Der Tropenlandwirt, Beiträge zur tropischen Landwirtschaft und Veterinärmedizin,
98. Jahrgang, Oktober 97, S. 151 - 162.

Changes of Stayability, Milk and Calf Production in Friesians, in Egyptian Environments

H.M.Farghaly*, I.Fayez M.Marai*, H.A Gabr* and F.Pirchner**

Abstract

Keywords: Stayability, milk and calf production, imported, locally born Friesians.

Data on 1691 lactations of 407 Friesian cows during the period 1978-1988 were classified into two groups. The first was composed of the dams imported from Holland. The second included their female offsprings locally born in Egypt. Records were analysed by general linear models for stayability, first lactation milk yield (FMY), total milk yield and calf production up to five years of age (TMY5 & CP5) and total milk yield to five years without first lactation milk yield (TMY5-1).

The results showed that the averages of survival rates up to 48, 60, 72 months of age were 50, 41 and 22 % for all Friesian cows studied. The stayability values were lower in locally born than in the imported animals, but the differences were not significant either for 36-48 or 60-72 months of age. The regression coefficients of stayability for 36-48 months on age at first calving and FMY were negative (-016 and -0.0002, respectively) and significant ($P<0.01$ and 0.05, respectively). FMY and CP5 were non-significantly and TMY5 and TMY5-1 were significantly ($P<0.01$) higher in imported than in locally born cows. Year-season of first calving showed highly significant ($P<0.01$) effects on FMY, TMY5, CP5 and TMY5-1. The FMY, TMY5, CP5 and TMY5-1 decreased between the years 1981 and 1985. The regression coefficients of FMY of offspring on those of dams in Holland, Egypt and both together were not significant. The effect of age at first calving on TMY5 was significant ($P<0.05$) and the effect of FMY on each of TMY5 and TMY5-1 was highly significant ($P<0.01$).

1 Introduction

Stayability, which is a measure of longevity is the probability of a cow to remain in the herd to a specific age when given the opportunity to reach that age (HUDSON AND VAN VLECK,

* Department of Animal Production, Faculty of Agriculture, Zagazig University, Zagazig, Egypt

** Department of Animal Science, Munich University of Technology, Freising-Weihenstephan, Germany

1981), reflects all factors that affect this trait at that age. The specific ages of 36, 48, 60, 72 or 84 months have been used because these ages have been assumed to coincide with culling decisions (VAN DOORMAAL, SCHAEFFER AND KENNEDY , 1985), but it has not yet been documented that these are the best ages for use in stayability evaluations. Differences in stayability were detected between breeds (ANDRUS, FREEMAN AND EASTWOOD, 1970 and EVERETT, KEOWN and CLAPP, 1976), between registered and grade cows (ANDRUS, FREEMAN AND EASTWOOD, 1970 and DENTINE, MCDANIEL AND NORMAN, 1987), and among different milk recording programs (VAN DOORMAAL, SCHAEFFER AND KENNEDY, 1985). However, it is well known that the performance of imported livestock may deteriorate when introduced to new and inferior environments, especially with defective management (FARGHALY, 1992).

The objectives of the present investigation were to study the changes that occur due to adaptation in imported and locally born Friesian cows in stayability, FMY, TMY5, CP5 and TMY5-1, under Egyptian environmental conditions. In addition, effects of environmental factors such as age of cows and year-season subclasses and the partial regression coefficient of first lactation milk yield of offspring on those of dams in Holland, Egypt and in both countries, were also estimated. The relation between each of age at first calving and FMY and each of stayability and CP5 were also determined.

2 Materials and Methods

2.1 Herd management

The data used in this study were collected from records of Damietta Dairy Pilot Project in north east of Nile Delta region, Egypt. The Friesian cows included in the present study represented two stages of acclimatization of Friesian cattle to subtropical conditions. The pregnant heifers imported directly from Holland represented the first stage and the locally born cows represented the second stage. All animals were kept under similar managerial conditions. All cows were kept in loose-housing and fed concentrates and Egyptian clover (*Trifolium alexandrinum*) during winter and spring months, and sorghum (mainly sordan), amshut (*Echinochloa stagnina*; amshut grows naturally as a weed in canals and has a relatively high nutritional value and good palatability) and concentrates during summer and autumn months. Concentrates were given to satisfy the nutritional requirements. Rice straw was available all the year round. Each kilogram of concentrate mixture fed was composed of 510 g wheat bran, 200 g cotton seed cake, 100 g yellow maize, 100 g soybean cake, 50 g rice bran, 30 g calcium carbonate and 10 g sodium chloride. Concentrates were offered twice daily before milking. A supply of fresh clean water and mineral mixture was always available to the animals. Cows were machine milked in a 2 x 6 Alfa Laval herring-bone milking-parlour twice a day at 05.00 and 17.00 h during summer and at 03.00 and 15.00 h during winter. Milk yield was recorded daily to the nearest 0.1 kg for each individual cow. The amount of milk produced in a lactation period was estimated as the sum of the actual milk yields produced by each individual cow from calving till drying off.

