

GENETIC PARAMETERS AND BREEDING VALUES FOR PRODUCTIVE REPRODUCTIVE AND PERSISTENCY OF MILK YIELD TRAITS OF CULLED COWS AND THEIR CONTEMPORARIES RETAINED IN HERD OF FRIESIAN CATTLE AT DIFFERENT LACTATIONS.

Mostafa, M.A.

Department of Animal Production, Fac. of Agriculture, Mansoura University, PC: 35516, Mansoura, Egypt.

ABSTRACT

Records of production, reproductive and persistency of milk yield performance of Holstein Friesian cows kept at Mezoheges State Farm, Hungary collected during the period from 1982 to 1990 were used. These were either culled after completing a particular lactation ($n = 2219$) or retained to give subsequent lactations up to the 4th lactation, ($n = 4138$). Data were analysed to estimate genetic parameters breeding values and to compare the productive and reproductive performance between the two groups. The data covered milk production traits: total milk yield (TMY), 305-day milk yield (305-d MY), 305-day fat yield (305-d FY) and persistency of milk yield (Pr MY) and reproductive traits: number of services per conception (NSC) and days open (DO).

The results obtained could be summarized as follows:

- The actual means of TMY, 305-d MY, 305-d FY, Pr MY, NSC and DO were 7197, 6974, 255 kg, 72.71%, 2.23 services and 125.8 day, respectively, across 1st four lactations. Coefficients of variation (CV%) of milk production traits ranged from 25.08 to 34.00%, but for Pr MY was 13.45%, while for NSC and DO were 73.99 and 63.56%, respectively.
- The estimates of heritability \pm S.E of the 1st lactation based on animal model method for TMY, 305-d MY, 305-d FY, Pr MY, NSC and DO were 0.31 ± 0.05 , 0.35 ± 0.05 , 0.30 ± 0.04 , 0.10 ± 0.03 , 0.12 ± 0.03 and 0.09 ± 0.03 , respectively.
- Estimates of r_g and r_p correlations between production and reproduction traits were positive and medium to high ranged from 0.58 ± 0.12 to 0.91 ± 0.05 and from 0.24 to 0.50, respectively. Also estimates of r_g correlation between Pr MY and each of NSC and DO were 0.21 ± 0.15 and 0.12 ± 0.11 , while r_p were 0.07 and 0.08, respectively.
- Culling rate increased with advance of parity, being 26.3 and 49.2% at the end of the 1st and 4th lactations, respectively. Culled cows had significantly higher TMY, 305-d MY, 305-d FY and Pr MY than those retained and the differences between the two groups were generally more pronounced in the 1st two lactations. Culled cows had also significant larger NSC and longer DO than retained cows. These results showed that the culled cows have lower reproductive performance and higher milk production traits than those retained in the herd.
- The range in estimates of breeding values of animals for all traits studied for both retained and culled cows was wide, suggesting that there is scope for selection.
- The results indicated that more attention should be given to high yielding cows, particularly their reproductive management, to increase their longevity and hence improve herd productivity. Moreover, culling decisions have an important influence on the economic performance of the dairy but are must be based on the EBVs for economic traits.

Keywords: Holstein Friesian, genetic parameters, culling rate, milk yield traits, reproductive traits, breeding value.

INTRODUCTION

The dairy animals breeders look to the milk yield, fertility and health as the most important traits influence the profitability of dairy production. Also, the role of longevity must be consider in the profitability evaluation of the dairy herds (Brotherstone *et al.*, 1997). The longevity may be defined from different side of views as the ability to avoid death or culling, the former being mostly from diseases or accident and the latter from reproductive failure, low milk yield, mastitis, etc. Culling is the act of removing a cow from a herd and replacing with another, often heifer at first-lactation. The culling rate describes the percentage of cows removed from a herd. It is clear that culling rates is important for managing dairy production. When dairy farm managers cull animal often or too quickly, replacement expenditures are excessive. In the same time, when managers keep cattle for too long, milk production, reproduction, or genetic improvement may be impaired. Thus, the culling rate had been found as an essential element in estimating the economics of dairy herds (Esslemont and Peeter, 1993). In this concept, an overall culling rate of 18% has been considered as optimal in good dairy herds, although only small percentage of herds achieve that target (Esslemont, 1992). Currently, reproductive failures contribute a substantial proportion of total cow disposals, about 16% in the US (Freeman, 1984) and 25% in Canda (Westell *et al.*, 1982). In the same trend the studies of Amand *et al.* (1980) indicated that reproductive failure was responsible for 16 to 30% of the total cows disposal. Moreover, past research has consistently estimated optimal herd-level culling rates ranging from 19 to 29% (Rogers *et al.*, 1988; Bauer *et al.*, 1993; Stott, 1994 and Jones, 2001).

Long ago, the milk yield is the main economic trait for selection in dairy cattle improvement, as well fat continues improvement in milk yield over the last 50 years this create decline in conception rate (Darwash *et al.*, 1999). Consequently, the deterioration in cow fertility had become a major problem in dairy cattle production.

The genetic antagonistic between production and reproduction traits in the other become more evident in high yielding cows. Consequently the level of the antagonistic is influenced by the role of management (Haile-Mariam *et al.*, 2003 and Kadarmideen *et al.*, 2003). Little genetic improvement could be achieve in the reproductive performance traits however still there are considerable additive genetic variability for exploitation, Oltenacu *et al.*, 1991. The relations between milk production, reproduction and longevity were showed by various reports (Nigm *et al.*, 1988; Sadek, 1994 and Aboul-Ela *et al.*, 2000), indicated that high yielding cows are generally culled earlier and have shorter longevity than low producers.

