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Factors Affecting Annualized Milk Yield in a Herd of Holstein Friesian Cows in Egypt

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stract

ıear mixed model was used to study the fixed effects of month of calving, year of calving and parity, and the random cts of sire and cow within sire on annualized milk yield (AMY). The study was conducted on 3056 lactation records of Holstein Friesian cows. A least squares analysis of variance showed significant effects of all factors on AMY ($P<0.05$ $^{\prime}<0.01$). Including days open (DO) and days dry DP) as a polynomial regression of the second degree in the model ded significant regression coefficients ($P<0.01$). The partial linear and quadratic regression of AMY on DO were -9$\pm$0.62 kg/d and 0.0127$\pm$0.0019 kg/d^2, respectively. The partial linear and quadratic regression coefficients ($P<0.01$). partial linear and quadratic regression of AMY on DO were -8.89$\pm$0.62 kg/d and 0.0127$\pm$0.0019 kg/d^2, respectively. partial linear and quadratic regression coefficients of AMY on DP were -2.30$\pm$0.45 kg/d and 0.005$\pm$0.0016 kg/d^2, ɔectively. Maximum production in the current lactations including the calf crop expressed in kilograms of milk was ined when cows were bred as early as possible after parturition. Therefore, a reduction of DO is a desirable goal of dairy ı.

roduction

's open (DO the interval between calving and conception considered an important measure of fertility. It is of ctical value to milk producers. It is effect on milk yield is ely environmental (Schaeffer and Henderson, 1972). y postpartum breeding in dairy animals resulted in more es and high milk per unit of time throughout the herdlife tt, 1975).

ıy workers (Bar-Anan and Soller, 1979; Thompson *et* 1982; Weller *et al.*, 1985; Ashmawy, 1991; Ashmawy Khattab, 1991; Rege 1991; Hamed 1994; Hussien, 96; Yener *et al.*, 1998) reported that AMY decreased h increasing days open and/or days dry. Louca and ates (1968) reported that milk yield per day or per year h as AMY is taken as the measure of economic formance.

ɔmpson *et al.* (1982) using days open adjusted, ıualized and fat corrected yields as alternatives to mature ıivalent records found that over the range of 60 to 300 's open, 305 day mature equivalent (ME) yields increased h increased days open whereas annualized yield creased. They added that small changes in culling cisions and sire evaluation when using AMY or yield usted for DO. However, they suggested that more study needed before AMY can be recommended for cow lection or sire evaluation.

eller *et al.* (1985) reported that cumulative yield of rrent and following annualized lactations, including the ntribution of the calf expressed in units of milk oduction was greatest at 117 and 98 days open for ifers and cows, respectively. However, Ashmawy and hattab (1991) working on Friesian cattle in Egypt, ncluded that AMY was greatest at 40 days open.

The present study was undertaken to determine the effect of sire and cow within sire as a random effects, month calving year of calving and parity as a fixed effects and days open and days dry as a covariate on AMY in Friesian cows in Egypt. In addition, losses by suboptimal AMY were assessed.

Materials and Methods

Data of the present study were obtained from the Holstein Friesian cattle kept, at the commercial farm in Egypt (Dalla farm). The total useable of records were 3056 produced by 803 cows during the period from 1987 to 1994. Records with lactation periods shorter than 150 days and/or abnormal ones affected by diseases or by disortes were excluded. Annualized milk yield was computed as 365 times the ratio of total milk yield over calving interval in days. The length of days open computed as the interval between the date of parturition and the date of successful mating or by subtracting the mean of gestation period, 275 day from the actual calving date if the date of successful mating as not known. Length of days dry was calculated as the interval between the date of drying off and the date of the next calving. Records with missing drying off were rejected.

Breeding plan: Artificial insemination (AI) was used at random. Heifers were served for the first time when they reached 18 mo or 350 kg. Therefore, cows were usually served two months postpartum. Pregnancy were detected by rectal palpation 60 days after the last service. Stores of frozen semen of bulls, exported from USA, were used. The number of sires and the average of daughters per sire were 237 and 10.98, respectively. The genetic analysis included the sire which have at least five daughters and each cow had more than one records.