2.2 *Record and statistical methods*

The records used comprised of 1691 complete normal lactations from 361 imported and 46 locally born Friesian cows during the years 1978-1988. The records were officially controlled by representatives of the Damietta Governorate and the Department of Development Cooperation of Africa, Ministry of Foreign Affairs, Netherlands. The data set used comprised of records to the end of 5 years of age of the cows. During the first 2 years of importation there were no locally born cows in production and after 1984 no importation took place. The imported cows were not included in the statistical analysis during the first 2 years of importation (by confounding between birth date of imported and locally born cows). The sum of milk yield was estimated up to five years of age. This measurement is considered a new practice to evaluate milk yield and depends on the yield potential and stayability of the animal. However, the 5 years may end by calving or end during lactation. In the first case, sum of milk yield was estimated by the sum of milk in the period between the cow's birth date and last calf birth date. In the second case, the milk in the remaining days of lactation included in the 5 years should be corrected before adding. The corrected milk yield during part of lactation remaining to 5 years is estimated from 305 days standard lactation using correction factors according to Pirchner (1960). The sires used are similar for both imported and locally born cows. Data analysis was carried out in the Department of Animal Breeding of the Technical University Munich, Germany. Data sets were analysed by least-squares methods (FMY, TMY5 and CP5) and Likelihood ratio Chi-square Procedure (stayability) of SAS program (1985). The basic statistical model included the fixed effects of the two groups of cows and year-season subclasses at first calving. Data were statistically analysed according to the following models:

Model 1

$$Y_{ijk} = \mu + YS_i + G_j + b_1x_1 + b_2x_2 + e_{ijk}$$

where: Y_{ijk} = stayability for 36-48 or 60-72 months (logit transformation) or TMY5, CP5 and TMY5-1, μ = overall mean. YS_i = effect due to the ith year-season subclasses at first calving, i = 1,..28, G_j = effect due to the jth groups, j = 1 and 2 (1 = imported cows 2 = locally born cows), b_1 & b_2 = the partial regression coefficient of Y_{ijk} on age at first calving (x_1) and first lactation milk yield (x_2) and e_{ijk} = residual.

Model 2

$$Y_{ijk} = \mu + YS_i + G_j + b_1x_1 + b_2x_2 + e_{ijk}$$

where: Y_{ijk} = first lactation milk yield (kg) and μ, YS_i, G_j and e_{ijk} were as in Model 1 and b_1 and b_2 = the partial regression coefficients of Y_{ijk} on dams milk yield within nested cows groups (Dutch dams = x_1 and Egyptian dam's = x_2 first lactation milk yield).

Model 3

$$Y_{ijk} = \mu + YS_i + G_j + b_3x_3 + e_{ijk}$$

where: Y_{ijk} = first lactation milk yield (kg) and, μ, YS_i, G_j and e_{ijk} were as in Model 1 and b_3 = the partial regression coefficient of Y_{ijk} on all dams (in Holland and Egypt) first lactation milk yield (x_1).

The various interactions were statistically not significant, so these interactions were not included in the final models mentioned above.

3 Results

3.1 Stayability

Two sets of regression analyses were performed with fixed effects (group of cows and year-season subclasses of first calving). The regression coefficients of stayability for each of 36-48 and 60-72 months on age at first calving and first lactation milk yield and Chi-square analysis of stayability for imported and locally born cows are presented in Table 1. The differences in stayability for each of 36-48 and 60-72 months between the two groups were not significant. Year-season subclasses at first calving insignificantly affected stayability to 36-48 and 60-72 months. Age at first calving was negatively correlated with stayability to 36-48 and 60-72 months of age. The regression coefficient of stayability to 36-48 months on age at first calving was -0.16 and highly significant, but the regression coefficient of stayability to 60-72 on age at first calving was -0.0123 and not significant. Percentages of stayability for imported and locally born cows are presented in Figure 1. The change percentages of locally born cows relatively to the imported cows were -15, -21 and -7 for stayability to 48, 60 and 72 months, respectively.