The objectives of this study were to estimate genetic parameters, breeding values, to determine the percentage of cattle culled within a lactation and conducted to investigate the productive and reproductive performance of culled cows as compared to their contemporaries retained to have subsequent lactations from 1st to 4th lactations in a herd of Holstein Friesian cows in Hungary.

MATERIALS AND METHODS

Records were obtained on productive and reproductive performance over the 1st four lactations of Holstein Friesian cows raised at Mezoheges State Farm Hungary during the period from 1981 to 1990. Detailed description of breeding policy and management practices was presented previously by Mostafa (2006). Total 6357 records was divided into two sets after their complete that 1st lactation. Group A comprised 4138 records of cows that were retained in the herd for the 1st, 2nd, 3rd and 4th lactation, with subsequent lactation record, while group B had 2219 records of cows that were culled at the end any of the 1st, 2nd, 3rd and 4th lactation, with their subsequent lactation record.

Traits studied were milk production traits; total milk yield (TMY), 305-day milk yield (305-d MY), 305-day fat yield (305-d FY) and persistency of milk yield (Pr MY) calculated as described by Mostafa (2006), and reproduction traits; number of services per conception (NSC) and days open (DO).

Separate analysis was performed for each lactation. Least squares means of the two groups (retained or culled) and the differences between them in production, persistency and reproduction traits in the first four lactations were obtained.

Animal models were used for analyses the data in the first lactation. The single-trait derivative-free restricted maximum likelihood (MTDFREML) suite of programs (Boldman *et al.*, 1995) was used for univariate trait analyses. Effects of year and month of calving were assumed to be fixed. Days open and age at first calving (AFC) were included in the model as covariate when TMY, 305-d MY, 305-d FY and Pr MY were analyzed. Milk yield and AFC were included in the model as covariate when reproduction traits were analyzed. And effects of animal and random residual effect considered to be random. The analyses of each trait were conducted using a single trait animal model. The vector presentation of this model is:

$$Y = Xb + Zu + e$$

Where, Y is the vector of observations for all traits, b is a vector of common fixed effects, u is a vector of random genetic effects and e is a vector of residuals and X and Z are incidence matrices relating observations to the fixed and animal effects, respectively.

All genetic estimates were based on 2571 first lactation records. The number of animals and the average number of daughters per sire were 54 and 10, respectively. Breeding value for studied traits were estimated for each animal in the first lactation and then the comparison between two groups (retained and culled) in different lactations were based on the breeding values for the same trait in the 1st lactation.

Mixed-model equations in the analyses were solved iteratively. Based on the variance of the log-likelihood function values, the convergence criterion was 1×10^{-9} . In addition, several restarts were necessary until changes in the log-likelihood function values were less than 1×10^{-5} . Restarts were performed for all analyses, using the final results of the previous

analysis, in order to locate the global maximum for the log likelihoods. Starting values for variance components for two-trait analyses were obtained from single-trait analyses on individual traits. Best linear unbiased prediction (BLUP) of estimated breeding values (EBVs) were obtained by back-solution using the MTDFREML program for all animals in the pedigree file for single-trait. The standard error for the genetic correlation was calculated as described by Falconer and Mackay (1996).

RESULTS AND DISCUSSION

Actual means and variation of records:

Table 1 shows the unadjusted means, standard deviations (S.D) and coefficients of variations (CV%) for reproduction production, persistency and traits estimated across 1st four lactations. Means of total milk yield (TMY) being 7197 kg and 305-day milk yield (305-d MY) being 6974 kg obtained in this study are close to those reported for Holstein Friesian by Mostafa (1991) and Amin *et al.* (1997) under Hungarian conditions, while the present findings were higher than those reported on Friesian cattle raised in Egypt by Sadek *et al.* (1994), Tag El-Dein (1997) and El-Awady (1998). Meanwhile, the estimate means obtained for 305-d MY (6974 kg) and 305-day fat yield (305-d FY) being 255 kg were also nearly similar to those found by Dematawewa and Berger (1998) being 6929 and 246 kg, respectively, across lactations of Holstein cows. The persistency of milk yield (Pr M) value across 1st four lactation was 73%, fall within the range of 69 to 77% reported by Amin *et al.* (1977), Mostafa *et al.* (1999) and Aboul-Ela *et al.* (2001) on the same breed. The mean of milk production traits in the present study mainly reflects high level of management of Holstein Friesian cows under Hungarian conditions. In general, the differences between the present results and those reported by other researchers could be due to one or more of the following: genotype, management, number of records used in the study and affecting factors considered in the methods of the statistical analysis model.

Table 1: Unadjusted means, standard deviations (S.D) and coefficients of variation (C.V%) for milk production, reproduction and persistency traits in the first four lactations.