Management: Cows were grazed on Alfalfa and concentrates mixture which consists of 45 per cent cotton seed cake, 26 per cent wheat bran, 17 per cent yellow maize, 7 per cent rice bran, 2 per cent, molasses 1 per cent sodium chloride and 2 per cent calcium. Concentrates were offered twice daily, animals are machine milked twice daily at 7 a.m. and 4 p.m.

Analysis: The following linear mixed model was used to study the effects of sire(s) and cow within sire (d) as a random effects, month of calving (m), year of calving (y), parity (p) as a fixed effects. Also, the model included polynomial regression coefficients of the second degree to describe the relationship between AMY and both DO and DP.

$$Y_{ijklm} = \mu + s_i + d_{ij} + m_k + y_l + p_m +$$
$$b_{1l}(x_1 - \bar{x}_1) + b_{2_q}(x_i = \bar{x}_l)^2 +$$

Where Y_{ijklm}; an AMY of the ijklm the observation, μ: the overall mean: b_{il} and b_{2q}: partial linear and quadratic regression coefficients of AMY on DO, respectively; b_{3l} and b_{4q} are the partial linear and quadratic regression coefficients of AMY on DP, respectively; X_1 and X_2 are DO and DP of the ijklm the cow; X_1 and X_2 are DO and DP of the ijklm the cow; $\bar{x}_1$ and $\bar{x}_2$ are the average of DO and DP, respectively; e_{ijklm}: random elements of variance peculiar to each observation with mean zero and variance $\sigma^2 e$. The calculate the expected loss in AMY due to delayed breeding the following equations was computed.

$$Y = \mu + b_{1l}(x_1 - \bar{x}_1) + b_{2_q}(X_1 - \bar{x}_1)^2 \qquad \text{(i)}$$

Then the expected loss in AMY at a certain length of DO (ELAMY) is computed by the following equations:

$$ELAMY = (Y_{max} - Y_t)^* \; 0.55 \qquad \text{(ii)}$$

Where Y_{mzx}: expected maximum AMY; Y_t: expected AMY at a certain length of DO; 0.55 a constant of income from milk over feed cost per day (Weller *et al.*, 1985).

The expected loss in calf crop per year due to delayed breeding (ELC is calculated as following:

Annualized calf crop = (calf value/actual calving interval (CI))* 365,

then

$$ELC = ACC_{min} - ACC_t \qquad \text{(iii)}$$

Where

ACC_t: annualized calf crop at a certain length of DO, ACC_{min}: an annualized calf crop at the minimum length of DO. Therefore, loss in AMY including the contribution of calf expressed in kilogram of milk was (ii) + (iii), assuming that a calf is equivalent to 270 kg of milk the average weight of a calf at birth was 30 kg as reported by Omar (1984) using the data of the same herd and considering the 1 kg calf = 9 kg milk using the whole sale price of each). Estimates of sire, cow within sire and remainder components of variances and covariance were estimated by using the mixed model least squares and maximum likelihood computer program of Harvey (1987).

Results and Discussion

Least squares mean of AMY was found to be 4242±81 kg (Table 1). The present mean was higher than that reported by Ashmawy and Khattab (1991) (2944 kg) using another herd of Friesian cattle in Egypt, while, the present mean was lower than that reported by Hansen et al. (1983) (6021, 6703 and 7120 kg) for the Ist, 2nd and 3rd lactations respectively. Also, Yener *et al.* (1998) working on Holstein Friesian cattle in Turkey found that AMY was 5134 kg However, estimates of means of 305 day milk yield and total milk yield were 4938 kg and 5200 kg, respectively using the same set of data (Hussein, 1996). The differences between AMY and the other measures of production are due to delayed breeding.