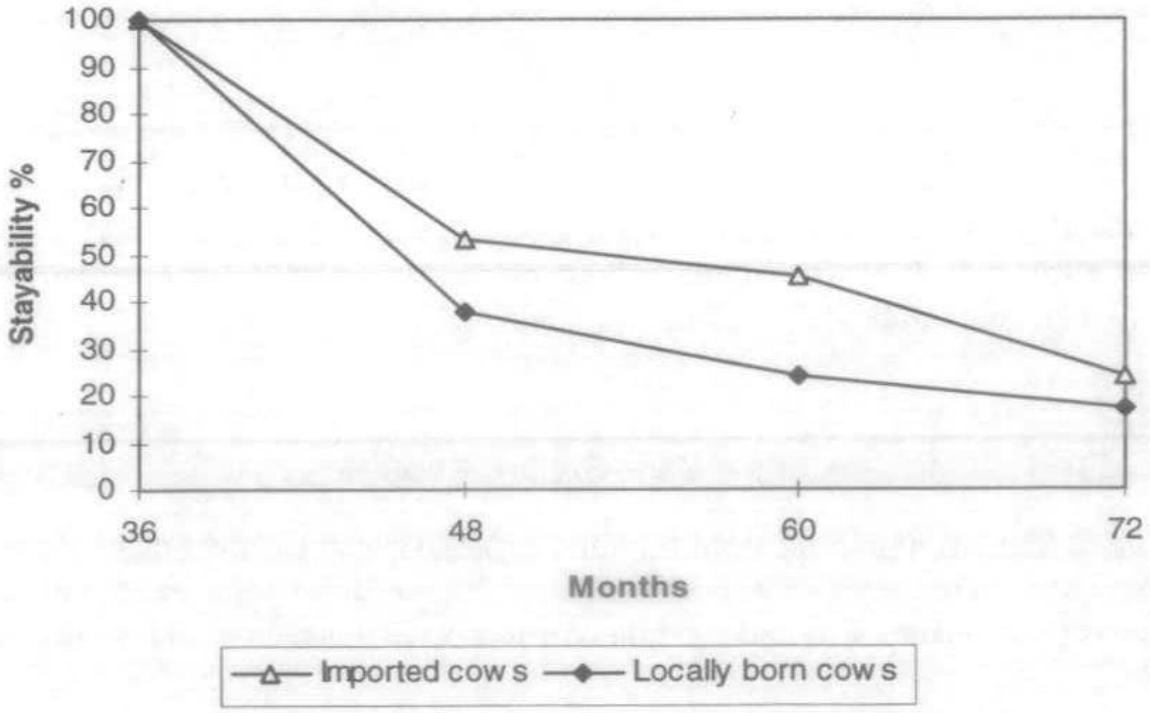

Figure 1: Stayability percentage of imported and locally born Friesan cows under Egyptian conditions

Table 1: The Chi-square analysis of stayability (36-48 and 60-72 months) for imported and locally born Friesian cows under Egyptian conditions

Source of variance	Stayability					
	36-48 months			60-72 months		
	d.f	Chi-square	Prob.	d.f.	Chi-square	Prob.
Group	1	0.00 ns	0.95	1	0.07 ns	0.79
Year-season at first calving	27	16.14 ns	0.95	20	21.63 ns	0.36
Age at first calving	1	11.76 **	0.01	1	0.04 ns	0.84
First lactation milk	1	4.54 *	0.03	1	0.10 ns	0.76
Likelihood ratio	480	302.82	1.00	260	195.62	1.00
Regression of stayability on:						
Age at first calving (b_1)	-0.16±0.05 **			-0.0123±0.059 ns		
First lactation milk (b_2)	-0.0002±0.00008 *			-0.00004±0.00012 ns		

