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Evaluation of Friesian Cattle Performance at First Lactation under Different Egyptian Conditions

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ABSTRACT

This research was conducted to evaluate the Friesian cattle performance and study the relationship among different days open periods, total milk yield and days in milk at the first lactation of Friesian cows under different Egyptian conditions. Milk productive and reproductive data were collected from 3258 Friesian cows of six farms. Farm No.1 is a governmental, while other farms are commercial farms located in Kafr El-Sheikh, Cairo-Alexandria desert road, Gharbia, Sharqia, Daqahlia, Beheira governorates and were named from 1, 2, … to 6, respectively. Days open (DO) was classified to 10 classes, each class of 30 days (from < 60 to ≥ 300 d). The overall average of age at first calving, days open, calving interval, days in milk (DIM) and total milk yield (TMY) of all farms were 29.4 mo, 174.4, 472.0 and 359.2 d and 6173.5 kg, respectively. Results of this study showed that, in all examined farms, the 1st lactation TMY and DIM significantly differed by the differences of the DO lengths. The study recommended that the most appropriate length of DO could be from 60 to <120 d, for Friesian cows under different managerial conditions in Egypt.

Keywords: Days open, Total milk yield, Days in milk, First lactation, Friesian.

INTRODUCTION

During the last two decades, considerable emphasis had been placed up on the importance of Friesian cattle in Egypt for milk production, accordingly the number of large Friesian herds had increased either in the governmental or in the commercial farms through importation from Europe and USA. The commercial production systems, where high technology in milk production and animal husbandry are used, represent only 10% of the total milk production in Egypt where the exotic dairy cattle breeds are raised (Hammoud *et al.*, 2010).

Environmental factors, as year of calving, season of calving and management as herd, represent important sources of factors for variation of milk production, reproductive traits and consequently herd life (Ajili *et al.*, 2007). From reproductive view, days open is routinely used to assess reproductive performance and to make economic decision in dairy herds (Arthur *et al.,* 2001). It is generally known that there is antagonistic relationship between productive and reproductive traits. Therefore, in many countries, the primary selection objective in dairy cattle breeding was oriented towards yield traits (Sewalem *et al.,* 2008). Due to negative genetic correlation between female fertility and milk production, the selection for increased milk yield resulted in genetic decline in female fertility (Andersen-Ranberg *et al.,* 2005).

The aim of this work is to evaluate the Friesian cattle performance at first lactation under different Egyptian conditions concerning the relation among different periods of days open, total milk yield and days in milk at first lactation under different conditions of six farms. Also, the range of days open related to the most appropriate productive performance was determined in different farms.

MATERIALS AND METHODS

Data of productive and reproductive traits were collected from 3258 Friesian primiparous cows of six farms that were distributed as following: 927 animals in farm 1, 1251 animals in farm 2, 874 animals in farm 3, 113 animals in farm 4, 48 animals in farm 5 and 45 animals in farm 6. Farm No.1 is a governmental farm, while other farms are commercial farms. These farms are located in Kafr El-Sheikh, Cairo-Alexandria desert road, Gharbeya, Sharqia, Daqahlia, Beheira governorates, namely 1, 2, … to 6, respectively. Data were analyzed to clear the relationship between different classes of days open and each of total milk yield and days in milk under different conditions of the six farms.

Animals in all farms were from Friesian breed and housed in free open yards. In farm 1, the routine feeding system was to allow cows in milk to graze Egyptian clover (*Trifolium alexandrinum*) from November till May, at 10:00 - 14:00 hr daily, and rice straw was offered at a rate of 4 kg/cow. Concentrate feed mixture was given to cover the rest of their standards nutritional requirements according to their milk production, body weight and reproductive status. From May to November the cows were fed on concentrate feed mixture, rice straw and berseem hay if available. In the other farms cows were fed, according to their milk production, body weight and reproductive status, on total mixed ration (TMR) that based on good quality corn silage and soybean meal, yellow corn, molasses and feed additives. Alfalfa hay and beet pulp were when available, while green berseem was used in the winter.

