Chairman, General Organization for Meat and Milk, Cairo, Egypt.

makers in the field of animal production to base their ideas on more realistic facts than on presumptive thoughts. The points of study were represented in milk yield, lactation period, dry period and calving interval. Also the heritability of those traits were estimated in different ways.

Material and Methods

Data

Milk records of the Friesian herd at the Tahreer Province, Egypt, were used in the present study. The number of cows included was 1126 cows having 2631 normal lactations ranging from the first to the fourth lactation and were collected over a period of ten years (1954-1963, inclusive). Lactation records shorter than 200 days and those affected by diseases were considered abnormal and were excluded.

Feeding and Management

Animals were mainly fed on Egyptian Clover or/and Alfalfa during the period from October to May. During the period from June to September, Alfalfa was the only available green fodder. Milking cows producing more than ten kilograms of milk per day and pregnant cows over seven months of pregnancy were given extra amounts of concentrates to meet their essential nutritional requirements. The concentrates used were composed of equal proportions of crushed cotton-seed cakes, wheat bran, and rice bran in addition to 0.5% salt.

Animals were housed in concrete barns. When the weather allowed, animals were put on pasture where grazing represented an essential part of the feeding and managerial practices. Cows were hand milked twice daily at 7 a.m. and 4 p.m., and milk yield was recorded individually for each cow by weighing to the nearst kilogram.

Cows were usually served two months after calving and pregnancy was diagnosed by rectal palpation sixty days after the last service. Although the general practice was to serve heifers and cows all the year around, yet most of the calvings occurred during the Autumn and Winter months.

Statistical analysis

Means, standard errors, and the analysis of variance for the traits studied were calculated after Snedecor (1956). Estimates of heritability were calculated only for the first lactation records from four times the intraclass correlation among paternal half-sibs obtained by the standard one-way classification analysis of variance among and within sires (Lush 1949). Two estimates of heritability were calculated on over all years-and within year-basis.

Results and Discussion

Productive Performance

Milk Production

The overall mean of the total milk yield was 3055 kg of milk in an average lactation period of 332 days. The average yield in 305 days was 2804 kg. Results shown in Table 1 demonstrated the increase of milk yield with the advance of age. The 305-days milk yield in the second, third and fourth lactations increased over the first lactation by 30%, 41%, and 54%, respectively. The rate of increase was more pronounced from the first to the second lactation. This might be due to the fact that the second lactation was preceeded by the longest dry period (156 days), and having the longest calving interval (502 days). This explanation was supported by a significant correlation coefficient of 0.137 ($P < 0.05$) between calving interval and 305-days milk yield obtained from the same data (Morad 1967).

The average milk yield during the first 70 days of the lactation period, *i.e.* the intensity of milk production was 790 kg representing 25.8% of the total milk yield. It could be seen from Table 1 that the intensity of milk production in the first four lactations represented 23.6%, 27.0%, 28.5% and 25.8% of the total milk yield, respectively.

The high intensity of the second, third, and fourth lactations reflected the higher daily yield at the early stage of lactation and the higher peak attained as the cows approached maturity. The apparent drop of the percentage of the milk produced in the first 70 days of the fourth lactation coupled with a higher absolute amount of milk production might be explained by the higher persistency of the cows at that age.

Lactation period, dry period and calving interval

The average lactation period in the present study was 332 days which was a little bit higher than the standard 305-days lactation, but seems reasonable for cows calving every 12 to 15 months, However, the lactation periods listed in Table 1 showed that the length of the second, third and fourth lactations were less than that of the first by 5.0%, 9.0% and 8.0%, respectively.

It seemed that the adjustment of the calving dates of the subsequent calvings of the newly imported heifers after giving their first calves to match the local environmental conditions was responsible for the long lactation period of the first lactation (346 days) and for the long following dry period of 156 days which resulted in the unduely long calving interval of 502 days that elapsed between the first and second calvings. The over-all average of the preceeding dry periods and calving intervals were 132 days and 464 days, respectively.

The average preceeding dry periods and calving intervals for the second, third and fourth lactations given in Table 1 showed that these averages were longer than those reported by various authors on Freisian cows in Egypt (Ragab and Askar, 1959 ; El-Itriby and Asker, 1958 ; Fahmy *et al*, 1963 ; and Ragab and Sourour, 1963).