** P<0.01 and * P<0.05

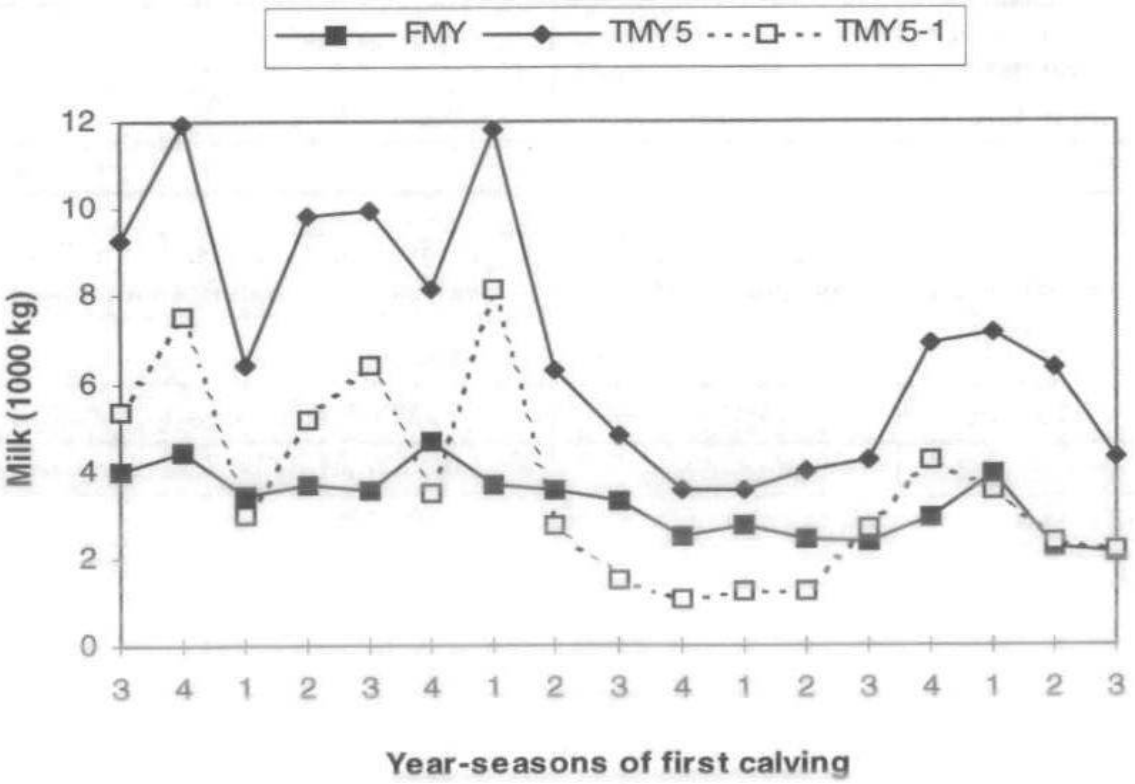

Figure 2: First (FMY), sum milk yield (TMY5) and sum without first lactation (TMY5-1) up to 5 years of age.

3.2 *First lactation milk yield (FMY)*

Least squares means ± S.D. and levels of significance of FMY are presented in Table 2. The overall mean of FMY was 3188 kg of both imported and locally born cows. The imported cows were insignificantly higher than the locally born cows in the FMY. Year-season subclasses of first calving showed highly significant effects (P<0.01) on FMY. The least squares means for FMY of various year-seasons of first calving are exhibited in Figure 2. The three sets of regression analysis made with fixed effects (groups of cows and year-season subclasses of first calving) (Table 2) showed that the regression coefficients of FMY of offspring on those of dams in Holland, Egypt and both together were -0.03, 0.24 and 0.04, respectively, and not significant, i.e. the values did not differ neither from zero nor from each other.

Table 2a: Least squares means ± S.E. of first lactation milk yield (FMY), for Friesians under Egyptian conditions

Classification	Number of animals	FMY	
		With b_1 & b_2	with b_3
Overall mean	407	3188	2917
Groups of cows			
Imported	361	3301±286[a]	2982±297[a]
Locally born	46	2994±391[a]	2982±316[a]
Regression on FMY			
b_1(Dutch dams)	-	-0.03±0.14[ns]	-
b_2(Egyptian dams)	-	0.24±0.26[ns]	-
b_3(All dams)	-	-	0.04±0.12[ns]

Table 2b: Sum of milk yield (TMY5), sum of milk yield without first lactation milk yield (TMY5-1) and calves production (CP5) up to five years of age in Friesian, under Egyptian conditions

Classification	TMY5	(TMY5-1)	CP5
	With b_1&b_2	With b_1&b_2	With b_1&b_2
Overall mean	7977	4818	2.14
Group of cows			
Imported	4821±528[a]	4813±524[a]	2.29±0.11[a]
Locally born	2698±498[ab]	2875±508[b]	1.98±0.18[a]
Regression			
b1 (AFC)#	-152±72.2*	-124±89.5ns	-0.03±0.02 ns
b2 (FMY)	1.6±0.2**	0.56±0.16**	0.0002±0.004 ns

- Means bearing different letters within each classification, differed significantly (P<0.01).
- ** P<0.01, * P<0.05.
- # (AFC) age at first calving.