Artificial insemination was used for cows, which were served for the first time when reached 18-20 months of age or 350 kg of weight in farm 1, while at 15 months and 350 kg in the other farms. After two postpartum estrous cycles and reproductive examination, cows were artificially inseminated imported semen. While in farm 1, cows were inseminated artificially using frozen semen locally prepared. Cows in estrus were detected by visually monitoring and/or by pedometers in some commercial farms. Pregnancy was detected by rectal palpation during 60 days after the last mating.

Dairy cows were machine-milked twice a day at 7.00 and 16.00 hr in farm 1 , while in the other farms they were machine-milked three times daily at 0600, 1300 and 1800 hr in herringbone parlor in the other farms. Daily milk yield was recorded to the nearest 0.1 kg per cow at each milking. In all farms, cows were usually milked until drying off two or three months before the expected date of calving.

Statistical analysis:

Data were analyzed using the General Linear Model (GLM) procedure of computer program of statistical analysis (SAS, 2014), to estimate the effect of different classes of days open (DO) on days in milk (DIM) and total milk yield (TMY) at the first lactation.

The following fixed model was used:

$$Y_{ijknm} = \mu + Yr_i + Se_j + F_k + D_n + e_{ijknm}$$

Where:

Y_{ijknm} = the individual observation of total milk yield or days in milk at first lactation.

μ = the overall mean.

Yr_i = the fixed effect of the i^{th} year of calving, k=1977, 1978 …and 2014).

Se_j = the fixed effect of the j^{th} season of calving, (j= 4 level), where 1=winter, 2=spring, 3= summer, and 4= autumn.

F_k = the fixed effect of the k^{th} farm, (F= 6 farms from 1, 2 ….. to 6).

D_n = the fixed effect of n^{th} class of DO, (n= 10 classes), where 1= less than 60 days, 2= from 60 to less than 90 days, ……. and 10= equal or more than 300 days.

e_{ijknm} = residual error assumed as random and distributed as a normal distribution with mean zero and variance $\sigma^2 e$.

RESULTS

The least square means of the productive and reproductive traits studied in the examined farms are shown in Table (1). Results showed that all farms had clear significant differences in the tested traits. The highest TMY was detected significantly (P<0.05) in farm 6 followed by farm 2. However, animals in farm 1 that showed the significantly (P<0.05) lowest TMY (about 3057 Kg) had the highest age at first calving (AFC) value, followed by farm 6. Moreover, farm 5 had the significantly (P<0.05) lowest AFC value, and the significantly highest DIM and DO values, followed by farm 6, and had also the highest CI. While, farm 3 with average TMY about 5386.7 kg showed significantly (P<0.05) the lowest DIM and DO. Generally, the examined farms cleared that the 1st lactation TMY increased significantly (P<0.05) by increasing DO, except farm 1 that had significantly (P<0.05) the lowest TMY and a long DO period. This could be due to poor nutrition, cows genetics and/or managerial conditions in farm 1 (governmental farm) which led to lower fertility performance than in other farms.

Table 1. Least square means (±SE) for effect of farm on reproductive and productive performance at first lactation of Friesian cows.

Farm (No.)	No.	TMY, kg	DIM, day	AFC, mo	DO, day	CI, day
1	927	3057.0^{f}±41.4	349.8^{d}±3.19	32.3^{a}±0.17	202.9^{c}±3.33	483.5^{ab}±4.3
2	1251	8815.4^{b}±97.6	380.6^{c}±3.9	28.7^{c}±0.14	187.7^{d}±3.72	481.4^{ab}±4.4
3	874	5386.7^{e}±68.4	327.2^{e}±2.3	27.8^{d}±0.12	121.9^{f}±2.41	449.5^{cd}±4.3
4	113	6051.5^{d}±220.8	406.4^{b}±12.0	26.5^{e}±0.28	169.2^{e}±9.11	459.6^{bc}±13.4
5	48	7688.8^{c}±370.0	416.6^{a}±18.9	26.4^{f}±0.48	217.1^{a}±21.97	502.6^{a}±21.9
6	45	10900.7^{a}±543.8	400.4^{b}±20.0	28.8^{b}±0.91	207.6^{b}±26.45	430.5^{d}±23.2
overall means ±SE		6173.5±41.97	359.2±0.58	29.4±0.08	174.4±1.86	472.0±1.36

