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GENETIC ANALYSES OF PRODUCTIVE, REPRODUCTIVE AND PRODUCTIVE-EFFICIENCY TRAITS IN DIFFERENT LACTATIONS OF FLECKVIEH CATTLE IN AUSTRIA. 2- GENETIC, PHENOTYPIC AND ENVIRONMENTAL CORRELATIONS

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SUMMARY

Total of 58050 productive and reproductive performance records covering first four lactations of Austrian Fleckvieh cows were used to analyze the performance of individual lactations, while total of 28315 records representing 10007 cows sired by 643 bulls were used for the combined analysis across all lactations. Estimates of genetic and phenotypic variations were obtained for the first four lactations and across all lactations. Traits studied were: total milk yield (TMY), fat yield (TFY) and protein yield (TYP) as total milk yield traits (TMYT); age at calving (AC), days open (DO) and calving interval (CI) as reproductive traits (RT); days in milk (DM) as interval trait (IT); total milk yield per day of days in milk (TMYDM); total milk yield per day of calving interval (TMYCI); total milk yield per day of age at first calving (TMY AFC) and total milk yield, per day of age at second calving (TMY ASC) as productive efficiency traits (PET).

Data of each lactation as well as across all lactations were analyzed separately using the (LSMLMW) computer program of Harvey (1990). The all possible genetic (r_G); phenotypic (rp) and environmental (r_E) correlations among traits through the first four parities as well as across all lactations were calculated and estimated.

Generally, positive and high magnitudes for r_G, (0.65±0.13 to 0.99±0.003); for rp (0.87 to 0.98) and for r_E (0.88 to 0.98) were found among TMYT. Estimates of r_G, rp and r_E between TMYT and RT, generally varied in direction and magnitudes from low to moderate. In general, r_G, rp and r_E estimates between TMYT and PET were positive and varied in magnitudes from moderate to high estimates (from 0.13±0.07 to 1.00±0.0), (from 0.19 to 0.99) and (from 0.17 to 0.99), respectively. Among RT, r_G, r_p and r_E estimates were generally positive and varied in magnitudes. Among PET, positive estimates for different correlations were observed and the estimates of r_G and r_E, generally varied in magnitude from moderate to high (0.13±0.09 to 1.0±0.0 and 0.13 to 0.76, respectively), while low to moderate estimates were obtained for r_p.

Keywords: Fleckvieh, productive efficiency traits, genetic, phenotypic and environmental correlations

INTRODUCTION

The overall productive performance of an animal is determined by various measurements of reproductive and productive traits which need to be considered in any breeding programme. Therefore, the efficiency of selection for improved fertility can be seriously impaired if there is an antagonistic genetic relationship between milk traits and fertility. In order to make correct evaluation of the effects of breeding for improved fertility and in order to improve existing breeding plans it is essential to have knowledge of genetic relationships between fertility and milk traits. However, one of the first indications of a sire's breeding value can be obtained by calculating the average daily milk yield of his daughters. Because maintenance costs of cows are time dependent, it would seem that some measures of production per unit time should be the predictant. Selection in dairy cattle is commonly based on milk yield of first lactation, but a better approach would be if selection is based on production efficiency rather than simply on milk yield.

Estimates of genetic and phenotypic parameters of productive efficiency, productive and reproductive traits are required for estimating breeding values of animals, for formulating an efficient breeding system and for evaluating genetic gains. Information on the genetic association between productive efficiency and productive as well as reproductive traits in dairy cattle is scarce. The aim of this study was to estimate the genetic, phenotypic and environmental correlations between measures of productive efficiency and measures of productive and reproductive traits in different parities.