Least squares analysis of variance of AMY is presented in Table 2. Effects of sire, cow within sire, month of calving, year of calving, parity, days open and days dry on AMY were significant ($P<0.05$ or $P<0.01$).

Results in Table 1 show that animals calving in spring months had the highest AMY, while summer calves produced the lowest AMY. The high yield in spring calves could be attributed to the favourable climatic conditions for abundant growth and availability of good quality of Alfalfa during the increasing stage of lactation. The present results are agree with those obtained by Ashmawy (1991), Ashmawy and Khattab (1991), Hamed (1994) working on different breeds of dairy cattle in Egypt. Also, Rege (1991) analyzed 31661 lactation records of Friesian cattle in Kenya, reported that the effect of season of calving on AMY was significant, seasonal variation in animal performance in the tropics is expected to be primarily manifestation of variation in feed quality. Cows calving during the long rain (March - May) had the best performance, highest AMY, while, performance was lowest for cows calving in the short rain (October - December) but was intermediate for those calving during the dry season.

The effect of year of calving on AMY was significant ($P<0.01$ Table 2). Similarly, significant effect of year of calving on AMY was reported by many authors working on different breeds of dairy cattle (e.g., Hansen *et al.*, 1983; Weller et al., 1985; Ashmawy, 1991; Ashmawy and Khattab, 1991; Rege, 1991; Hamed, 1994 and Yener *et al.*, 1998). The present results indicates that changes in AMY from year to another can be attributed to change in herd e, age of animals improved management practices roduced from year to year and phenotypic trend.

ble 1: Least squares estimates of effects and standard errors (S.E.) Of different factors affecting annualized milk yield (AMY) of Holstein Friesian cows in Egypt.

assification	No.	Estimate (kg)	SE (kg)
erall mean	3056	4242	81
onth of calving			
1	262	72	78
2	224	24	81
3	202	-183	82
4	154	-52	87
5	178	14	82
6	209	-104	77
7	323	-109	64
8	370	123	59
9	262	73	61
10	260	122	72
11	257	44	75
12	255	62	78
ar of calving			
87	263	-1246	289
88	410	-331	200
89	599	659	127
90	748	327	87
91	683	515	86
92	212	-389	151
93	112	-116	211
94	29	581	326
rity			
1	778	427	260
2	778	674	173
3	664	255	103
4	424	-94	86
5	310	-401	126
6	89	-642	201
>7	13	-220	348
egression			
ays open, linear		-8.8900	0.6200
ays open, quadratic		0.0127	0.0019
ays dry, linear		-2.2800	0.4500
ays dry Quadratic		0.0056	0.0016

ege (1991) reported that differences among years can be tributed to both annual fluctuations in weather conditions nd possibly phenotypic trend. He added that phenotypic end for AMY which estimated by regression adjusted nnual milk yield on year was 4.4 kg.

actation number had a significant effect on AMY (P<0.01, able 2). Results indicate that AMY increased with the crease in the order of lactation until the third lactation and ecrease after that (Table. This is logical due to the crease in body weight combined with advancing age and the full development of the secretory tissue of the udder. The present results are in agreement with that of Yener *et al.* (1998) working on Holstein Friesian cattle in Turkey, reported that the highest AMY was reached in the third lactation, while, Ashmawy and Khattab (1991) and Rege (1991) found that AMY increased with the increase of order of lactation upto 5th lactation.

Table 2: Least squares analysis of variance for factors affecting annualized milk yield (AMY) of Holstein Friesian in Egypt.

Source of variation	d.f.	F-values
Sire	273	1.30**
Cow:Sire	529	2.07**
Month of calving	11	1.75*
Year of calving	7	84.55**
Parity	6	17.54**
Regression		
Days open, linear	1	26.39**
Days open, quadratic	1	12.45**
Days dry, linear	1	205.28**
Days dry, quadratic	1	45.63**
Remainder	2225	842652.00

* P<0.05; ** P<0.01.