Means in the same column having different small letters (a-f) are significantly differed (P < 0.05).
TMY: Total milk yield, DIM: Days in milk, AFC: Age at first calving, DO: Days open, CI: Calving interval.

The frequency distribution of animals in DO classes of 1st lactation was varied between farms as manifested in Table (2). Regardless the differences in the 1st lactation TMY among farms, results cleared that farms 2, 3, 4, 5 and 6 had the highest frequency distribution of cows at the DO classes from 60 to <150 d. While, in farm 1, that had the lowest 1st lactation TMY, most cows showed DO ranging from 150 to < 240 d. Moreover, almost all farms, except farm 3 had high distribution of cows at DO class of ≥ 300 d.

Table (3) cleared that the DIM in all farms ranged from 256.9 d in farm 1 to 631.1 d in farm 6. Results revealed that there was a positive relationship between DO length and DIM in all farms. By increasing the length of DO, length of DIM significantly increased. Animals with the longest DO (≥ 300 d) had the longest DIM in all farms. Generally, it could be noticed that the overall means of the examined farms for 1st lactation DIM values of the DO classes from 60 to <120 days was about 305.7 days (Table 3) that achieve the standard DIM period.

Data presented in Table (4) showed that the 1st lactation DO classes cleared significant differences (P<0.05) in the 1st lactation TMY in all examined farms. However, the animals with the shortest DO produced the lowest milk yield in all farms, while animals with the longest DO had the highest TMY in farms 1, 2, 3 and 6.

Generally, within each farm the high producing cows showed low fertility performance. Moreover, the overall means of the examined farms for 1st lactation TMY values of the DO classes from 60 to <120 days was about 6309.5 Kg, that is close to the overall mean of the examined farms TMY (6173.5 kg) (Table 1), and that achieved by standard overall means of DIM being 305.7 days (Table 3).

Table 2. Number (N) and frequency distribution (%) of cows for different days open classes (DO) in the tested farms.

DO classes (Day)	Farm 1		Farm 2		Farm 3		Farm 4		Farm 5		Farm 6	
	N	%	N	%	N	%	N	%	N	%	N	%
< 60	57	6.15	107	8.55	111	12.70	7	6.19	7	14.58	-	-
60 - < 90	78	8.41	231	18.47	250	28.60	22	19.47	8	16.67	10	22.22
90 - < 120	94	10.14	154	12.31	179	20.48	18	15.93	2	4.17	9	20.00
120 - < 150	63	6.80	144	11.51	114	13.04	12	10.62	6	12.50	6	13.33
150 - < 180	113	12.19	112	8.95	85	9.73	10	8.85	3	6.25	3	6.67
180 - < 210	122	13.16	69	5.52	36	4.12	10	8.85	-	-	4	8.89
210 - < 240	108	11.65	76	6.07	25	2.86	5	4.43	3	6.25	-	-
240 - < 270	70	7.55	87	6.95	21	2.40	9	7.96	4	8.33	2	4.44
270 - < 300	44	4.75	55	4.40	17	1.95	6	5.31	-	-	3	6.67
≥ 300	178	19.20	216	17.27	36	4.12	14	12.39	15	31.25	8	17.78
Total	927		1251		874		113		48		45	

Table 3. Least square means (±SE) for effect of different days open (DO) classes on days in milk (DIM) of Friesian cows at first lactation in different farms.