3.3 Total milk yield to five years of age (TMY5) and total milk yield without first lactation milk yield (TMY5-1)

Least squares means ± S.D. and levels of significance of TMY5 and TMY5-1 are presented in Table 2. Each of TMY5 and TMY5-1 were significantly (P<0.01) higher in imported than in locally born cows. Year-season subclasses of first calving showed highly significant (P< 0.01) effects on each of TMY5 and TMY5-1. The least squares means for year-season subclasses of first calving are given in Figure 2. Age at first calving affected significantly (P<0.05) TMY5 and insignificantly TMY5-1. FMY affected significantly (P<0.01) TMY5 and TMY5-1.

3.4 Calf production to five years of age (CP5)

Least squares means ± S.D. and levels of significance of CP5 are presented in Table 2. The estimated value of CP5 was higher in imported (2.27) than in locally born cows (1.93), but the difference was not significant. Year-season of first calving showed significant effects (P<0.01) on CP5. The least squares means for year-season of first calving are shown in Figure 3. Both age at first calving and FMY did not affect significantly the CP5.

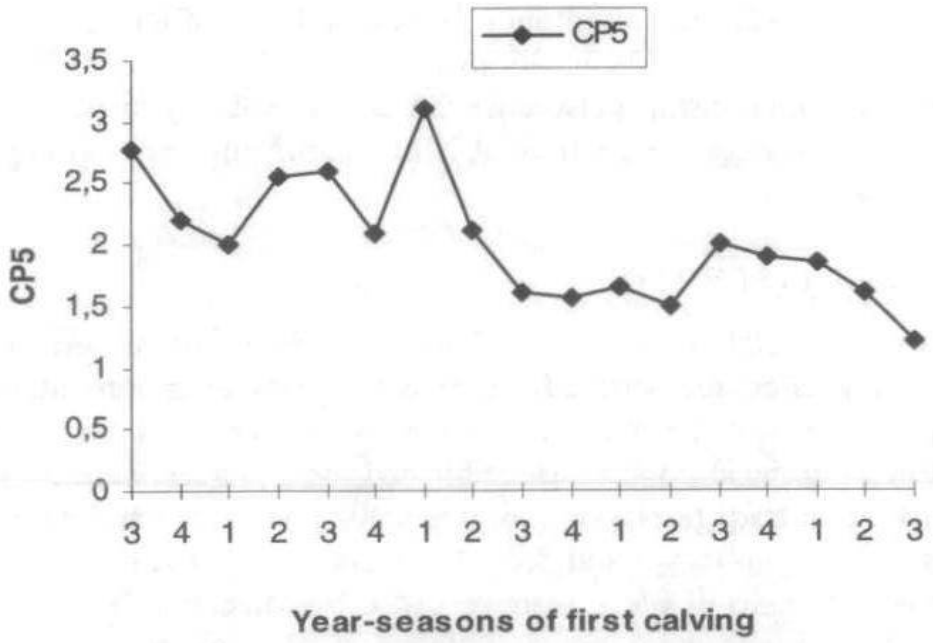

Figure 3: Number of calves (CP5) to 5 years of age in Fresian cows

4 Discussion

4.1 Stayability

The averages of survival rates to 48 months of age for imported and locally born cows were 53 and 38 %, respectively, i.e. 47 and 62 % of the imported and locally born cows, respectively, left the herd prior to 48 months of age. Similar findings were reported by Vaccaro, Cardozo and de Vaccaro (1983), since they found that 68% of imported Holstein-Friesians did not survive until their third calving in Venezuela. The same authors found

that losses before first calving, between first and second calving and between second and third calvings were 15.7, 13.3 and 21.1 %, respectively. In another study on Friesians in Egypt, Pirchner et al. (1989) found that 62% of pure Friesian cows survived to the second lactation. The above results show that the higher rates of involuntary culling in both imported and locally born cattle in subtropical conditions might restrict the scope for voluntary culling and selection of females.