Including DO as a polynomial regression of the second degree in the model yielding significant partial linear and quadratic regression coefficients of AMY on DO (Table 2), being -8.89 ± 0.62 kg/d and 0.0117 ± 0.0019 kg/d^2, respectively (Table 1). AMY showed a trend opposite to that shown by 305 day milk yield and total milk yield for the same set of data (Hussien, 1996).

The negative relationship observed between DO and AMY in this study (Table 1) may be due to that longer DO resulted in more days in milk which extend the late lactation part with lower daily production. Another reason that DO is a component of the denominator of AMY Hansen et al. (1983) reported that AMY was negatively correlated with DO. Also, Thompson *et al.* (1982), Ashmawy (1991), Ashmawy and Khattab (1991), Hamed (1994) and Yener *et al.* (1998) found that 305 day milk yield increased with increased days open while, AMY decreased.

In addition, Louca and Legates (1968) fitting a polynomial of second degree of milk yield on DO, found that there was a decline of 3.6 and 3.7 kg of milk for second and third lactation, respectively for each additional days open. However, the losses per day open reported herein are smaller than those reported by Olds *et al.* (1979), they found that within herds, each days open between 40 and 140 days open of lactation resulted in an over of 8.6 kg less AMY during current lactation for cow in second and later lactations. The same authors also found that with peak production occurring during the first few months of lactation, any prolongation of CI was likely to lower average production per unit of time.

Losses in milk per year, assuming that 45 per cent of the

Table 3: Loss per year in annualized milk yield plus the contribution of calf crop expressed in kilograms of milk (LAMY1CC)

t	Days open (DO)*	Expected annualized Milk yield	Expected loss in AMY[b] (ELAMY)	Annualized calf crop (ACC)	Expected loss in ACC (ELC)	LAMYICC = (2) + (4)
1	40	4718	-	313	-	-
2	50	4618	55	303	10	65
3	60	4520	109	294	19	128
4	70	4425	161	286	27	188
5	80	4332	212	278	35	237
6	90	4142	262	270	43	305
7	100	4154	310	263	50	360
8	110	4059	357	256	57	414
9	120	3987	452	249	64	516
10	130	3907	446	243	70	526
11	140	3829	489	237	76	565
12	150	3754	530	232	81	611
13	160	3682	570	227	86	656
14	170	3612	608	221	92	700
15	180	3545	645	217	96	741
16	190	3480	681	212	101	782
17	200	3418	715	207	106	821
18	220	3301	779	199	114	893
19	240	3194	838	191	122	960
20	260	3098	891	184	129	1020
21	280	3011	939	178	135	1074
22	300	2935	981	171	142	1123
23	320	2869	1017	166	147	1164
24	340	2813	1048	163	150	1198
25	360	2768	1072	155	158	1230

a = calving interval = DO + 275; b = ELAMY = $(Y_{max} - Y_t)$*0.55 since 0.45 of milk price is spent for feed cost.

price of milk is spent for food and loss in calf crop expressed in kilogram of milk are presented in Table 3. Expected annualized milk yield (EAMY) and annual calf crop (ACC) plus the contribution of the calf crop was greatest at 40 day open, also the losses in AMY were decreased by increase in DO. Weller *et al.* (1985) concluded that cumulative yield of current and following annualized lactations, including the contribution of the calf expressed in unit of milk production is the greatest at 114 and 98 days open for primiparous and multiparous cows. Bar-Anan and Soller (1979) reported that 30 to 50 DO for cows results in the highest annual production over current and following lactation. Expected loss in calf crop (ELC) per year due to delayed breeding were decreased by increase in DO. The number of calves available for replacement also decreased as a result of delayed breeding. Therefore, a length of DO of 40 days is appropriate period for maximum period in current lactation for Holstein Friesian cows. Estimates of partial linear and quadratic regression coefficients of AMY on DP were significant ($P<0.01$, Table 2), being -2.28 ± 0.45 kg/d and 0.0056 ± 0.0016 kg/d^2, respectively (Table 1).