Trait	Abbr.	x	S.D	C.V%
Number of service per conception	NSC	2.23	1.65	73.99
Days open (day)	DO	125.8	79.98	63.56
Persistency %	Pr MY	72.71	9.78	13.45
Total milk yield (Kg)	TMY	7197	2446.9	34.00
Milk yield in 305-days (Kg)	305-d MY	6974	1749.1	25.08
Fat yield in 305-days (Kg)	305-d FY	255.0	64.3	25.28

The mean of days open (DO) across 1st four lactations (125.8 day) is almost similar to that reported by Aboul-Ela *et al.* (2001) being 123 day and Oudah *et al.* (2001) being 124 day on the same breed, but it is lower than that estimated by Dematawewa and Berger (1998) being 169 day and Mostafa (2001) being 185 day across all lactations on Holstein Friesian in Egypt.

Consequently, the mean of number of services per conception (NSC) across 1st four lactations (2.23 services) found in the present study is close to that obtained by different authors, Aboul-Ela *et al.* (2004) being 2.1, Oudah *et al.* (2001) being 2.0 and Kadarmideen *et al.* (2003) being 2.0. On the other hand, this mean was slightly higher than that found by Grosshans *et al.* (1997) 1.5, Dematawewa and Berger (1998) 1.9 and Wall *et al.* (2003) 1.7. However, it is clearly lower than the value estimated by Mostafa (2001) 2.9 services of Holstein Friesian in Egypt.

Estimates of CV% values of TMY, 305-d MY and 305-d FY across 1st four lactations ranged from 25 – 34% almost similar to estimated by Aboul-Ela *et al.* (2001) being 24 – 32% on Holstein Friesian in Hungary and Mostafa (2001) being 35 – 37% on Holstein Friesian in Egypt. While estimate of C.V of Pr MY across all parities being 14% is almost similar to estimated value by Aboul-Ela *et al.* (2001) being 13% on the same breed.

Estimate of C.V% were higher in DO and NSC being 64 and 73.99%, respectively, across 1st four lactations, lower than that found by Aboul-Ela *et al.* (2001) being 46 and 59%, respectively, on the same breed; and Mostafa (2001) being 59 and 66%, respectively, on Holstein Friesian in Egypt, which reflect the large individual variations in reproductive performance.

In general, estimates of CV% values were lower for Pr MY comparable to CV% in milk yield traits which may reflect the role of temporary environment influencing Pr MY. While higher estimates CV% for reproductive traits compared to milk yield traits and Pr MY may indicates that reproductive traits are relatively more influenced by environmental and management of the herd. Consequently, such large CV% of reproductive traits are indicative for improvement opportunities in these traits.

Genetic parameters:

Estimates heritability (h^2) and their standard error (S.E), genetic and phenotypic correlations for productive, reproductive and persistency of milk yield traits obtained in the 1st lactation are given in Table 2. The estimate of h^2 for TMY (0.31 ± 0.05) was fall within the range from 0.25 to 0.40 reported by Mostafa (1991). Amin *et al.* (1997) and Kadarmideen *et al.* (2000). But it was lower than that reported by Aboul-Ela *et al.* (2001) 0.54 ± 0.07 and Olori *et al.* (2002) being 0.56 ± 0.03 on the same breed. While, estimated h^2 for 305-d MY (0.35 ± 0.05) was higher than those reported by Dematawewa and Berger (1998) being 0.30, Mostafa *et al.* (1999) 0.22 ± 0.05 , Kadarmideen *et al.* (2003) being 0.28 and Mostafa (2006) being 0.26 ± 0.04 . Estimate of h^2 of 305-d FY was 0.30 ± 0.04 , almost similar to that obtained by Mostafa (2006) being 0.29 ± 0.04 and higher than that found by Dematawewa and Berger (1998) being 0.28 and Kadarmideen *et al.* (2003) being 0.21 on the same breed, while it was lower than that found by Mostafa *et al.* (1999) being 0.54 ± 0.07 . In general, the present estimates indicated that h^2 value for 305-d MY was higher than h^2 values for both TMY and 305-d FY (0.35 versus 0.31 and 0.30, respectively) Table 2. A similar trend was also observed by Kadarmideen *et al.* (2003) found that the values of h^2 were 0.28 versus 0.21, Dematawewa and Berger (1998) being 0.30 versus 0.28, Mostafa *et al.* (1999) being 0.54 versus 0.22 and Mostafa (2006) being 0.29 versus 0.26. In

general, the moderate h^2 estimates for milk production traits (e.g. TMY, 305-d MY and 305-d FY) obtained in the present study may be relatively good opportunity for selection for these traits and significant genetic progress would be achieved.

Estimate of h^2 for Pr MY was 0.10 ± 0.03 , almost similar values for h^2 reported by Aboul-Ela (2001) being 0.09, Haile-Mariam *et al.* (2003) 0.09 and Shalaby (2005) being 0.08 on Holstein Friesian in 1st lactation. However the h^2 estimate of Pr MY in the present study was lower than those reported by Amin *et al.* (1997) being 0.22 and Muir *et al.* (2004) being 0.18, but slightly higher than those reported by Gengler *et al.* (2001) being 0.05 of Holstein Friesian in USA. It seems from the present findings that among the studied production traits, Pr MY would be the trait would respond least to genetic improvement through selection.