TABLE 1. Means ($\bar{X}$) and Standard Errors (SE) of Productive Characters of Friesian Cows in the Tahreer Province.

	1*st* lactation		2*nd* lactation		3*rd* lactation		4*th* lactation	
Number of animals	1126		742		500		263	
Character	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
70-days milk yield (Kg) . . .	639	5.00	863	10.86	944	14.24	940	24.06
305-days milk yield (Kg) . . .	2304	17.58	3600	28.92	3250	50.33	3551	40.16
Total milk yield (Kg)	2712	26.91	3192	38.19	3312	56.27	3648	67.39
Lactation period (day)	346	2.99	329	4.00	315	3.47	320	5.21
Preceeding dry period (days). .	—	—	156	4.24	102	4.92	126	8.72
Calving interval (days)	—	—	502	5.83	431	5.68	441	6.34

Although the average dry periods and calving intervals obtained were longer than the optimum dry periods and calving intervals for European dairy breeds, yet the zero estimates of hertability obtained from the same data for these traits (Morad 1967) suggested that most of the variation was due to non-additive genetic factors. Therefore, improving the managerial techniques should lead to a considerable decrease in the length of dry periods and eventually calving intervals. Mahadevan (1957) in Ceylon demonstrated that the calving interval of European cattle was reduced from 466 to 413 days in eight years by the gradual improvement in methods of management.

Estimates of heritability

Estimates of heritability were calculated only for the various traits of the first lactation. The general model underlying an observation of a cow's phenotype could be represented as :

$$Y_{ij} = u + S_i + e_{ij}$$

where Y_{ij} = an observation taken on the J^{th} daughter of the i^{th} sire,

u = an affect common to all cows,

s_i = the effect of the i^{th} sire,

e_{ij} = a random effect associated with the observation taken on the j^{th} daughter of the i^{th} sire.

Estimates of heritability were calculated from the analyses of sets of paternal half-sibs. The analyses involved the computing of the mean squares among and within sires in the standard one-way classification analysis of variance, equating the mean squares to their expectations and solving for the sire components of variance. An estimate of heritability depends on the ratio of the sire component of variance to the total variance of a certain trait in a particular population under a specific set of environmental conditions. Any change of the magnitude of the various components of variance would result in a change in the estimated value of heritability. Therefore, estimates of heritability were calculated overall and within years to remove from the components of variance any inflation that might be caused by year-to-year variation.

Table 2 demonstrated the changes in the mean squares among and within sires when the analyses of variance were performed overall years and within years. In general, the analysis of variance within years resulted in a reduction in the mean squares in all cases except in the case of lactation period. The discrepency between the estimates of heritability obtained from the two methods of analysis was due to the change in the relative magnitude of the among and the within sires mean squares.

Estimates of heritability of the various traits were given in Table 3. The most striking result was the drastic reduction in the estimates of heritability of the total milk yield, the proceeding dry period and the calving interval when the estimates were computed within years. The result indicated the inflation of the sire components of variance with an additional amounts of variance caused by year-to-year variability when the analysis was done over all years. This might be mainly due to the inconsistency of the systems of management practiced in the herd from one year to another. Elimenating the year-to-year variance decreased the estimates of heritability from 0.57 to 0.20 for the total milk yield and from 0.35 and 0.36 for the proceeding dry period and for the calving interval, respectively to zero. The zero estimate of heritability of the latter two traits suggested that all the variance among cows in the proceeding dry period and in the calving interval was of non-additive genetic nature.

It might be of interest to notice, on the other hand, that the highest estimate of heritability among the milk production traits calculated within years (70-days, 305-days, and total milk yield) was that of the 70-days milk yield (0.29). This result indicated that the effect of environmental factors became more pronounced as the lactation advanced and that a major part of the differences among cows during the early stage of the first lactation was of genetic nature, Moreover, the highly significant correlation of .63 ($P<0.01$) between the 70-days milk yield and 305-days milk yield calculated from the same date (Morad 1967) indicated the possibility of utilizing the 70-days milk yield as a criterion for early selection for milk production.

TABLE 2. Values of the Mean Squares (MS) Calculated Over-all and within-years for the 1*st* Lactation Productive Characters.