MATERIAL AND METHODS

Data:

Data on productive and reproductive performance of Austrian Fleckvieh cows were accumulated and obtained by the Official Federation of Austrian Cattle Breeders (ZAR) in lower Austria. Detailed description of these data have been presented previously by Soliman (1984). The records used were those of primiparous and multiparous cows calved in six consecutive years from 1976 to 1982. The data consisted of productive and reproductive performance of 58050 records. Data were available on 19117, 19046, 12138 and 7749 daughters representing 1409, 1596, 1331 and 1072 sires in the first four parities, respectively. However, total of 28315 records representing 10007 cows sired by 643 bulls extracted from 50050 records were used in the combined analysis across all lactations.

Heifers were inseminated when they reached an average of 320 Kg body weight, while cows were inseminated starting from the first heat period after the 60th day post- partum. Artificial insemination was used avoiding half-sib, full-sib and sire-daughter matings. The data set comprised only cows that had information on their first lactation and subsequent later ones. However, those cows having information on later lactations with no first lactation information were eliminated. All daughters were obtained from AI bulls, those daughters were chosen randomly as one daughter per sire per herd. To avoid bias due to differences among sires in the average values of herd, each record was expressed as deviation from its herd average, i.e. herd effect was eliminated as described by Soliman and Hamed (1994). Consequently, any herd that contained only one record did not contribute in the present study. Also, if the cow was changed from a herd to another, her records were eliminated. Only sire with at least two daughters were included in the analysis. Other details of the breeding policy and management followed were described by Hartmann *et al.* (1986).

Traits studied were: total milk yield (TMY), fat yield (TFY) and protein yield (TPY) as total milk traits (TMT); age at calving (AC), days open (DO) and calving interval (CI) as reproductive traits (RT); day in milk (DM) as interval trait (IT); total milk yield per day of days milk (TMYDM), total milk yield per day of calving interval (TMYCI), total milk yield per day of age at first calving (TMY AFC) and total milk yield per day of age at second calving (TMYASC) as productive efficiency traits (PET).

Statistical analysis: Table (1) lists random and fixed effects included in the different models used to analyze different sets of traits of each of the first four and across all lactations. The expectations of the mean squares for random effects of variance components were computed according to Harvey (1990).

Variance and covariance components estimates (sire and remainder) in case of separate lactations from the 1st to the 4th and (sire; cow: sire and remainder) in case of across all lactations (first four ones) were computed according to Henderson's method III (Henderson, 1953) by using LSMLMW (Harvey, 1990).

Paternal half-sisters analysis of variances and covariances were performed to obtained estimates of correlations (genetic, phenotypic and environmental).

Genetic correlation (r_G) estimates between any two traits (Xi; XJ were calculated as:

$$r_G = Cov_s (X_1, X_2) / [\sigma^2_s (X_1)] [\sigma^2_s (X_2)]$$

where: Cov_s (x_i. x_j) = sire covariance component between traits x_i; x_j. σ^2_s (x_i) and $\sigma^2_s(x_i)$ = sire variance components of trait x_i; and x_i, respectively.

Estimates of phenotypic corre(rp) between any two traits were calculated as:

$$r_p = Cov_s (x_j.x_j + COV_e (x_i, x_i)/ [\sigma^2_s (x_i) + \sigma^2e (x_i)] [\sigma^2_s (x_j + \sigma^2_s (x_i)]$$

where: Cov_s (x_i, x_i) = remainder component of covariance between the first (x_j) and second (x_i) trait; and other components as defined previously.

Estimates of environmental correlation (r_E) were obtained by computing techniques described by Harvey (1990).

Standard errors for estimates of r_G were approximated according to Harvey (1990) as described by Swiger *et al.* (1964).