The estimate of h^2 for days open (DO) was 0.09 ± 0.03 , which are comparable to other findings in the literature mostly being less than 0.07, but it could be considered lower than that obtained by Aboul-Ela *et al.* (2001) being 0.20; Mostafa *et al.* (2006) being 0.11; Dematawewa and Berger (1998) being 0.12 and Shalaby (2005) being 0.11. It was slightly higher than that obtained by Amin *et al.* (1997) being 0.07 and Abdallah and McDaniel (2000) 0.03, which may be due to differences in data size and statistical model for analysis. Estimate of h^2 for number of services per conception (NSC) was 0.12 ± 0.02 , higher than that obtained by Dematawewa and Berger (1998) being 0.03; Kadarmideen *et al.* (2003) being 0.02 and Wall *et al.* (2003) being 0.02. However, it was lower than that of Amin *et al.* (1997) being 0.14 and Aboul-Ela *et al.* (2001) being 0.05 on the same breed. In general, because of the rather low h^2 estimates of reproductive traits improvement of reproductive efficiency through selection would be meaningless, since they are masked to a large extent by the highly variable managerial practices. Thus, improving the management system for two reproductive traits and selection for the high milk yield traits would be effective ways for improving these traits.

Table 2: Estimates heritability \pm S.E (on diagonal) genetic \pm S.E (above diagonal) and phenotypic (below diagonal) correlations among production, reproduction and persistency traits in the first lactation.

	NSC	DO	Pr MY	TMY	305-d MY	305-d FY
NSC	0.12 ± 0.03	0.83 ± 0.10	0.21 ± 0.15	0.58 ± 0.12	0.62 ± 0.16	0.69 ± 0.19
DO	0.65	0.09 ± 0.03	0.12 ± 0.11	0.91 ± 0.05	0.86 ± 0.07	0.88 ± 0.07
Pr MY	0.07	0.08	0.10 ± 0.03	0.71 ± 0.11	0.69 ± 0.10	0.53 ± 0.12
TMY	0.41	0.50	0.30	0.31 ± 0.05	0.99 ± 0.04	0.93 ± 0.06
305-d MY	0.24	0.31	0.22	0.91	0.35 ± 0.05	0.78 ± 0.09
305-d FY	0.32	0.33	0.21	0.45	0.46	0.30 ± 0.04

Table 2 present estimates of genetic (r_g) and phenotypic (r_p) correlations among the production, reproduction and persistency of milk yield traits in the 1st lactation were positive and ranged from 0.21 to 0.99 and from 0.07 to 0.91, respectively, are similar to findings reported by Moore *et al.* (1991) for 1st parity Holsteins in Canada, Welper (1991) in the US Friesian, Mostafa

(2006) of 1st parity Holstein Friesian in Hungary, Brown Swiss cattle in Italy (Santus *et al.*, 1993) and dairy cattle in Australia (Visscher and Goddard, 1995) have reported similar estimates, indicating that correlations among yield traits are relatively stable over standardization procedure, breed or country.

High positive r_g Table 2 also was found between DO and NSC (0.83 ± 0.10) is agreement with result by Mostafa (2006) being 0.82 ± 0.21 of 1st lactation on the same breed, indicating evidence for common genetic and physiological mechanisms controlling the two traits. However, a high positive r_p 0.65 also was found between DO and NSC in agreement with results by Hansen *et al.* (1983) and Mostafa (2006) being 0.72 on the same breed, because both traits were indicators of less of fertility many management factors, such as estrus detection and the insemination technician contribute to the phenotypic correlation between the two traits.

Estimates of both r_g and r_p between productive and reproductive traits were positive and medium to high Table 2, ranged from 0.58 to 0.91 and from 0.24 to 0.50, respectively, in agreement with found by Mostafa (2006). However, r_g estimates between production and reproduction traits were positive, in relation to early finding that selection for production alone is expected to lead to a genetic decline in fertility Haile-Mariam *et al.* (2003), Shalaby (2005) and Mostafa (2006). It is concluded that fertility traits should be incorporated into selection programmers for dairy cows to counteract the antagonistic relationship between milk production and fertility traits. On the same trend, the high r_g found in the present study suggest that incorporating reproductive measures in bull indices to hinder the deterioration of reproductive performance in high yielding cows, as proposed by Hermas *et al.* (1987) and Mostafa (2006).

The r_g and r_p correlations between Pr MY and both DO and NSC were positive and small (r_g 0.12 and 0.21 and r_p 0.08 and 0.07, respectively) Table 2. Shalaby (2005) recorded positive r_g and r_p correlations between Pr MY and DO 0.64 and 0.11, respectively. In contrast, Aboul-Ela *et al.* (2001) reported that r_g between Pr MY and each of DO and NSC were rather poor (-0.16 and -0.08, respectively). Mostafa (2006) found that r_g between Pr MY and each of DO and NSC were negative and small (-0.19 and -0.17, respectively) while the r_p were -0.78 and 0.13, respectively, and concluded that the effort to minimize the negative effect of selection for milk yield on fertility and health traits could be obtained by considering Pr MY in breeding program, Solkner and Fuch (1987) reached to similar conclusion.

