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MILK PRODUCTION CHARACTERISTICS IN THE FIRST TWO LACTATIONS OF FRIESIAN CATTLE IN THE UNITED ARAB EMIRATES

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SUMMARY

A total of 1020 lactation records of 636 German and Dutch Friesian cows obtained from two farms, Al-Ain and Ras Al-khaimah ((R.A.K), were used to study milk production characteristics in the first two lactations of Friesian cattle in U.A.E. The overall least squares means of total milk yield (TMY), lactation period (LP), daily milk yield (DMY) and annualized milk yield (AMY) in the first lactation were 5405 Kg, 375 days, 14.6 Kg/day and 4285 Kg., in respective order. corresponding means for the second lactation were 5345 Kg, 306 days, 17.5 Kg/day and 4845 Kg, respectively.

Total milk yield was affected by farm (P<.0001), origin (P<.03), season of calving (P<.03) and year of calving (P<.0001) in the 1st lactation; and by farm (P<.02), year of calving (p<.03) and age at 2nd calving (P<.03) in the 2nd lactation. Average production per cow was greater at Al-Ain farm than R.A.K. Dutch Friesians were higher than German and mild season calvers (Oct.-March) produced higher than calvers of hot season (April- Sept.)in the 1st lactation (P<.05).

Daily milk yield was affected by farm (p<.0001), season of calving (p<.0005) in the 1st lactation; and by year of calving (p<.04) and age at 2nd calving (p<.003) in the 2nd lactation. DMY was higher at Al-Ain farm than R.A.K. . Animals calving in mild season, later years of calving and older ages produced higher DMY than

did cows which calved in hot season, earlier years and younger ages.

Annualized milk yield (AMY) was affected by farm and season (P<.0001), and by year of calving (p<.002) in the 1st lactation, and by year of calving and age at 2nd calving (p<.02) in the 2nd lactation. Al-Ain farm, calvers in mild season, later years of calving and older ages produced higher AMY (p<.05).

The results demonstrated the ability of imported Friesians to maintain their production standards under the prevailing production systems in U.A.E.

Keywords: Friesian, milk production traits, U.A.E.

INTRODUCTION

United Arab Emirates has about 50,000 heads of cattle, most of them are of local origin with poor meat and milk production. Average milk yield/year is estimated to be 500 kg (MOA, U.A.E., 1992). In attempting to improve milk production, many large dairy farms have been established during the last two decades. Establishment of dairy herds depended mainly on importing pregnant heifers from Germany and Holland, with limited numbers imported from U.S.A. As a common practice, to maintain herd size, replacement heifers are imported almost annually, while only few farms raise a small proportion of the progeny for replacement. Young stock are sold for slaughter as veal at weaning.

High ambient temperatures prevailing throughout the hot season of April through September adversely affect fertility and milk yield of imported cattle. Cows that fail to get pregnant during summer cause deficiency in total herd milk yield in the following spring. Some producers import pregnant heifers in summer to meet consumption demands. Limited research studies have been conducted on the production traits of Friesian cattle in the U.A.E.

The objective of the present investigation was to evaluate five major milk production characteristics in the first two lactations of Friesian cattle in the U.A.E. Effects of farm, origin, season, year of calving and age at calving on milk production traits were also studied.

MATERIALS AND METHODS

Data utilized in this study were collected from two farms; Maraii Al-Ain, located in Al-Oha, Al-Ain, 165 km to the east of Abu Dhabi, and the Arab Co. for Animal Production, Digdaga, located in Ras Al-Khaima (R.A.K.), about 250 km to the north east of Abu Dhabi. The climatic conditions prevailing in the two locations are presented in annex "A".

Management practices

Management practices were essentially similar in the two farms. Animals were imported as 5-7 month pregnant heifers mainly from Germany, plus a few from Holland. All heifers, genetically, were at least 75% Holstein Friesian blood. Animals were housed in open sheds roofed with special metal sheets to protect animals from solar radiation. These sheds were provided with cooling systems to keep animals cool during the day in the hot season. Yards were sandy in Al-Ain and concrete in R.A.K.