Character	Source of variance	Over-all-years		Within-years	
		df	MS	df	MS
70-days milk yield	sire	56	35.682	56	16.930
	Within sire	418	19.235	416	9 018
305-days milk yield	Sire	60	442.950	59	321.195
	Within sire	453	227.731	449	186.065
Total milk yield	Sire	59	1.233.532	59	711.930
	Within sire	434	522.661	433	498.421
Lactation period	Sire	59	9.828	58	12.686
	Within sire	434	6.832	340	5.545
Proceeding dry period	Sire	45	34.613	44	13.257
	Within sire	304	19.986	301	16.192
Calving interval	Sire	46	38.155	44	15.105
	Within sire	304	22.020	295	16.469

TABLE 3. Estimates of Heritability (h^2) and their Standard Erros(SE) Calculated Over-all and Within-years for the 1*st* Lactation Productive Characters.

Character	Over-all years		Within years	
	h^2	SE	h^2	SE
70-days milk yield	0.37	0.140	0.39	0.141
305-days milk yield	0.26	0.144	0.33	0.112
Total milk yield	0.57	0.184	0.20	0.112
Lactation period	0.20	0.120	0.54	0.166
Proceeding dry period	0.35	0.160	0.00	—
Calving interval	0.36	0.168	0.00	—

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قياسات مظهرية ووراثية لبعض الصفات الانتاجية فى قطيع من ماشية الهولستين فريزيان فى مدينة التحرير .

محمد توفيق رجب ، أحمد سعيد عبد العزيز ، حمدى محمود مراد .
قسم الانتاج الحيوانى ـ كلية الزراعة ـ جامعة القاهرة .

أجريت الدراسة على ٢٦٣١ سجلا كاملا للبن أنتجتها ١١٢٦ بقوة فريزيان من قطيع مديرية التحرير لتقدير كمية اللبن فى السبعين يوما الأولى وكمية اللبن الناتجة فى ٣٠٥ يوم وكمية اللبن الكلية وفترة الحليب وفترة الجفاف والفترة بين ولادتين فى مواسم الحليب الأربعة الأولى . كما حسبت المعاملات الوراثية لهذه الصفات بالنسبة لموسم الحليب الأول . وقد كانت المتوسطات العامة لكمية اللبن الناتجة فى سبعين يوما وفى ٣٠٥ يوما وكمية اللبن الكلية ٧٩٠ كيلو جراما و ٢٨٠٤ كيلو جراما و ٣٠٥٥ كيلو جراما من اللبن على التوالى . كما كانت متوسطات فترة الحليب وفترة الجفاف والفترة بين الولادتين ٣٣٢ يوما و ١٣٢ يوما و ٤٦٤ يوما على التوالى . وتزايدت كمية اللبن تدريجيا من الموسم الأول الى الموسم الرابع الا أن الزيادة كانت أوضح من الموسم الأول الى الثانى ـ بينما تراوحت فترة الحليب من ٣١٥ يوما فى الموسم الثالث الى ٣٤٦ يوما فى الموسم الأول وتراوحت فترة الجفاف السابقة من ١٠٢ يوما فى الموسم الثالث الى ١٥٦ يوما فى الموسم الثانى ، وتراوحت الفترة بين ولادتين بين ٤٢١ يوما فى الموسم الثالث الى ٥٠٢ يوما فى الموسم الثانى.

وحسبت المعاملات الوراثية بطريقتين : بين وداخل السنين لازالة أثر السنة على تقديرات المعامل الوراثى وكانت أوضح التغيرات التى حدثت نتيجة لتغيير طريقة الحساب هى نقص المعامل الوراثى لناتج اللبن الكلى من ٥٧ر٠ الى ٢٠ر٠ والمعاملات الوراثية لكل من فترة الجفاف اللاحقة للموسم الأول والفترة بين الولادة الأولى والثانية من ٣٥ر٠ و ٣٦ر٠ على التوالى الى صفر . مما يوضح أهمية البيئة فى التباين بين الأبقار بالنسبة للصفتين الأخيرتين . وكان أعلا معامل وراثى لصفات انتاج اللبن المقدرة فى داخل السنين هو المعامل الوراثى لانتاج اللبن فى السبعين يوما الأولى من الموسم الأول (٣٩ر٠) مما يوضح أنه يمكن الاعتماد على الانتخاب الوراثى فى تحسين هذه الصفة التى ترتبط ارتباطا وثيقا بناتج اللبن فى ٣٠٥ يوما .