RESULTS AND DISCUSSION

Genetic Correlations (r_G)

Genetic correlations (r_G) among TMYT (TMY, TFY and TPY) in the first four and across all parities were generally high, positive and ranged from 0.76±0.08 to 0.95±0.01 (Table 2). Estimates of r_G among milk yield traits of Fleckvieh cattle (Soliman and Khalil, 1993) on the same data were, in general, similar being positive and high (estimates ranged from 0.62 to 0.98). The estimates of r_G in the 19 parity ranged from 0.88±0.02 to 0.91±0.01 between TMY and other yield traits, and 0.92±0.01 between TFY and TYP (Table 2). In other parities, the same trend was

Table 1. Effects included in the different mixed models used to analyzed milk, reproductive, interval and productive efficiency traits of each of the first four and across all lactations of Austrian Fleckvieh cows in lower Austria

Traits	Random effects							Fixed effects				
	Model No.	Parity	Sire	Cow:Sire	Reminder	Herd book	Year-Season	Age at Calving		Days open		Parity
								AC (L)	AC (Q)	DO (L)	DO (Q)	
Total milk and interval traits												
TMY, TFY, TPY, DM	1	1-4	X		X	X	X	X	X	X	X	X
	2	All	X	X	X		X	X	X	X	X	
Reproductive traits												
AC, DO, CI	3	1-4	X		X	X	X					
DO, CI	4	All	X	X	X		X					X
Productive efficiency traits												
TMYDM	5	1-4	X		X	X	X	X	X	X	X	
	6	All	X	X	X		X	X	X	X	X	
TMYCI, TMYAFC, TMYASC	7	1-4	X		X	X	X					
	8	All	X	X	X		X					X

Table 2. Estimates of genetic (r_G), phenotypic (r_p) and environmental (r_E) correlations between total milk yield and reproductive traits in the first four and across all lactations of Fleckvieh cattle

Traits Correlated	1st lactation			2nd lactation			3rd lactation			4th lactation			All lactation		
	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E
TMY & TFY	0.88±0.02	0.92	0.94	0.84±0.02	0.91	0.92	0.82±0.04	0.90	0.91	0.79±0.07	0.89	0.90	0.88±0.01	0.92	0.92
TPY	0.91±0.01	0.94	0.95	0.85±0.02	0.94	0.95	0.77±0.05	0.93	0.94	076±0.08	0.93	0.95	0.91±0.01	0.93	0.94
AC	0.02±0.06	0.09	0.13	-0.07±0.07	0.14	0.19	0.29±0.10	0.11	0.09	0.13±0.14	0.11	0.12	-±-	--	--
DO	0.68±0.07	0.51	0.50	-0.10±0.22	0.47	0.50	0.15±0.21	0.45	0.48	0.54±0.24	0.43	0.43	0.70±0.06	0.48	0.50
CI	0.68±0.07	0.51	0.50	-0.10±0.22	0.47	0.50	0.15±0.21	0.45	0.48	0.54±0.24	0.43	0.43	0.70±0.06	0.48	0.50
TFY & TPY	0.92±0.01	0.93	0.94	0.93±0.01	0.93	0.93	0.91±0.02	0.92	0.92	0.90±0.03	0.91	0.91	0.95±0.01	0.92	0.91
AC	0.02±0.05	0.09	0.13	0.03±0.07	0.13	0.19	0.27±0.09	0.10	0.07	0.07±0.12	0.11	0.13	-±-	--	--
DO	0.62±0.07	0.51	0.51	-0.18±0.19	0.46	0.50	0.03±0.20	0.44	0.48	0.37±0.23	0.40	0.41	0.64±0.07	0.47	0.50
CI	0.62±0.07	0.51	0.51	-0.18±0.19	0.46	0.50	0.03±0.20	0.44	0.48	0.37±0.23	0.40	0.41	0.64±0.07	0.47	0.80
TPY & AC	0.00±0.06	0.10	0.15	0.01±0.07	0.13	0.19	0.22±0.10	0.10	0.09	0.07±0.12	0.10	0.12	-±-	--	--
DO	0.66±0.07	0.54	0.53	-0.24±0.19	0.48	0.53	0.09±0.22	0.48	0.50	0.42±0.22	0.45	0.45	0.65±0.06	0.50	0.52
CI	0.66±0.07	0.54	0.53	-0.24±0.19	0.48	0.53	0.09±0.22	0.48	0.50	0.42±0.22	0.45	0.45	0.65±0.06	0.50	0.52
AC & DO	0.27±0.08	0.06	0.02	0.33±0.13	0.09	0.08	0.39±0.10	0.12	0.07	0.44±0.16	0.13	0.08	-±-	--	--
CI	0.27±0.08	0.06	0.02	0.33±0.13	0.09	0.08	0.39±0.10	0.12	0.07	0.44±0.16	0.13	0.08	-±-	--	--
DO & CI	1.00±0.00	1.00	1.00	1.00±0.00	1.00	1.00	1.00±0.00	1.00	1.00	1.00±0.00	1.00	1.00	1.00±0.00	1.00	1.00