DO classes (Day)	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6
< 60	256.9^{h}±4.3	296.3^{i}±7.03	271.7^{h}±2.3	266.4^{j}±3.06	281.1^{h}±5.4	-
60- < 90	279.5^{g}±6.6	294.2^{j}±5.13	292.2^{g}±2.0	295.5^{i}±12.53	301.4^{g}±2.2	291.8^{h}±3.28
90- < 120	297.9^{f}±6.0	310.4^{h}±4.55	313.8^{f}±2.7	353.7^{g}±18.79	319.0^{f}±5.0	318.6^{g}±2.99
120- < 150	308.7^{f}±6.8	314.5^{g}±7.50	333.9^{e}±3.7	346.3^{h}±7.65	345.0^{e}±5.3	350.7^{f}±2.49
150- < 180	335.8^{e}±7.1	364.4^{f}±7.26	356.9^{d}±5.5	388.6^{f}±23.24	395.3^{d}±10.0	384.0^{e}±6.66
180- < 210	365.6^{d}±7.4	374.9^{e}±10.23	396.5^{c}±9.4	464.9^{e}±30.10	-	415.5^{c}±11.24
210- < 240	361.0^{d}±7.9	386.9^{d}±12.07	401.3^{c}±10.6	495.2^{c}±46.96	445.7^{c}±8.9	-
240- < 270	380.1^{c}±12.1	396.2^{c}±11.73	440.0^{b}±13.3	545.9^{b}±39.39	494.8^{b}±24.3	386.5^{d}±82.50
270- < 300	403.7^{b}±11.5	493.0^{b}±8.40	445.4^{b}±20.5	482.5^{d}±9.59	-	497.0^{b}±12.53
≥ 300	418.1^{a}±8.8	582.2^{a}±8.38	473.4^{a}±17.1	587.3^{a}±21.91	560.7^{a}±28.5	631.1^{a}±46.87

Means in the same column having different small letters (a-j) are significantly differed (P < 0.05).

Table 4. Least square means (±SE) for effect of different days open (DO) classes on total milk yield (TMY) of Friesian cows at first lactation in different farms.

DO classes (Day)	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6
< 60	2365.2^{j}±97.4	7168.5^{j}±300.3	5139.8^{i}±197.6	4392.1^{j}±679.8	6977.7^{f}±683.6	-
60- < 90	2594.7^{i}±122.2	7593.4^{h}±168.8	5104.5^{j}±123.5	4825.8^{i}±288.2	7009.4^{e}±922.6	8345.0^{h}±640.9
90- < 120	2699.2^{h}±97.6	7607.5^{g}±206.3	5160.2^{h}±151.4	5801.9^{f}±481.5	9298.5^{b}±889.5	8664.4^{g}±647.3
120- < 150	2733.5^{g}±121.8	7434.1^{i}±243.4	5508.4^{e}±170.8	5515.6^{h}±678.3	6335.5^{h}±1202.0	10455.0^{e}±438.2
150- < 180	2971.3^{e}±104.2	8679.9^{f}±235.8	5446.4^{g}±198.8	5577.7^{g}±385.6	7931.3^{d}±986.4	10776.7^{d}±548.2
180- < 210	3328.8^{c}±124.4	8975.1^{e}±366.8	6182.1^{b}±291.3	5833.6^{e}±672.5	-	11575.0^{c}±1050.8
210- < 240	2795.5^{f}±108.4	9380.2^{c}±375.2	6177.7^{c}±434.9	6042.6^{d}±1042.1	9496.7^{a}±1575.0	-
240- < 270	3163.4^{d}±140.5	8990.2^{d}±324.3	5750.9^{d}±453.5	8999.7^{a}±1222.9	6579.3^{g}±1329.1	8740.0^{f}±2040.0
270- < 300	3404.3^{b}±198.5	9972.7^{b}±350.2	5492.2^{f}±363.3	7263.8^{c}±389.7	-	12713.3^{b}±1204.6
≥ 300	3683.6^{a}±110.2	12175.8^{a}±261.5	7100.7^{a}±422.0	7669.9^{b}±554.7	8595.5^{c}±703.8	16515.0^{a}±1307.9

Means in the same column having different small letters (a-j) are significantly differed (P < 0.05).