Table 3 contains a summary of percentage and number of records of Holstein Friesian used in each parity distributed between the two groups, group (A) has subsequent records (Survival to the next lactation) and group (B) has no subsequent records. The percentage of cows culled (group B) from the herd increased gradually between the end of 1st lactation (26.3%) and at the end of 4th lactation (49.2%). A trend of increase in culling rate with advance of lactation has been reported in other studies on dairy cows (e.g. Mostageer *et al.*, 1987; Nigm *et al.*, 1988; Sadek, 1994 and Aboul-Ela *et al.*, 2000). The lowest culling rate (26.3%) was that the end of the 1st lactation, this would be expected where as a major reason for disposal were reproductive problems. Also, in later lactations (3rd and 4th) this was

overtaken 42.2 and 49.2%, respectively, by low milk yield and reproductive as a major reason for culling. However, the culling rate records in the end 1st lactation 26.3% were nearly close to that reported by Aboul-Ela *et al.* (2000) being 27.2% and Olori *et al.* (2002) being 29% on Holstein Friesian cows in Hungary and Ireland, respectively. On the other hand, the percentage of cows retained or survived (group A) to gave the 2nd lactation (73.7%) in the present study is nearly similar to that obtained by Aboul-Ela *et al.* (2000) being 72.8% on Holstein Friesian in Hungary and Olori *et al.* (2002) being 71% in Holstein Friesian in Ireland. But it is lower than that reported by Mostageer (1987) being 85.5% on Friesian cows in Libya; Sadek (1994) being 96% on Friesian cow in Egypt.

Table 3: Number and percentages* of records of groups of cows that were either retained (A) or culled (B) at the end of various lactations.**

Group	Lactations				
	1 st	2 nd	3 rd	4 th	Total
A	1894 (37.7%)	1199 (63.3%)	693 (57.8%)	352 (50.8%)	4138 (65.1%)
B	677 (26.3%)	695 (36.7%)	506 (42.2%)	341 (49.2%)	2219 (34.9%)
Total	2571 (100%)	1894 (100%)	1199 (100%)	693 (100%)	6357 (100%)

* Percentage are between parentheses

** Group A: retained cows with subsequent records.

B: culled cows with no subsequent records or (survival cows from one lactation the next).

Moreover, relatively higher culling rates were observed at the end of the 2nd, 3rd and 4th lactations being 36.7, 42.2 and 49.2%, respectively, in the present study (Table 3) as compared to those reported by Esslemont (1992) being 25% average culling rate in UK, Sadek (1994) being 13.9 and 10.6% after the end 2nd and 3rd lactations, respectively, in Egypt and Aboul-Ela *et al.* (2000) being 38.4 and 46.3% at the end of 2nd and 3rd lactation on Holstein Friesian cows in Hungary. However, the present results indicated that culling rate was 34.9%, while survival rate being 65.1% at the end 1st four lactations Table 3. Moreover, actual means for culling in the present study were not available.

The least squares means and standard errors (S.E) of production, persistency and reproductive traits in the two groups (A and B) and the difference between the mean of each traits ($D = \bar{x}_B - \bar{x}_A$) for the 1st four lactations are presented in Table 4. The present results indicate that culled cows (group B) had generally significant higher values of 305-d MY than those retained cows (group A) in the 1st four lactations (Table 4) with the exception of 305-d MY value in the end of 4th lactation, which may be due to practicing selection after the end of 4th lactation, also some cows which have been retained in the herd of such period became more regular calves. However, the difference in 305-d MY between the two groups may be due to the combined effects of the Pr MY, DO and NSC traits which were higher (longer) in the culled cows than retained cows in the 1st three lactations. The results obtained here agree with that found by Aboul-Ela *et al.* (2000) on Friesian cows. On the other hand, culled cows (group B) tended to be slightly

lower values and insignificant of TMY and 305-d FY than those retained cows (group A) in the end 1st four lactations except the end of 2nd lactations for the same traits (Table 4). Cows retained for 2, 4 and 5 lactations had greater TMY and 305-d FY by 499, 188 and 800 kg, 7, 10 and 17 kg, respectively than those called during 1st, 3rd and 4th lactations. Higher Pr MY values were obtained for culled cows than retained cows in the end of 1st two lactations (Table 4) but this was reversed in the end of 3rd and 4th lactations and the difference between two groups was insignificant. Aboul-Ela *et al.* (2000) reported that higher Pr MY values were obtained for retained cows in the end of 1st lactation but this was reversed in the end of 2nd lactation. On the same trend, cows retained for 4th and 5th lactations had greater 3rd and 4th parity Pr MY than those called during 3rd and 4th lactations. It is interest to note that cows that were culled for longer DO and increase NSC generally had higher 305-d MY cows retained in the herd (Table 4).

Table 4: Least squares means (X) and standard errors (S.E) of milk production, reproduction and persistency traits of the retained (A) and culled (B) groups of Friesian cows in different lactations.