found but with a decreasing magnitude, because of the genetic variances and covariances decreased with the advance of the parity. The estimates of r_G between TMY and TPY in the 19 and 2[nd] parity were slightly higher than those between TMY and TFY, while the reverse was nearly noticed at the 3[rd] and 4[th] parities. These trends are generally supported by the results on Fleckvieh cattle (e.g. Soliman and Khalil, 1993; Hamed and Soliman, 1994, Zahed, 1994 and Genena,1998). Estimates of rG between TMY and both TFY and TPY indicated that the genetic improvement of TPY is expected to be the same as that achieved for TFY, because the estimates of r_G between TMY with both TFY and TPY are nearly the same. Since the cost of producing a unit of fat requires twice as much feed energy as the production of an equal weight of protein (Dommerholt *et al.*, 1978) and, it seems necessary, from the economical point of view and from the human health, to take more attention for selection of milk with more protein than for milk with more fat.

Estimates of r_G between AC and TMYT at the 19 parity were positive and close to zero, and this was supported by findings of some investigators (e.g. Soliman and Khalil, 1991; Soliman and Hamed 1994 and Genena, 1998). Generally, the r_G estimates between AC and TMYT ranged from 0.00 :t. 0.06 to 0.29 :t. 0.10 in the 1 9 four lactations and these estimates, generally tended to increase from the 2D-Q to the 3rQ parity and decreased thereafter (Table 2). These results indicate that in order to select for obtaining the highest yields of milk traits, the breeder must choose the young cows, which had lower AC within the same parity. This concept is in the desirable direction. Moreover, most of the studies observed favorable r_G between AC and milk traits (e.g. Hansen *et al.* , 1983b; Abubaker *et al.* , 1986; Soliman and Khalil, 1991; Soliman and Hamed, 1994 and Genena,1998). The estimates of r_G between both DO and CI with TMYT were positive and varied in magnitude in the 1[st] four and across all parities except in 2[nd] parity (Table 2). Across the 1[st] four parities, r_G estimates decreased, in general from 1[st] to 2[nd] parity and increased thereafter. These estimates are in the range between -0.10±0.22 to 0.70±0.06 (Table 2). These r_G's are unfavorable for selection for high milk traits, since it leads to an increase in DO or CI, and consequently decreasing life time production of a cow. These trend are in agreement with some workers, which reported positive estimates between DO and milk traits (e.g. Raheja *et al.*, 1989; Soliman and Khalil, 1991 and Genena, 1998). While, Soliman and Hamed (1994) reported a reverse trend.

Moderate and positive r_G estimates were generally found between AC and both DO and CI, ranged from 0.27±0.08 to 0.44±0.16, and high estimates around 1.00±0.00 were between DO and CI in the 1[st] four parities (Table 2). Estimates of r_G between AC and both DO and CI (Similar estimates) increased gradually as the parity advanced. They exhibit unfavorable relationships since these estimates indicate that as AC increased the lengths of DO and CI would be increased and this has a negative influence on length of productive life and the income of the herd. The trend of these results was supported by the findings of Soliman and Khalil, 1991, Soliman and Hamed, 1994 and Genena, 1998. Estimate of r_G among RT (DO and CI) across all lactations was high and positive 1.00±0.00 (Table 2).