The change percentages of stayability indicate that the numbers left the herd were higher in locally born cows than in the imported ones. Further studies on the reasons of such phenomenon are needed. However, neither the imported nor the locally born cows were able to maintain their numbers under Egyptian conditions. The stayability and each of age at first calving and FMY were negatively correlated, i.e the conventional selection practices according to these traits (age at first calving and FMY) would not lead to an increase of stayability to 60-72 months of age.

The regression coefficient of stayability to 36-48 months on age at first calving was -0.16 and highly significant, but the regression coefficient of stayability to 60-72 on age at first calving was -0.0123 and not significant. Gill and Allaire (1976) found that the phenotypic correlation between age at first parturition and herd life was -0.10. Such results confirm that age at first calving may play an important role in stayability of the cows in the herd. The regression coefficient of stayability to 36-48 months on FMY was -0.0002 and significant ($P<0.05$), but the relationship between FMY and stayability to 60-72 months of age was not significant. The negative coefficient is in contradiction to results from European and American analyses.

4.2 First lactation milk yield (FMY)

The overall mean of FMY (3188 kg) was lower than that of the registered Friesian cows in Holland. Such result may reflect the wide difference between the environmental conditions in Egypt and Holland. However, the mean of FMY recorded here is in the range reported for the same breed in subtropical conditions. Published mean values were 3462 in Chile (Lizana et al., 1985), 3028 in Iraq (Juma and Jajo, 1986), 3045 (Khattab and Ashmawy, 1987) and 3490 (Morsy et al., 1989) in Egypt and 3352 kg in Nigeria (Udedibie, Umo and Shaibu, 1987). However, lower estimates of FMY were recorded by Mustapha (1985) in Malaysia, Mostageer et al. (1987) in Egypt and Mbap and Ngere (1989) in Nigeria (2775, 2000 and 2893 kg, respectively) and higher estimates were recorded for the same breed in Indonesia (4757 kg) by Subandriyo, Sugiarti and Sitorus (1986).

Year-season subclasses of first calving showed highly significant effects ($P<0.01$) on FMY reflecting in part the temporal variation in climate, nutrition and management. The least squares means for FMY of various year-seasons of first calving are exhibited in Figure 2. It could be noticed that the FMY of the imported and locally born cows decreased between the years 1981 and 1985, reflecting that both of them were still undergoing the adaptive process during the years of the study, under Egyptian conditions.

The insignificant regression coefficients of FMY of offspring on those of dams in Holland may indicate the similarity of the FMY of dams in Holland and Egypt. In addition to that

the level of management during the first lactation of the imported dams in Egypt, seemed to be close to that in Holland. This latter conclusion suggested estimation the TMY5-1 parameter to highlioght the difference in the management and environmental conditions of the two localities, Egypt and Holland.

4.3 Total milk yield to five years of age (TMY5) and total milk yield without first lactation milk yield (TMY5-1)

Each of TMY5 and TMY5-1 were significantly (P<0.01) higher in imported than in locally born cows. The differences between the two categories may be due to differences in age at first calving (26 and 27.2 months in imported and locally born cows, respectively) and in the FMY (3185±127 and 3035±218 kg in imported and locally born cows, respectively) (FARGHALY, 1992).

The gradual changes of TMY5 and TMY5-1 due to the year-season effects reflected again continuation of the adaptive process during the years of the study. Such results may suggest that estimation of the degree of adaptation of such animals could be estimated by testing the lactation curve of the same breed under Egyptian conditions by the standard one of the same breed in its original locality. However, it may be of interest to carry out further studies in the same farms and also in other farms to find out what will be the level of production at which no more reduction occurs, i.e. the levels of production at which such animals will be adapted to their new conditions.

Age at first calving affected significantly (P<0.05) TMY5 and insignificantly TMY5-1. The partial regression coefficient of TMY5 on age at first calving was -152, i.e. one month decrease in age at first calving was accompanied with an increase of 152 kg milk up to five years of age in the two groups. This reflects the importance of the decrease in age at first calving, in TMY5. FMY affected significantly (P<0.01) TMY5 and TMY5-1. The partial regression coefficient of TMY5 on FMY showed the part-whole relationship. These results agreed with those of Hoque and Hodges (1980), Bhatnagar and Sharma (1983) and Schneeberger and Casanova (1990) and showed that high total milk yield was associated with high first lactation yield. Similarly, the partial regression coefficients of TMY5 and TMY5-1 on FMY confirmed the latter results. These results agreed with those of Parker (1962) and Gaalaas and Plowman (1963) who reported that high production in the first lactation was compatible with high production in later lactations. The performance of locally born cows decreased than in the imported ones in FMY, TMY5 and TMY5-1 (4.7, 28.4 and 44%, respectively). The difference in TMY5 and TMY5-1 were high, indicating that the locally born cows were affected negatively more than their dams by the environment, confirming the need for detecting the level at which such decline stops.