Lactation	N	Group A X ± S.E	N	Group B X ± S.E	Difference D = (X _B -X _A)	T value	P > value
Number of services/conception (NSC)							
1 st	1855	2.1 ± 0.04	514	2.2 ± 0.07	+ 0.1	1.2	0.25 ^{N.S}
2 nd	1184	2.2 ± 0.05	566	2.6 ± 0.08	+ 0.4	4.2	0.0001 ^{**}
3 rd	682	2.1 ± 0.06	390	2.6 ± 0.09	+ 0.5	9.4	0.0001 ^{**}
4 th	341	2.2 ± 0.09	241	2.4 ± 0.12	+ 0.2	1.3	0.19 ^{N.S}
Days open (DO, day)							
1 st	1853	135 ± 1.9	512	130 ± 3.9	- 5	-1.3	0.20 ^{N.S}
2 nd	1179	121 ± 2.3	565	136 ± 3.6	+ 15	3.5	0.0005 ^{**}
3 rd	680	112 ± 2.8	387	123 ± 4.1	+ 11	2.3	0.024 [*]
4 th	340	114 ± 3.8	239	116 ± 4.6	+ 2	0.3	0.76 ^{N.S}
Persistency (Pr MY%)							
1 st	1715	76.5 ± 0.51	379	76.6±0.22	+ 0.1	0.18	0.8566 ^{N.S}
2 nd	1078	71.0 ± 0.30	386	71.6±0.45	+ 0.6	1.10	0.2532 ^{N.S}
3 rd	623	69.9 ± 0.38	268	69.0±0.58	- 0.9	- 1.2	0.2406 ^{N.S}
4 th	302	68.9 ± 0.55	160	68.3±0.65	- 0.6	- 0.7	0.5013 ^{N.S}
Total milk yield (TMY, Kg)							
1 st	1891	7043 ±49.5	604	6544±108.3	- 499	- 4.2	0.0001 ^{**}
2 nd	1204	7526 ±63.8	634	7629±119.2	+ 103	0.8	0.4438 ^{N.S}
3 rd	695	7477 ±77.9	440	7289±141.5	- 188	- 1.2	0.2429 ^{N.S}
4 th	347	7506±109.7	289	6706±166.7	- 800	- 0.4	0.0001 ^{N.S}
305-day milk yield (305-d MY, Kg)							
1 st	1256	6560±35.4	428	6806±76.6	+ 246	2.9	0.0037
2 nd	1120	7179±49.9	464	7459±92.5	+ 280	2.7	0.0078
3 rd	652	7194±65.4	306	7332±124.5	+ 138	- 2.2	0.0316
4 th	324	7200±87.5	214	7020±165.6	- 180	- 1.0	0.3377 ^{N.S}
305-day fat yield (305-d FY, Kg)							
1 st	1737	246 ± 1.3	438	239 ± 2.8	- 7	- 2.3	0.0250
2 nd	1127	264 ± 1.9	506	269 ± 3.4	+ 5	1.2	0.2361 ^{N.S}
3 rd	654	266 ± 2.2	568	256 ± 4.1	- 10	- 2.2	0.0316
4 th	397	259 ± 3.2	243	242 ± 5.4	- 17	- 2.7	0.0074

In the present study culled cows had slightly longer DO than retained cows in the end of 1st four lactations (Table 4) and the difference between two groups was significant, except in the end of 1st and 2nd lactations. On the same trend, cows retained in the herd for 2nd, 3rd and 4th lactations conceived earlier during 1st lactation (15, 11 and 2 days) fewer DO, respectively, than those culled during 1st lactation. However, the difference values of DO ranging from 2 to 15 day in various lactations can be partly attributed to lower conception rate with NSC value being 0.1 to 0.5 services in culled cows (Table 4), Aboul-Ela *et al.* (2000) reported that culled cows had longer DO as well as higher values of NSC than retained cows and the differences in DO and NSC ranging from 15 to 53 day and 0.1 to 0.5 services, respectively, in the end 1st four lactations. However, culled cows had higher value of NSC than retained cows in the end 1st four lactations and the difference between two groups were significant, except in the end 1st and 4th lactations and non-significant (Table 4). On the same trend, cows retained for 2nd, 3rd, 4th and 5th lactations had lower 1st, 2nd, 3rd and 4th lactations NSC by 0.1, 0.4, 0.5 and 0.2 services than those culled cows during 1st, 2nd, 3rd and 4th lactations, respectively.

Table 5 contains a summary of mean, standard deviations (S.D), minimum, maximum, range of estimated breeding values of cows (EBVs) and difference between retained and culled cows groups for EBVs of production, persistency and reproductive traits in the end of 1st four lactations. The range in EBVs of cows of 1st four lactations for TMY for both retained (survival) and culled cows was from 4140 to 7727 kg and from 4008 to 7654 kg, respectively. Regarding the means of EBVs obtained for TMY of retained cows had significant lower values than culled cows in the end 1st and 4th lactations, while culled cows had higher range of EBVs than retained cows in the 2nd and 3rd lactations and the difference between them were significant. The range in EBVs of cows of 1st four lactations for 305-d MY for both retained and culled cows were from 3962 to 5572 kg and from 3863 to 5280 kg, respectively. However, regarding the EBVs and S.D obtained for of 1st and 2nd lactations, may be due to a major reason for culling cows by reproductive disorders, while in the end of 3rd and 4th lactations culled cows were significant higher values than retained cows for 305-d MY, may be due to a major reason for culling cows by low milk production. However, for retained culled cows groups the S.D of EBVs of 305-d MY increased from the end 1st to end 2nd lactation, while it was dropped from the end 3rd to end 4th lactation (Table 5). Also, the mean of EBVs for 305-d MY of retained cows was increased with advance of parity, while in culled cows un-similar trend was shown Table 5. The range in EBVs of cows of 1st four lactations for 305-d FY for both retained and culled cows were from 121 to 192 kg and from 121 to 169 kg, respectively. Also, the present study indicated that the range of EBVs for 305-d FY of retained cows were significant higher values than culled cows in the 1st four lactations (Table 5), except in the end 4th lactation. Moreover, the values of EBVs of 305-d FY of retained cows were higher than culled cows in the end 1st two lactations and it was reverses in the end 3rd and 4th lactations. The range in EBVs of cows of 1st four lactations for Pr MY for both retained and culled cows were from 7.9 to 9.3% and from 7.2 to 8.4%, respectively.