Estimates of r_G between TMYT and PET in the 1[st] four parities were positive and generally varied from moderate to high, except TMYT and both of TMYAFC and TMYASC in the 2[nd] and 3[rd] parity (Table 3). In general, the 1[st] parity recorded higher estimates of r_G than those estimates of the other parities and ranged from

Table 3. Estimates of genetic (r_G), phenotypic (r_p) and environmental (r_E) correlations between total milk yield and productive efficiency traits in the first four and across all lactations of Fleckvich cattle

Traits Correlated	1st lactation			2nd lactation			3rd lactation			4th lactation			All lactation		
	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E
TMY & TMYDM	0.98±0.02	0.76	0.71	0.92±0.03	0.75	0.73	0.92±0.05	0.76	0.74	1.30±0.34	0.76	0.74	0.99±0.01	0.79	0.74
TMYCI	0.88±0.03	0.68	0.65	0.87±0.05	0.66	0.65	0.76±0.09	0.65	0.64	0.71±0.18	0.64	0.63	0.98±0.01	0.73	0.63
TMYAFC	0.69±0.03	0.73	0.74	0.10±0.08	0.23	0.31	0.05±0.11	0.12	0.18	0.16±0.24	0.10	0.10	0.88±0.01	0.83	0.83
TMYASC	0.94±0.02	0.81	0.79	0.10±0.08	0.22	0.31	0.05±0.12	0.15	0.18	0.15±0.19	0.10	0.09	0.91±0.01	0.82	0.80
TFY & TMYDM	0.85±0.03	0.67	0.62	0.71±0.05	0.65	0.63	0.67±0.03	0.64	0.64	1.03±0.29	0.65	0.64	0.85±0.02	0.70	0.65
TMYCI	0.79±0.04	0.62	0.59	0.74±0.06	0.60	0.58	0.66±0.09	0.58	0.57	0.61±0.19	0.58	0.58	0.92±0.01	0.67	0.57
TMYAFC	0.63±0.04	0.69	0.70	0.08±0.08	0.21	0.29	0.03±0.10	0.11	0.15	0.25±0.21	0.08	0.06	0.83±0.02	0.78	0.78
TMYASC	0.86±0.02	0.76	0.74	0.07±0.07	0.21	0.29	0.02±0.11	0.12	0.16	0.24±0.16	0.07	0.05	0.87±0.02	0.77	0.74
TPY & TMYDM	0.90±0.02	0.68	0.63	0.73±0.04	0.66	0.65	0.64±0.08	0.66	0.66	0.91±0.25	0.67	0.67	0.89±0.02	0.71	0.66
TMYCI	0.80±0.04	0.62	0.58	0.75±0.06	0.60	0.58	0.59±0.11	0.57	0.57	0.57±0.19	0.57	0.57	0.93±0.01	0.66	0.56
TMYAFC	0.66±0.04	0.70	0.71	0.06±0.08	0.21	0.29	0.02±0.11	0.11	0.16	0.13±0.21	0.09	0.08	0.86±0.02	0.79	0.78
TMYASC	0.00±0.00	0.00	0.00	0.00±0.00	0.00	0.00	0.03±0.11	0.13	0.16	0.13±0.16	0.08	0.08	0.88±0.01	0.77	0.74