Ashmawy and Khattab (1991) found that the linear regression coefficients of AMY on DP (-1.64 ± 0.96 kg/d), while, the quadratic term (0.00076 ± 0.0023 kg/d^2) was significant. Dias and Allaire (1982) found that cows with less than 340 days required at least 55 days dry maximizing milk production in two consecutive lactatio The present results indicated that maximum production practically attained when cows had the least length of In addition, increasing the length of DP are dependent the cost of milking cows with extended lactation. Da cattle breeders tend to milk their cows in later lactations long as the difference of income over feed cost per exceeds the cost of milking. The present results sugges that maximum in production in the current lacta including calf crops was attained when cows were bre early as possible after parturition. Also, DO can be redu by good managerial practices such as success in detection and insemination at an optimum time during period using good quality of semen and skilled insemina El-Fouly *et al.* (1976) advised that preparing the bu cows to have the full chance for conception during season of bull ovarian activity (October - March) reduce DO considerably.

Finally, an intensive program of heat detection and effi practices of insemination would usually shorten DO.

eferences

shmawy, A.A., 1991. Repeatability of productive traits in Egyptian buffaloes. J. Anim. Breed. and Genet., 108: 182.

shmawy, A.A. and A.S. Khattab, 1991. Factors annualized milk yield in Friesian cows in Egypt. Egypt. J. Anim. Prod. 28: 1.

r-Anan, R. And M.C. Soller, 1979. The effects of days open on milk yield and breeding policy postpartum. Anim. Prod., 29: 109.

itt, J.H., 1975. Early postpartum breeding in dairy cows. A Review. J. Dairy Sci., 55: 266.

as, F.M. and F.R. Allaire, 10982. Dry period to maximize milk production over two consecutive lactations. J. Dairy Sci., 65: 136.

Fouly, M.A., E.A. Kotby and H.E. El-Sobhy, 1976. The functional reproductive peak in Egyptian buffaloes cow as related to dry days length and ambient temperature. Archivo. Veterinario, 27: 123.

ansen, L.B., A. E. Freeman and P.J. Berger, 1983. Yield and fertility relationships in dairy cattle. J. Dairy Sci., 66: 293.

amed, M.K., 1994. Age and days open correction factors and repeatability estimates for yield and interval traits. Egypt. J. Anim. Prod., 31: 163.

arvey, W.R., 1987. Users guide for LSMLMW mixed model least squares and maximum likelihood computer program. Ohio, State University, Calumbia.

Hussien, M.A., 1996. Age correction factors, for some productive traits in a commercial herd of Friesian cows in Egypt. M.Sc. Thesis, Faculty of Agriculture, Tanta University, Egypt.

Olds, D.T. Copper and F.A. Thrift, 1979. Relationships between milk yield and fertility in dairy cattle. J. Dairy Sci., 62: 1140.

Omar, A.E., 1984. Effect of genetic and environmental factors on the growth of male and female calves. M.Sc. Thesis, Faculty of Agriculture, Tanta University, Egypt.

Rege, J.E.O., 1991. Genetic analysis of reproductive performance of Friesian cows in Kinya. J. Anim. Breed. And Genet., 108: 427.

Schaeffer, L.R. and C.R. Henderson, 1972. Effects of days dry and days open on Holstein milk production. J. Dairy Sci., 55: 107.

Thompson, J.R., A.E. Freeman and P.J. Berger, 1982. Days open adjusted, annualized, and fat corrected yield as alternatives to mature equivalent records. J. Dairy Sci., 65: 1562.

Weller, J.I., R. Bar-Anan and K. Osterkorn, 1985. Effects of days open on annualized milk yield in current and following lactations. J. Dairy Sci., 68: 1241.

Yener, S.M., N. Akman and A.S. Khattab, 1998. Analysis of milk production trait of Holstein cattle in Turkey and Egypt. I - Nongenetic factors. Turkish J. Vet. And Anim. Sci., (In press).