Cows were inseminated artificially at the first observed heat starting 45 days postpartum, using imported Holstein or Charolais frozen semen. Animals were observed for heat twice a day; in the early morning and before sunset. Cows were machine milked at 3.00 a.m. and 3.00 p.m. Pregnant cows were dried off two months before the expected calving date. Milk yield was based on weekly recording of single daily yield.

Animals were fed Rhodes grass (Chloris gayana) and were supplemented with concentrates at a rate of one kg of pelleted concentrate mixture for each two kg milk.

Data collection and statistical analysis

Data on 1020 lactation records of the first two lactations were collected on 636 cows. The following traits were studied: 1) Total milk yield (TMY, kg), total milk produced per cow for the complete lactation; 2) Lactation period (LP, day), No. of days in milk; 3) Daily milk yield ((DMY, kg)= TMY/LP); (4) Annualized milk yield (AMY, kg)= (TMY/ respective calving interval in days) x 365; and (5) Milk per day of productive life (M/D of PL)= TMY produced to the end of second lactation divided by days from first parturition to the end of second lactation (Lin et al., 1988).

The data were analyzed by the least squares technique using the general linear models procedure of SAS (1985). Two fixed effects models were used; model (1) to analyze TMY, LP, DMY and AMY in the first two lactations and reads:

$$Y_{ijklmn} = U + f_i + o_j + s_k + r_l + a_m + e_{ijklmn}, \text{ where}$$

Y_{ijklmn} is TMY, LP, DMY or AMY; U is the overall mean; f_i is the effect of farm i (1=Al-Ain, 2= R.A.K.); o_j is the effect of origin j (1= German, 2= Dutch); s_k is the effect of season of calving k (1=mild including October through March, 2=hot including April through September); r_l is the effect of year of calving l (1987, ..., 1990 for the first and 1988..., 1991 for the second lactation); a_m is the effect of age at calving m (as shown in tables 1 to 5); and e_{ijklmn}, is a random error term. Model (2) was used to analyze milk per day of productive life and reads:

$$Y_{ijklm} = U + f_i + o_j + r_k + a_l + e_{ijklmn}, \text{ where}$$

r_k is the effect of year of first calving k (1987, 1988, 1989 and 1990); a_l is the effect of the age at first calving l (as shown in table 5); and other components of the model are as defined in model 1.

RESULTS AND DISCUSSION

Table 1 shows the least squares means (±SE) of TMY, LP and DMY in the first lactation. The least square mean of TMY in the present study (5405 kg) lies within the range of estimates reported for FR in Saudi Arabia (4800 kg by Al-Khamees an Al-Mokhadub, 1986; 5262 kg for British FR by Salah et al., 1988, and 6113 kg reported by Mansour, 1992 for American Holstein). It should be noted that the cattle in this study were genetically at least 75% Holstein Friesian blood. Farm, origin, season and year of calving affected TMY significantly. Al-Ain farm had higher TMY and longer LP with more DMY ($p<.05$) as compared to R.A.K. Farm. Climatological condition in the two locations (annex "A") could be partially responsible for these differences. Al-Ain showed, almost consistently, lower values of maximum ambient temperature and relative humidity.

Table 1: Least squares means[1] (±SE) of total milk yield (TMY, Kg), lactation period (LP, Day) and daily milk yield (DMY, Kg) in the first lactation of Friesian Cattle in the U.A.E.

		TMY			LP			DMY		
	N	$\bar{X}$	±SE	P>F	X	±SE	P>F	$\bar{X}$	±SE	P>F
Overall	636	5405			375			14.6		
Farm:				.0001			.0001			.0001
Al-Ain	323	6320[a]	167		417[a]	10		15.7[a]	0.54	
R.A.K.	313	4490[b]	169		332[b]	11		13.5[b]	0.55	
Origin:				.03			.02			NS
German	609	5130[a]	106		356[a]	7		14.6	0.34	
Dutch	27	5680[b]	262		393[b]	16		14.6	0.85	
Season:				.03			NS			.0005
Mild	381	5530[a]	166		372	10		15.2[a]	0.54	
Hot	255	5280[b]	168		377	11		13.9[b]	0.54	
Year :				.0001			.0001			NS
1987	65	6360[a]	215		442[a]	13		14.7	0.70	
1988	91	5375[b]	204		382[b]	13		14.1	0.66	
1989	294	5350[b]	156		362[b]	10		14.8	0.50	
1990	186	4535[c]	179		312[c]	11		14.8	0.58	
AFC :				NS			NS			NS
≤24 mo.	11	4995	385		371	24		13.3	1.25	
>24 to ≤27	218	5525	149		378	9		14.9	0.48	
>27 to ≤30	256	5570	140		377	9		15.1	0.45	
>30 mo.	151	5525	149		372	9		15.0	0.48	