0.63±0.04 to 0.98±0.02. At the 1st parity, the highest r_G estimates were obtained between TMY and TMYDM (0.98±0.02), while the lowest one was obtained between TFY and TMYAFC (0.63±0.04). At the 2nd parity, the highest r_G estimates were found between TMY and TMYDM (0.92±0.03), while the lowest estimate was noted between TPY and TPYASC (zero estimates). AT the 3rd parity, the highest estimate was obtained between TMY and TMYDM 0.92±0.05, while the lowest estimate were noted between TFY and TFYASC (0.02±0.11). Finally, at the 4th parity, the highest r_G estimate was found between TMY and TMYDM 1.30±0.34, while the lowest value were recorded between TMY and TPYASC 0.13±0.16, from the previous results, it could be concluded that, it is better to choose TMYDM as selection criteri on at different parities than any other PET because it recorded the highest r_G with all TMYT. Thus this trait merits to be an important selection criterion in a breeding programme in dairy cattle. As shown in Table (3) the r_G estimate at the 1st parity between TMY and TMYDM (0.98±0.02) was in close agreement with those estimates (0.99, 0.98 and 1.00) reported by Murdia and Tripathi (1991), Dull and Taneja (1994), and Genena (1998), respectively. However, it is higher than the range of 0.23- 0.73 recorded by Chakravarty and Rathi (1988) and Singh *et al.* (1993). The estimate of r_G between TFY and TMYDM (0.85±0.03) at the 1st parity was lower than 1.05 and 0.88+0.01 obtained by Murdia and Tripathi (1991) and Genena (1998), respectively. Estimate of rG between TMY and TMYCI (0.88±0.03) at the 1st parity was lower than 0.99,0.95, 0.90+0.03 which given by Murdia and Tripathi, (1991), Dutt and Taneja (1994), and Genena (1998), respectively, but higher than 0.77 and 0.84 estimated by Chakravarty and Rathi, (1986) and Javek *et al.* (1990), respectively. The rG estimate between TFY and TFYCI (0.85±0.03) at the st parity was higher than 0.79±0.04 reported by Genena (1998), but lower than 1.02 reported by Murdia and Tripathi (1991). Estimate of rG between TMY and TMYASC (0.94 + 0.02) at the 1St parity was higher than 0.28, 0.04, 0.81 and 0.89+0.02 estimated by Chakravarty and Rathi, (1986), Deshpande *etaL,* (1988), Javek *et al.* (1990) and Genena (1998), respectively. Results in Table (3), show that the r_G estimates between TMYT and PET, generally decreased as parity advanced, and this reflects that a higher approach would be for the genetic improvement if selection is based on 1st parity rather than on other parities, because at that parity the genetic variability were at the highest values, and so it can be expected to obtain the highest correlated response from such relationships. Estimates of r_G between TMYT and PET across all lactations were positive and varied from moderate to high. They ranged from 0.83±0.02 to 0.99±0.01 Table 3). The highest r_G was obtained between TMY and TMYDM (0.99±0.01), while the lowest ones (0.83 + 0.02) were found between TFY and TFYAFC. Estimates of r_G between TMY aPET were generally higher than those between PET and other TMYT (Table 3). However, the estimates of r_G for the relationships between TPY and PET were generally higher than between TFY and PET. Thus, it is better to select for TMY and TPY as selection criteria in a breeding programmes of dairy cattle to improve PET.

The r_G estimates between AC and PET were low and varied in magnitude and direction (Table 4). They generally ranged from -0.29±0.04 to 0.03±0.06. Negative estimates of r_G were shown in the 1-St parity for the relationship between AC and PET. The estimate of r_G between AC and TMYDM at the 1st parity (-0.12±0.05) was lower than 0.16 which obtained by Dull and Taneja (1994), and was nearly estimate

Table 4. Estimates of genetic (r_G), phenotypic (r_p) and environmental (r_E) correlations between reproductive and productive efficiency traits in the first four and across all lactations of Fleckvieh cattle