Table 5: Mean, standard deviations (S.D), minimum maximum and range of estimated breeding values (EBVs) of milk production, reproduction and persistency of lactation traits of the retained (A) and culled (B) groups of Friesian cows in different lactations.

Lactation	Retained group (A)					Culled group (B)				
	Mean	S.D	Minimum	Maximum	Range	Mean	S.D	Minimum	Maximum	Range
NSC										
1 st	-0.09	0.32	-1.26	1.64	2.90	-0.03	0.19	-0.77	1.13	1.90**
2 nd	-0.13	0.35	-1.04	1.64	2.68	-0.02	0.27	-1.26	1.40	2.66**
3 rd	-0.21	0.35	-0.09	1.64	2.63	-0.03	0.32	-1.04	1.31	2.35**
4 th	-0.24	0.36	0.99	1.64	2.63	-0.17	0.33	-0.94	0.89	1.83**
DO (day)										
1 st	-1.62	9.98	-54.15	55.97	110.12	-2.17	8.22	-24.86	42.69	67.55 ^{N.S}
2 nd	-2.02	10.19	-35.40	55.97	91.37	-0.91	9.59	-54.15	54.35	108.50*
3 rd	-3.45	9.96	-35.40	33.05	68.05	-0.07	10.18	-24.84	55.97	80.81**
4 th	-4.21	10.81	-35.40	33.05	68.05	-2.66	9.69	-22.58	28.24	50.82*
TMY (Kg)										
1 st	-23.2	836.34	-2535	5192	7727	23.3	762.29	-1625	3134	4759**
2 nd	-137.3	811.69	-2535	3433	5968	173.6	842.19	-2462	5192	7654**
3 rd	-209.6	729.35	-2229	1996	4225	-38.5	903.92	-2535	3433	5968**
4 th	-264.8	707.00	-2144	1996	4140	-152.5	748.48	-2229	1779	4008*
305-d MY (Kg)										
1 st	-48.4	748.81	-2658	2914	5572	198.73	516.96	-1826	2037	3863**
2 nd	-134.8	773.37	-2658	2622	5280	100.68	679.58	-2011	2914	4925**
3 rd	-204.5	721.88	-2330	2076	4406	-39.30	830.04	-2658	2622	5280**
4 th	-262.8	673.57	-2139	1823	3962	-145.40	765.07	-2330	2076	4406*
305-d FY (Kg)										
1 st	-37.78	260.92	-918.2	999.4	191.76	33.45	194.55	-55.07	67.12	121.19**
2 nd	-72.18	25.53	-91.82	99.94	191.76	21.56	25.99	-73.30	95.37	168.67**
3 rd	-89.46	23.62	-67.85	99.94	167.79	-48.51	27.79	-91.82	74.64	166.46*
4 th	-11.71	22.17	-67.85	52.99	120.84	-6.09	24.73	-61.55	99.94	161.49**
Pr MY %										
1 st	-0.15	1.42	-5.10	4.20	9.30	0.27	1.20	-3.00	4.17	7.17*
2 nd	-0.25	1.51	-5.10	3.84	8.94	0.02	1.25	-4.19	4.20	8.39**
3 rd	-0.27	1.53	-4.78	3.84	8.62	-0.22	1.47	-5.10	3.15	8.25 ^{N.S}
4 th	-0.37	1.57	-4.06	3.84	7.90	-0.17	1.49	-4.78	3.45	8.23*

While, regarding the range of EBVs obtained in the present study for Pr MY of retained cows were significant lower than culled cows in the end 1st four lactations (Table 5), except in the end 3rd lactation the difference between them was non-significant. Also, the mean of EBVs of retained cows was increased with advance the parity, while for culled cows it was had non-similar trend Table 5.

The range in EBVs of cows of 1st four lactations for both retained and culled cows were from 2.6 to 2.9 and from 1.8 to 2.7 services, respectively. Regarding the EBVs obtained for NSC, retained cows had significant lower values than culled cows in the end 1st four lactations. The range in EBVs of cows of 1st four lactations for DO for both retained and culled cows were from 69 to 110 day and from 51 to 109 day, respectively. However, the present study indicated that the EBVs for DO of retained cows were lower value than culled cows in the first four lactations and the difference between two groups for EBVs were significant.

CONCLUSIONS

It can be concluded from the present study that, in general, the range in EBVs of cows for all traits studied for both retained and culled cows were wide, suggesting to the effective scope for selection. The present findings indicated that the EBVs for reproductive, milk production and persistency traits were higher value for culled cows than retained cows. These results showed that the culled cows have lower reproductive performance and higher milk production traits than those retained in the herd. Thus, the need to give special attention to reproductive management of high yielding dairy cows and thus, increase their longevity. Culling decisions high yielding cows mean loss of the super genes of this animal from the population. At the culling time start the economic losses in one hand and the benefit genes in the other hand. Thus the herd manager must be given more attention to this decision. Therefore, good breeding must be used to choice the culling decisions animal. Moreover, culling decisions have an important influence on the economic performance of the dairy but are must be based on the EBVs for economic traits.

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المعالم الوراثية والقيم التربوية للصفات الإنتاجية والتناسلية والمثابرة على إنتاج اللبن لأبقار الهولشتين فريزيان المستبقة والمستبعدة خلال المواسم المختلفة.