DISCUSSION

The aim of this work is to evaluate the Friesian cattle performance at first lactation under different Egyptian conditions concerning the relation between different classes of days open, total milk yield and days in milk at first lactation under different conditions of six farms. Also, the range of days open related to the most appropriate productive performance was determined in different farms.

Results showed significant differences among the different farms in all tested productive and reproductive traits at first lactation. However, in the term of discussing the present study reproductive traits tested at 1st lactation, the obtained AFC (29.4 mo) was nearly similar to 29.3 m and 29.81 mo as reported by Salem *et al.* (2006) and Teke and Murat (2013) in Friesian cows in Egypt and Turkey, respectively. On the other hand, AFC was higher (39.2 mo) for Holstein cows in Ethiopia as recorded by Tadesse *et al.* (2010). Also, Ibrahim (2006) showed lower AFC values (23.7 mo) for Friesian cows in Egypt.

Additionally, the DO in the present study (174.4 d) was close to 177 and 170.7 d as recorded by Gebeyehu *et al.* (2007) and Riecka and Candrák (2011)

on Holstein cows in Ethiopia and Slovak Republic, respectively. The recorded DO was higher than 157.3 and 163.3 d as reported by Gabr (2005) and Ajili *et al.* (2007) on Friesian cows in Egypt and Tunisia, respectively. Also, DO was lower than 185.9 d as detected by Osman *et al.* (2013), on Friesian cows in Egypt.

Regarding the detected CI value in this study (472.0 d), it was nearly similar to 470 d as recorded by Salem *et al.* (2006). While lower values (425.25 d and 394 d) were found by Gabr (2005) and Ibrahim (2006), respectively, but higher value (508.5 d) was recorded by Abou-Bakr (2009).

Concerning the tested productive traits at first lactation, the obtained value of TMY (6173.5 kg) was close to 6427.6 and 5905 kg as found by Nilforooshan and Edriss (2004) on Friesian cows in Iran and Ajili *et al.* (2007), respectively. Lower values of TMY (3103.9 and 3651 kg) from Friesian cows in Egypt were reported by Alemam (2002) and Hussein (2007), respectively, while higher values of TMY (6845.1 and 8750 kg) were presented by Gabr (2005) and Osman *et al.* (2013), respectively, for Friesian cows in Egypt. Average DIM in this study (359.2 d) was nearly similar to that recorded on Friesian cows in Ethiopia (362 d) (Tadesse and Dessie, 2003). Longer DIM values (407 and 398.8 d) were recorded by Salem *et al.* (2006) and Osman *et al.* (2013), respectively, whereas shorter DIM (347.7 d and 322 d) were observed by Gabr (2005) and Ibrahim (2006), respectively on Friesian cows in Egypt.

Concerning the frequency distribution of animals of different classes of DO in each farm, higher distribution of animals in the 5 commercial farms had shorter DO than farm 1 (governmental), except in farm 5, which had high distribution (31.25 %) of cows with DO ≥ 300 d. Generally, the commercial farms were expected to achieve good management practices and adequate high quality ration, in addition their high genetic potential. It is important to mention that the present of perceptible ratio in the last class with longer DO this may be due to the antagonistic relationship between high milk production and fertility.

It is of interest to note that cows with DO of 60-90 d showed the highest distribution in all farms except in farm 1.This may be attributed to managerial factors in farm 1.

There were significant differences between each of the tested traits (TMY, DIM) with the differences of DO classes. Regard to the relation between DO classes and TMY, Alemam (2002) demonstrated partial linear and quadratic regression coefficients of DO on TMY with highly significant effect. Also, Loker *et al.* (2009) indicated that milk production for cows with DO ≤180 tended to have low yields in the last part of lactation. Cows with longer DO, however, had proportionally higher milk yield throughout lactation, suggesting a possible confounding effect of production level with DO effects. In concern to the relation between DO classes and DIM, the obtained results are in agreement with Soliman and Hamed (1994), who found that length of DO was found to be a significant source of variation in length of lactation period. Also, El-Sheikh (1995) reported that the regression coefficients of lactation period on DO had significant effect at linear and quadratic values.