Traits	1st lactation			2nd lactation			3rd lactation			4th lactation			All lactation		
Correlated	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E
AC & TMYDM	0.12±0.05	0.10	0.21	0.03±0.06	0.12	0.18	0.00±0.09	0.07	0.09	0.06±0.30	0.05	0.08	-	-	-
TMYCI	0.13±0.06	0.06	0.13	0.07±0.06	0.07	0.14	0.02±0.08	0.01	0.03	0.20±0.17	0.00	0.04	-	-	-
TMYAFC	0.27±0.05	0.18	0.14	0.29±0.04	0.09	0.07	0.14±0.05	0.11	0.09	0.02±0.12	0.12	0.17	-	-	-
TMYASC	0.25±0.06	0.10	0.05	0.26±0.04	0.04	0.15	0.16±0.06	0.07	0.01	0.00±0.09	0.09	0.14	-	-	-
DO & TMYDM	0.39±0.11	0.05	0.11	0.19±0.19	0.08	0.09	0.01±0.18	0.11	0.11	1.13±1.34	0.12	0.16	0.63±0.08	0.04	0.15
TMYCI	0.24±0.13	0.24	0.30	0.59±0.27	0.32	0.31	0.53±0.23	0.34	0.33	0.18±0.42	0.38	0.39	0.52±0.09	0.22	0.33
TMYAFC	0.38±0.08	0.38	0.40	0.10±0.13	0.11	0.13	0.00±0.11	0.05	0.06	0.29±0.26	0.01	0.03	0.41±0.08	0.40	0.41
TMYASC	0.47±0.09	0.30	0.29	0.19±0.13	0.07	0.07	0.07±0.12	0.02	0.04	0.17±0.20	0.00	0.01	0.48±0.08	0.21	0.20

-0.08±0.05 obtained by Genena (1998). The estimate of r_G between AC and TMYCI at the 1st parity (-0.13±0.08) was lower than -0.16 and -0.22±0.08 given by Murdia and Tripathi (1991) and Genena (1998), respectively, and was opposite in direction than 0.11 obtained by Dutt and Taneja (1994). The highest negative r_G estimates were obtained between AC and TMYASC at the 1st four parities (Table 4). On the other hand; the lowest negitive r_G estimates were reported between AC and TMYDM in the 1st and 4th parity. The high negative r_G estimates between AC and TMYASC through different parities are desirable for many reasons, first: to increase the productive life of the cow and improve production traits as the cow was chosen in a young age, second: TMYASC is very important trait because it can be used as an index trait in selection programms, and also, this trait is a combination of AFC, first CI and first DM. Thus, this trait is qualified to be a comprehensive and ideal trait for selection under field conditions for comparing the economic merit of the dairy cattle. The r_G estimates between AC and TMYDM increased generally from the 1- up to 3- parity and decreased thereafter. The negative relationship between AC and TMYCI decreased from 1- up to 3- parity and increased thereafter. The r_G between AC and both TMYAFC and TMYASC showed an antagonistic relationship between them, which increased from 1- to 2- parity and decreased in 3- parity. Estimates of r_G between both of DO and CI with PET ranged from -0.00 ±0.11 to 0.47+0.09 in the 1st four lactations, except an overestimate of 1.13±1.34 for the relationship between both DO and CI with TMYDM at the 4th parity. Positive r_G estimates were found between both DO and CI with PET in the 1st parity only. The highest r_G estimates were found for r_G between both DO and CI with TMYDM (1.13±1.34) in the 4ib parity, with TMYCI (0.240.13) in the 1st parity, with TMYAFC (0.38±0.08) in the 1st parity and with TMYASC (0.470.09) in the 1st parity (Table 4). However, the lowest r_G estimates were found for r_G between both DO and CI with TMYDM (-0.01± 0.18) in the 3rd parity, with TMYASC (-0.07+ 0.12) in the 3- parity. Estimates of r_G between both TMYDM and TMYCI with DO (0.39 ± 0 11 0 24+ 0.13) in the 1st parity was higher than 0.08 and 0.21 obtained by Murdia and Tripathi (1991). The highest negative r_G estimates obtained for the relationships between both DO and CI with TMYCI at the 2nd and 3rd parity (Table 4) is desirable and indicate that TMYCI should be used as a criterion for selection instead of TMYDM in view of short DM and long CI's. Also, this trait reflects both productive and reproductive performances as one composite trait and thus merits to be an important selection criterion in a breeding programme and prolonged the productive life of dairy cattle. The positive trend of the r_G estimates between PET with both DO and CI decreased from the 1st up to the 3rd parity and increased thereafter. Estimates of r_G between both DO and CI with PET across all lactations were moderate and positive and ranged from 0.41+0.08 to 0.63±0.08 (Table 4). The highest similar rG were found between both DO and CI with TMYDM (0.63±0.08), while the lowest similar ones were obtained with TMYAFC (0.41±0.08).