4.4 Calf production to five years of age (CP5)

CP5 was insignificantly higher in imported than in locally born cows. Year-season of first calving showed significant effects (P<0.01) on CP5. It was noted that CP5 decreased from 1981 to 1985. The gradual change in CP5 was probably due to the effects of poor management and the unfavorable subtropical environment on reproduction. The partial regres-

sion coefficients of CP5 on each of age at first calving and first lactation milk yield were -0.03 and 0.00002, respectively.

In conclusion, the observed trends of stayability (to 36-48 and 60-72 months) and FMY, TMY5, CP5 and TMY5-1 showed, in general, the unfavorable effects of management and climate conditions on the traits of the imported and locally born cows and indicated that both imported and locally born cows seemed to undergo the adaptive process during the period of the study. A year-seasons trend can be due to changes in the genotype expression due to changes in environmental conditions. In addition, the conventional selection practices according to age at first calving and first lactation milk yield would not lead to the increase in stayability to 36-48 months, but management improvement is necessary in order to permit higher producing cows to stay in the herd.

Veränderungen in Persistenz, Milchleistung und Kalbungen bei Friesians unter ägyptischen Umweltbedingungen

Zusammenfassung

Die Daten aus 1691 Laktationen von 407 Friesian Kühen während der Zeit von 1978 bis 1988 wurden ausgewertet und in zwei Gruppen, eine Gruppe importierte Tiere aus Holland und die zweite in Ägypten geboren, eingeteilt. Untersucht wurden ‚Persistenz, 1. Laktationsmilchmenge, Gesamtmilchmenge und Kalbungen bis zum 5. Lebensjahr und Gesamtmilchmenge ohne 1. Laktationsmilch.

Die Ergebnisse zeigen die durchschnittliche Lebensdauer bis zu 48, 60 und 72 Monaten lag bei 50, 41 und 22 % für alle Kühe, während die bei den lokal geborenen Tieren niedriger lagen, aber nicht signifikant waren.

Im Allgemeinen zeigen ungünstige klimatische Bedingungen und Managementfehler die gleichen Auswirkungen auf lokal geborene und importierte Tiere und weisen auf einen Adaptionsprozeß während der Untersuchung hin. Managementverbesserungen sind für eine höhere Leistung und Persistenz notwendig.

5 Acknowledgements

Many thanks are due to Dr. Rudolf Graml, Dr. T. Nibler and Dr. N. Reinsch, Department of Animal Breeding, Technical University, Munich, Germany for their help during the computer work.