AFC = Age at 1st calving, NS = Nonsignificant at the 5 % level.
[1]Means followed by different letters differ significantly (P< .05).

Dutch Friesian produced about 500 kg more TMY than did German Friesian in the 1st lactation (p<.05), due obviously, to their longer LP (p<.05). Both strains, however, produced the same DMY (14.6 kg/day). Heifers calving in the mild season of October through March yielded 250 kg TMY more than heifers calvers in the hot season of April through September in almost the same lactation period, scoring higher DMY (P<.05). Monthly maximum ambient temperature during the hot season was much higher than that of the mild season in both locations. Rodriquez et al. (1985), Sharma et al. (1988) and Ray et al. (1992) reported that high temperature significantly affected TMY, with the effect being more

pronounced at temperatures higher than 29°C.

Table 2 presents the least squares means of annualized milk yield (AMY) which indicates the efficiency of the combined reproduction and production performances. Farm and season of calving (P<.0001) and year of calving (P<.002) affected AMY. Al-Ain farm had significantly (P<.05) higher AMY than R.A.K, mainly due to the higher TMY, however, AMY represented 77.6% of the TMY in Al-ain compared to 81.7% in R.A.K. This trend reflected the longer calving interval in Al-Ain than R.A.K.

Table 2. Least squares means[1] (±SE) of annualized milk yield (AMY, Kg) in the first lactation of Friesian Cattle in the U.A.E.

		AMY		
	N	$\bar{X}$	±SE	P>F
Overall	533	4285		
Farm:				.0001
Al-Ain	264	4905[a]	183	
R.A.K.	269	3670[b]	194	
Origin:				NS
German	510	4250	113	
Dutch	23	4325	285	
Season:				.0001
Mild	312	4224	182	
Hot	221	3950	182	
Year :				.002
1987	61	4405[a]	320	
1988	84	4300[ab]	218	
1989	267	4495[a]	168	
1990	121	3950[b]	201	
AFC :				
≤24 mo.	10	3880	410	NS
>24 to ≤27	190	4320	161	
>27 to ≤30	216	4430	153	
>30 mo.	117	4520	166	

AFC = Age at First calving, NS = Nonsignificant at the 5 % level.

[1]Means followed by different letters differ significantly (P< .05).

Significant effect of season of calving (P<0.0001) on AMY may be attributed to its effect on days open. There is a considerable delay in getting cows pregnant again in the hot season as compared to those calving during the mild season. Meanwhile, origin and age at first calving showed no significant effect on AMY of first lactation.

Table 3 shows the least squares means (±SE) of TMY, LP and DMY of Friesian cattle in their second lactation. The overall mean TMY (5345 kg) is 60 kg less than that of the first lactation. This decline was associated with shorter LP of 306 days. However DMY (17.5 Kg/day) was 20% higher than that of the first lactation. Significant sources of variation were fewer than those observed in the first lactation; namely, farm (P<.02), year of calving and age at second calving (P<.03) in TMY; farm (P<.006), season (P<.003) and year of calving (P<.02) in LP; and year (P<.04) and age at second calving (P<.003) in DMY.

Table 3: Least squares means[1] (±SE) of total milk yield (TMY, Kg), lactation period (LP, day) and daily milk yield (DMY, Kg) in the second lactation of Friesian Cattle in the U.A.E.