محمد عبد الرحمن مصطفى

قسم إنتاج الحيوان - كلية الزراعة - جامعة المنصورة، رقم بريدى ٣٥٥١٦ - المنصورة - مصر

استخدم في هذه الدراسة السجلات الإنتاجية والتناسلية لأبقار الهولشتين فريزيان (٦٣٥٧ سجلا) تابعة لمزرعة ميزوهاجش بالمجر خلال الفترة من ١٩٨٢ حتى ١٩٩٠، وكانت الأبقار المستبعدة (٢٢١٩ سجلا) والمستبقة (٤١٣٨ سجلا) للمواسم الأربعة الأولى لتقدير المعالم الوراثية والقيم التربوية للأبقار ولمقارنة الأداء الإنتاجى والتناسلى بين المجموعتين للصفات الإنتاجية والتناسلية والمثابرة على إنتاج اللبن.

وشملت البيانات الصفات الإنتاجية: إنتاج اللبن الكلى، إنتاج اللبن فى ٣٠٥ يوم، إنتاج الدهن فى ٣٠٥ يوم والمثابرة على إنتاج اللبن والصفات التناسلية: فترة الأيام المفتوحة، عدد التلقيحات اللازمة لحدوث الحمل.

وأوضحت النتائج ما يلى:

- كانت قيم المتوسطات لصفات إنتاج اللبن الكلى وإنتاج اللبن فى ٣٠٥ يوم وإنتاج الدهن فى ٣٠٥ يوم والمثابرة على إنتاج اللبن وفترة الأيام المفتوحة وعدد مرات التلقيح اللازمة لحدوث الحمل ٧١٩٧، ٦٩٧٤، ٢٥٥ كجم و ٧٢,٧١%، ١٢٥,٨ يوم و ٢,٢٣ تلقيحه على التوالي. وتراوحت قيم معامل الاختلاف للصفات الإنتاجية بين ٢٥,٠٨ - ٣٤%، بينما لصفة المثابرة على إنتاج اللبن ١٣,٤٥% ولصفتى طول فترة الأيام المفتوحة وعدد مرات التلقيح اللازمة لحدوث الحمل ٦٣,٥٦، ٧٣,٩٩% على التوالي وذلك للمواسم الأربعة معاً.
- بلغت قيم العمق الوراثى لصفات إنتاج اللبن الكلى وإنتاج اللبن فى ٣٠٥ يوم وإنتاج الدهن فى ٣٠٥ يوم والمثابرة على إنتاج اللبن وفترة الأيام المفتوحة وعدد مرات التلقيح اللازمة لحدوث الحمل فى الموسم الأول ٠,٣١ + ٠,٠٥، ٠,٣٥ + ٠,٠٥، ٠,٣٠ + ٠,٠٤، ٠,١٠ + ٠,٠٣، ٠,٠٩ + ٠,٠٣، ٠,١٢ + ٠,٠٣ على التوالي.
- كانت معاملات الارتباطات الوراثية والمظهرية بين الصفات الإنتاجية والتناسلية فى الموسم الأول موجبة ومتوسطة إلى عالية تراوحت بين ٠,٥٣ + ٠,١٢ - ٠,٩٩ + ٠,٠٤ ومن ٠,٢١ - ٠,٩١ على التوالي.
- زاد معدل الاستبعاد مع التقدم فى مواسم الحليب حيث بلغ ذلك المعدل ٢٦,٣، ٤٩,٢% وذلك فى نهاية الموسم الأول والرابع على التوالي.
- كانت للأبقار المستبعدة قيم أكبر معنوياً فى إنتاج اللبن الكلى وإنتاج اللبن فى ٣٠٥ يوم وإنتاج الدهن فى ٣٠٥ يوم والمثابرة على إنتاج اللبن وفترة الأيام المفتوحة وعدد التلقيحات اللازمة لحدوث الحمل مقارنة بالأبقار المستبقاة.
- كانت الاختلافات بين المجموعتين أكثر وضوحاً فى الموسم الثانى للصفات المدروسة (+ ١٠,٣ كجم إنتاج اللبن الكلى و + ٢٨٠ كجم إنتاج اللبن فى ٣٠٥ يوم و + ٥ كجم إنتاج الدهن فى ٣٠٥ يوم و + ٠,٠٦% مثابرة على إنتاج اللبن و + ١٥ يوم فى فترة الأيام المفتوحة و + ٠,٤ تلقيحه لازمة الحمل). وهذا يشير إلى أن الأبقار المستبعدة كانت منخفضة الصفات التناسلية وعالية الصفات الإنتاجية مقارنة بالأبقار المستبقاه فى القطيع.
- كان المدى واسع للقيم التربوية المقدرة للأبقار المستبقاة والمستبعدة لجميع الصفات المدروسة، وهذا يشير إلى إمكانية التحسين الوراثى للصفات الإنتاجية والتناسلية والمثابرة عن طريق انتخاب الأبقار وأيضاً يمكن الحصول على تحسين وراثى باستخدام العمق الوراثى العالى لصفة إنتاج اللبن فى ٣٠٥ يوم ولباقى الصفات الإنتاجية.
- أشارت النتائج أيضاً إلى ضرورة الاهتمام بالأبقار عالية الإنتاج وخاصة بالرعاية التناسلية لها وذلك لزيادة طول فترة حياتها الإنتاجية وبالتالي تحسين الكفاءة الإنتاجية للقطيع. كما أن عملية الاستبعاد لها تأثير هام على الصفات الاقتصادية فى ماشية اللبن بناءً على القيم التربوية لهذه الصفات.