6 References

1. Andrus, D.F., Freeman, A.E. and Eastwood, B.R. (1970). Age distribution and herd life expectancy in Iowa dairy herds. Journal of Dairy Science, 53: 764-771.
2. Bhatnagar, D.S. and Sharma, R.C. (1983). Note on longevity in relation to age at first calving and first lactation yield in Karan-Swiss cows. Asian Journal of Dairy Science, 3: 237-240.
3. Dentine, M.R., McDaniel, B.T. and Norman, H.D. (1987). Evaluation of sires for traits associated with herd life of grade and registered Holstein cattle. Journal of Dairy Science, 70: 2623-2634.
4. Everett, R.W., Keown, J.F. and Clapp, E.E. (1976). Production and stayability trends in dairy cattle. Journal of Dairy Science, 59: 1532-1539.
5. Farghaly, H.M. (1992). Studies on performance of some exotic breeds under Egyptian conditions. Ph.D. Thesis, Department of Animal Production, Faculty of Agriculture, Zagazig University, Zagazig, Egypt.
6. Gaalaas, R.F., and Plowman, R.D. (1963). Relationship between longevity and production in Holstein-Friesian cattle. Journal of Dairy Science, 46: 27-33.
7. Gill, G.W. and Allaire, F.R. (1976). Relationships of age at first calving, days open, days dry and herd life to a profit function of dairy cattle. Journal of Dairy Science, 59: 1131-1139.
8. Hermosura, S.R. and Esguerra, V.C. (1955). A study of the milking and breeding efficiency of Holstein-Friesian and Red Sindhi cows at the Sta. Mesa Dairy Farm. Natural and Applied Science Bulletin, University of the Philippines, 15: 139-152.
9. Hermosura, S.R. and Laygo, P.M. (1953). The milking and breeding efficiency of Holstein-Friesian, Jersey and Sahiwal dairy cows at Alabang. Natural and Applied Science Bulletin, University of the Philippines, 13: 128-142.
10. Hoque, M. and Hodges, J. (1980). Genetic and phenotypic parameters of lifetime production traits in Holstein cows. Journal of Dairy Science, 63: 1900-1910.
11. Hudson, G.F.S. and Van Vleck, L.D. (1981). Relationship between production and stayability in Holstein cattle. Journal of Dairy Science, 64: 2246-2250.
12. Juma, K.H. and Jajo, S.H. (1986). Evaluation of factors affecting 305-day milk yield in Friesian cattle in Iraq. 3rd World Congress on Genetics Applied to Livestock Production, Lincoln, Nebraska, USA.
13. Khattab, A.S. and Ashmawy, A.A. (1987). Relationships of days open and days dry with milk production in Friesian cattle in Egypt. Journal of Animal Breeding and Genetics, 105: 300-305.
14. Lizana, C., Barria, P., Stolzenbach, M.G., Perez, C. and Buzzetti, G. (1985). Characterization of the first lactation of dairy cows in Chile. Memorias, Asociacion Latinoamericana de Produccion Animal, 18: 156-161.
15. Mbap, S.T. and Ngere, L.O. (1989). Productivity of Friesian cattle in a subtropical environment. Tropical Agriculture, 66: 121-124.
16. Morsy, M.A., Nigm, A.A., Sadek, R.R. and Rashad, N.S. (1989). Some aspects of reproductive performance of crossbred cattle in Egypt. Egyptian Journal of Animal Production, 26: 1-14.
17. Mostageer, A., Afifi, Y. A., Morsy, M. A. and Nigm, A.A. (1987). Grading up Baladi cattle with Friesian in Egypt. Journal of Animal Breeding and Genetics, 104: 383-390.
18. Mustapha, M. (1985). A comparative study of the milk yield and live weight change of Friesian and Friesian x Sahiwal cows in Malaysia. Proceedings of the 3rd AAAP Animal Science Congress, 2: 790-792.
19. Parker, R.J. (1962). The relationship between first lactation production, size and type and subsequent performance in Holstein-Friesian cattle. M.Sc. Thesis, University of Toronto, Toronto, Ontario.
20. Pirchner, F. (1960). Versuchsstation für Rinderzucht und-fütterung, an der Bundesversuchswirtschaft Wieselburg. Erlauf-Versuchsbericht.
21. Pirchner, F., Mostageer, A., Morsy, M.A., Nigm, A.A. and Rashad, N.S. (1989). The potential of crossbreeding between native and European breeds for dairy production. EAAP Publication No. 38, Cairo, Egypt.
22. SAS Institute Inc. (1985). SAS User's Guide: Statistics, Version 5 Edition, Cary, NC.

23. Schneeberger, M. and Casanova, L. (1990). Relationship between longevity and milk production of Swiss Braunvieh cows. Proceedings of the 8th Conference of AAABG, Hamilton and Palmerston North, pp 371-374.

24. Subandriyo, Sugiarti, T. and Sitorus, P. (1986). Productivity of imported and Local Friesian dairy cattle in Pangalengan, Bandung, West Java. 3rd World Congress on Genetics applied to Livestock Production, Lincoln, Nebraska, USA.

25. Udedibie, A.B.I.,Umo, I. and Shaibu, I. (1987). The Vom herd. 2. Effect of lactation number and season of calving on lactational characteristics of imported Friesian cows. Journal of Animal Production Research, 5: 31-44.

26. Vaccaro, R., Cardozo, R. and de Vaccaro, L. (1983b). Milk production, reproduction and death rates of Holstein heifers imported into tropics. Tropical Animal Production, 8: 77-86.

27. Van Doormaal, B.J., Schaeffer, L.R. and Kennedy, B.W. (1985). Estimation of genetic parameters for stayability in Canadian Holsteins. Journal of Dairy Science, 68: 1763-1769.