Among the examined farms, pronounced variations could be noticed in each of productive and reproductive traits. Based on the present results, it could be noticed from the reproductive side of view that DO represent the key of TMY success in the farm. Short DO lead directly to short calving interval and by way increase the longevity of the cow. On the other side, this case indirectly affects the length of DIM, TMY and dry period. The present results also cleared a positive (unfavorable) relation between the level of TMY and the length of DO as observed by Pryce *et al.* (2004). Thus, selection for high milk yield in dairy cattle is accompanied by a decline in fertility which eventually appears as low reproductive performance (Oltenacu and Broom, 2010). The results indicated that the largest TMY in most examined farms were obtained from animals with the longest DO (≥ 300 d). Meanwhile, shortening DO may be not appropriate in case of farms with high yielding animals.

CONCLUSION

Obtained results cleared that the most appropriate length of DO could be from 60 to <120 d for Friesian cows under different management conditions in Egypt. Such recommended DO length is suggested to achieve an appropriate milk production and reproductive performance of Friesian cows raised in Egypt.

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تقييم أداء ماشية الفريزيان فى موسم الحليب الأول تحت ظروف مصرية مختلفة

فايق حسنى فراج ، ناظم عبدالرحمن شلبى ، عمرو أحمد جبر و مصطفى أحمد العشرى

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أجري هذا البحث لتقييم أداء ماشية الفريزيان ودراسة العلاقة بين فئات مختلفة من طول فترة الأيام المفتوحة، وإجمالي إنتاج الحليب وعدد أيام الحليب في الموسم الأول للأبقار الفريزيان تحت ظروف مصرية المختلفة. تم جمع بيانات إنتاج الحليب والتناسل من ٣٢٥٨ بقرة فريزيان من ٦ مزارع. المزرعة الأولى هى مزرعة حكومية، في حين أن المزارع الأخرى مزارع تجارية . تقع هذه المزارع في كفر الشيخ، طريق القاهرة الإسكندرية الصحراوي، الغربية، الشرقية، الدقهلية، محافظة البحيرة، وتم تسمية المزارع من ١، ٢، ... إلى ٦، على التوالي. تم تصنيف طول فترة الأيام المفتوحة إلى ١٠ فئات كل فئة ٣٠ يوم (تبدأ من > ٦٠ إلى ≤ ٣٠٠ يوم) بطول شهر لكل فئة. وكان المتوسط العام للمزارع فى العمر عند أول ولادة، طول فترة الأيام المفتوحة، الفترة بين ولادتين، عدد أيام الحليب وإجمالي إنتاج الحليب هى ٢٩.٤ شهر، ١٧٤.٤ ، ٤٧٢.٠ ، ٣٥٩.٢ يوم و ٦١٧٣.٥ كجم ، على التوالي. تشير نتائج هذه الدراسة إلى أن هناك اختلافاً معنويا فى إجمالي إنتاج اللبن وعدد أيام الحليب بإختلاف طول فترة الأيام المفتوحة في جميع المزارع قيد الدراسة. هناك علاقة إيجابية بين طول الأيام المفتوحة، وعدد أيام الحليب وإجمالي إنتاج اللبن في الموسم الأول حيث بصفة عامة تزداد القيم بزيادة طول فترة الأيام المفتوحة في أغلب المزارع بالدراسة. تقترح الدراسة إلى أن الطول المناسب لفترة الأيام المفتوحة وفقاً للمزارع قيد الدراسة تحت ظروف الرعاية المختلفة في مصر من الممكن أن يكون حوالي ٦٠-١٢٠ يوم ، حيث أن ذلك قد يحقق الحصول على انتاج من اللبن يقارب المتوسط العام لإنتاج اللبن الكلي للمزارع قيد الدراسة.