	N	TMY $\bar{X}$	±SE	P>F	LP $\bar{X}$	±SE	P>F	DMY $\bar{X}$	±SE	P>F
Overall	384	5345			306			17.5		
Farm:				.02			.006			NS
Al-Ain	198	5650[a]	229		322[a]	10		17.6	0.62	
R.A.K.	186	5035[b]	252		291[b]	11		17.3	0.68	
Origin:				NS			NS			NS
German	366	5220	123		305	5		17.1	0.33	
Dutch	18	5470	350		308	15		17.8	0.94	
Season:				NS			.003			NS
Mild	243	5240	195		296[a]	9		17.8	0.52	
Hot	141	5445	242		318[b]	11		17.1	0.65	
Year :				.03			.02			.04
1987	67	5800[a]	282		332[a]	11		17.4[ab]	0.76	
1988	84	5180[b]	260		315[b]	11		16.3[b]	0.70	
1989	203	5340[ab]	210		310[b]	9		17.3[b]	0.56	
1990	30	5060[ab]	343		269[b]	15		18.8[a]	0.92	
ASC :				.03			NS			.003
≤36 mo.	16	5185[ab]	388		303	17		17.1[ab]	1.04	
>36 to ≤39	82	5090[a]	232		303	10		16.8[b]	0.63	
>39 to ≤42	115	5455[ab]	220		315	10		17.4[b]	0.59	
>42 mo.	171	5650[b]	179		305	8		18.6[a]	0.48	

ASC = Age at second calving, NS = Nonsignificant at the 5 % level.
[1]Means followed by different letters differ significantly (P< .05).

Cows in Al-Ain farm produced 12% more TMY, than cows in R.A.K.. This may be due to the longer LP (P<.05), however, DMY showed no significant difference. Due to delayed breeding, significant longer LP for hot season calvers (318 vs. 296 days, P<.05) were identified. Cows calving during hot season produced, consequently more TMY than cows calving during mild season, but the difference (205 Kg) was nonsignificant. Ansell (1976) found that no conception had taken place in the period from June to October in a herd of Holstein cows imported to U.A.E. Ashmawy and Khattab (1991) found.that longer days open in the hot season resulted in more days in milk which extended the late lactation part with lower daily production.

It is worth noting that TMY increased from the first to the second lactation in R.A.K., despite the shorter LP in the second lactation (332 vs 291 day). However, in Al-Ain the TMY in the second lactation was less than the first. This may be attributed largely to the decline in LP (417 vs 322 day).

Daily milk yield increased with advancement of year of calving (P<.04), due probably to more controlled breeding practices and consequently to shorter lactation period. While TMY increased with advancement of age at second calving (p<.03), LP was almost unchanged and DMY was higher for older cows (P>.003) at the second calving.

Least squares means of AMY in the second lactation are presented in Table 4. The overall mean was 4845 which is 13%, higher than that of the first lactation. Al-Ain farm, German FR and mild season calving produced more AMY than their corresponding group. Differences, however, were nonsignificant. Year of calving affected significantly AMY (P<.02) with no specific trend. AMY tended to increase with advancement of age at second calving, however, the trend was inconsistent. It is of interest to note that the ratio of AMY: TMY increased by about 10-13% in the second lactation compared to the first (87.2 vs 77.6% in Al-Ain and 94.6 vs 81.7% in R.A.K.). The consistently higher value of this ratio in R. A. K. than Al-Ain may indicate better reproductive care in R.A.K.

Table 4. Least squares means[1] (±SE) of annualized milk yield (AMY, Kg) in the second lactation of Friesian Cattle in the U.A.E.

		AMY		
	N	$\bar{X}$	±SE	P>F
Overall	230	4845		
Farm:				NS
Al-Ain	117	4925	299	
R.A.K.	113	4765	327	
Origin:				NS
German	222	4895	133	
Dutch	8	4795	458	
Season:				NS
Mild	157	5005	246	
Hot	73	4690	298	
Year :				.02
1988	62	5035[a]	339	
1989	38	4265[b]	350	
1990	104	4990[ab]	284	
1991	26	5095[ab]	400	
ASC :				.02
≤36 mo.	13	4775[ab]	433	
>36 to ≤39	50	4495[b]	290	
>39 to ≤42	53	4935[ab]	279	
>42 mo.	114	5180[a]	233	

ASC = Age at Second calving, NS = Nonsignificant at the 5 % level.
[1]Means followed by different letters differ significantly (P< .05).

Table 5 shows the average milk yield per day of productive life (M/D of PL) for cows which is a reliable measure of the dairy cow profitability. Farm was the only significant source of variation in this trait (P<.02). Al-Ain farm scored higher mean than did R.A.K. (15.2 vs 14.0 Kg, P<.05). Dutch Friesians tended to produce more M/D, however, the difference (0.6 Kg/D) was nonsignificant. Year of calving and age at first calving showed no significant differences on M/D.

Table 5. Least squares means[1] (±SE) of milk /day of productive life (M/D of PL) till the end of second lactation of Friesian Cattle in the U.A.E.

		M/D of PL		
	N	$\bar{X}$	±SE	P>F
Overall	393	14.6		
Farm:				.02
Al-Ain	204	15.2[a]	0.42	
R.A.K.	189	14.0[b]	0.48	
Origin:				NS
German	373	14.3	0.25	
Dutch	20	14.9	0.60	
Year :				NS
1987	61	14.3	0.50	
1988	78	13.8	0.46	
1989	217	14.9	0.36	
1990	37	15.3	0.67	
AFC :				NS
≤24 mo.	8	14.5	0.88	
>24 to ≤27	143	14.2	0.36	
>27 to ≤30	157	14.7	0.33	
>30 mo.	85	14.9	0.36	

AFC = Age at first calving, NS = Nonsignificant at the 5 % level.
[1]Means followed by different letters differ significantly (P< .05).

The results of the present study showed no marked difference in productivity between German and Dutch strains. Difference in AMY in both lactations did not exceed 100 kg (nonsignificant). The same was true for milk per day of productive life, the difference was only 0.6 kg/day.

The mean TMY obtained in the present study (5405 and 5345 kg in the 1st and 2nd lactations, respectively) is close to the estimates reported by Jassioroowski et al. (1988) under the intensive farming system for Polish Friesians x American Holstein (5402 kg); Polish x Canadian Holstein (5255 kg); Polish x German Friesians (4933 kg); and Polish x British Friesians (5065 kg). Also, the present estimate of Friesians in U.A.E. is higher than those reported in Saudi Arabia of 4800 kg by

Al-Khamees and Al-Mokhadub (1986) and of 5262 by Salah et al. (1988) for British Friesians. Jassiorowski et al. (1988) also, reported estimates of the mean TMY of 7230, 6842, 6174 and 6252 kg for pure Holstein in U.S.A., Canada, for German Friesians and for British Friesians, in respective order. In Tunisia, Djemali and Berger (1992) reported 5003, 7421 and 4564 kg in first lactation for pure Holstein, European Friesians and locally born Friesians, in respective order. In Libya, Friesians produced 3490, 3786 Kg in the first two lactations, respectively (Morsy et al., 1986). In Egypt, Khattab and Ashmawy (1988) found an estimate of 3423 Kg for Friesians. Nigm (1990) reported estimates of 2661 and 3063 kg for the first lactation of European Friesians and European Friesian x American Holstein, respectively; Corresponding estimates for the second lactation were 3106 and 3891 Kg for the two strains, respectively. The estimates of productivity obtained for Friesian cattle in the U.A.E., are reasonable as compared to the performance of the same breed in temperate areas and Arab countries.

The decline in AMY of hot season calvers as compared to the cows which started lactation in the mild season was only 7% and 6% in the first and second lactations, respectively. Comparable estimates have been reported for Holstein cattle in Florida (Rodriquez et al., 1985). The results obtained herein indicating the ability of imported Friesians to maintain high productive performance under the prevailing production systems in the U.A.E.

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Annex (A) : Monthly averages of air temperature (A.T) and relative humidity (R.H).

Month*	Al - Ain				R. A. K.			
	A.T. (°C)		R.H		A.T. (°C)		R.H	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Jan.	21.3	11.1	98	57	24.0	10.6	96	41
Feb.	23.2	11.9	98	47	26.1	10.2	95	34
March	26.0	12.2	92	35	30.6	13.7	95	20
April	32.4	16.5	88	35	36.1	16.9	94	15
May	41.2	22.2	72	29	41.6	20.9	96	16
June	43.5	23.6	76	26	42.9	23.2	92	12
July	43.4	26.2	87	28	44.1	26.9	89	16
August	43.3	27.5	84	30	42.4	26.0	89	18
Sept.	39.9	23.1	80	27	41.8	23.2	95	17
Oct.	34.0	18.8	93	32	36.2	18.8	97	21
Nov.	29.9	14.3	89	36	31.7	13.8	97	20
Dec.	25.5	12.6	97	47	29.1	11.0	96	30

* Based on the period from 1987 - 1990.

صفات إنتاج اللبن لأول موسمين حليب فى ماشية الفريزيان بالإمارات العربية المتحدة

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أجريت هذه الدراسة على ١٠٢٠ سجلا لإنتاج اللبن لعدد ٦٣٦ من أبقار الفريزيان المستوردة من المانيا وهولندا والمرباة بمزرعتين (مراعى العين، رأس الخيمة) بالإمارات العربية المتحدة وذلك بغرض دراسة صفات إنتاج اللبن فى أول موسمين حليب.

وتتلخص أهم النتائج المتحصل عليها فى الآتى:

١- كانت المتوسطات العامة لصفات إنتاج اللبن الكلى، طول موسم الحليب، إنتاج اللبن اليومى، إنتاج اللبن السنوى فى الموسم الأول هى ٥٤٠٥ كجم، ٣٧٥ يوم، ١٤,٦ كجم/يوم، ٤٢٨٥ كجم، على التوالى. و كانت القيم المناظرة فى الموسم الثانى هى: ٥٣٤٥ كجم، ٣٠٦ يوم، ١٧,٥ كجم/يوم، ٤٨٤٥ كجم، على التوالى.

٢- تأثرت صفة إنتاج اللبن الكلى معنويا بالمزرعة وسنة الوضع (بإحتمال ٠,٠٠٠١ لكل) ، منشأ البقرة وفصل الوضع (بإحتمال ٠,٠٣ لكل) فى الموسم الأول، بينما أثرت المزرعة (بإحتمال ٠,٠٢) وسنة الوضع والعمر عند ثانى ولادة (بإحتمال ٠,٠٣ لكل) على نفس الصفة فى الموسم الثانى.

٣- تفوقت أبقار مزرعة العين على أبقار مزرعة رأس الخيمة، الأبقار المانية المنشأ على تلك الوراده من هولندا وولادات فصل السنة المعتدل (أكتوبر - مارس) على ولادات فصل السنة الحار (أبريل - سبتمبر) فى صفة إنتاج اللبن الكلى للموسم الأول.

٤- تأثرت صفة إنتاج اللبن اليومى بالمزرعة (بإحتمال ٠,٠٠٠١) وفصل الوضع (بإحتمال ٠,٠٠٠٥) فى الموسم الأول، بينما أثرت سنة الوضع (بإحتمال ٠,٠٤) والعمر عند ثانى ولادة (بإحتمال ٠,٠٠٣) فى الموسم الثانى.

٥- حققت حيوانات مزرعة العين إنتاج لبن يومى أعلى عن تلك الموجودة بمزرعة رأس الخيمة، وتفوقت ولادات فصل السنة المعتدل وولادات السنوات الأخيرة والأكبر عمرا فى إنتاج اللبن اليومى عن تلك التى وضعت فى فصل السنة الحار وفى السنوات الأولى وعلى عمر مبكر.

٦- تأثرت صفة إنتاج اللبن السنوى أيضا بالمزرعة وفصل الوضع (بإحتمال ٠,٠٠١ لكل) وسنة الوضع (بإحتمال ٠,٠٠٢) فى الموسم الأول، بينما أثرت سنة الوضع والعمر عند الوضع الثانى (بإحتمال ٠,٠٢) فى الموسم الثانى. وكانت أبقار مراعى العين وولادات الفصل المعتدل وولادات السنوات الأولى والأكبر عمرا أعلى معنويا (بإحتمال ٠,٠٥) عن نظائرها فى صفة إنتاج اللبن السنوى.

٧- أشارت نتائج الدراسة الى ان أبقار الفريزيان المستوردة يمكنها أن تحافظ على مستوى إنتاجها من اللبن تحت نظم الإنتاج السائدة بدولة الإمارات العربية المتحدة.