The estimates of r_G among PET were generally positive and moderate to high in the 1st four parities (Table 5). This indicate that as well as genetically, these traits were correlated or influenced by the same set of genes. Generally, at the 1st parity the r_G estimates among PET were positive and strong relative to other parities, and this is desirable to select such traits at early stage (parity). Those estimates ranged from 0.69±0.04 to 0.98±0.02 between TMYDM and other PET, from 0.67±0.05 to

Table 5. Estimates of genetic (r_G), phenotypic (r_p) and environmental (r_E) correlations between total milk yield and productive efficiency traits in the first four and across all lactations of Fleckvieh cattle

Traits	1st lactation			2nd lactation			3rd lactation			4th lactation			All lactation		
Correlated	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E	r_G±SE	r_p	r_E
TMYDM and	0.98±0.02	0.76	0.72	0.83±0.04	0.73	0.72	0.850.05	0.75	0.74	1.15±0.56	0.75	0.74	0.99±0.00	0.81	0.74
TMYCI	0.69±0.04	0.44	0.37	0.09±0.07	0.14	0.21	0.00±0.09	0.09	0.13	0.24±0.53	0.09	0.09	0.88±0.02	0.58	0.48
TMYAFC	0.94±0.03	0.60	0.52	0.12±0.07	0.17	0.26	0.06±0.10	0.13	0.15	0.19±0.41	0.10	0.10	0.91±0.01	0.66	0.58
TMYASC	0.67±0.05	0.49	0.45	0.12±0.07	0.15	0.22	0.02±0.08	0.09	0.13	1.45±0.28	0.09	0.7	0.91±0.02	0.61	0.53
TMYCI and	0.93±0.03	0.65	0.60	0.14±0.06	0.17	0.27	0.01±0.10	0.13	0.16	0.33±0.21	0.11	0.08	0.93±0.01	0.74	0.68
TMYAFC	0.86±0.02	0.76	0.73	00.98±0.00	0.92	0.89	0.66±0.03	0.79	0.87	1.11±0.03	0.96	0.94	0.88±0.02	0.58	0.48

0.93±0.03 between TMYCI and others and around 0.86±0.02 between TMYAFC and TMYASC. At the other parities, similar trends were noticed but generally with a decreasing trend in magnitude. The r_0 estimate at the ${}_1$st parity between TMYDM and TMYCI (0.98±0.02) was higher than 0.90, 0.89 and 0.89±0.03 reported by Singh *et al.* (1989a), Dutt and Taneja (1994) and Genena (1998), respectively and it was lower than 1.05 obtained by Murdia and Tripathi (1991) at 1^{st} parity. Estimates of r_G between TMYDM and PET decreased from the 1^{st} to 2^{nd} parity and increased thereafter, while an opposite trend was detected for the relationship between TMYAFC and TMYASC. The r_G estimates between TMYCI and each of TMYAFC and TMYASC decreased from 1^{st} up to 3^{rd} parity and increased thereafter. Table (5) shows that the highest r_G estimates among PET were found between TMYDM and TMYCI (1.15±0.58) at the 4^{th} parity; between TMYDM and both TMYAFC and TMYASC at the ${}_1$st parity (0.67±0.05 and 0.93±0.03) and finally between TMYAFC and TMYASC (1.11±0.03) at the 4^{th} parity. Such relationships must be regarded for any selection program. On the other side, the lowest r_G estimates were obtained at the 2^{nd} and 3^{rd} parities between both TMYDM and TMYCI and PET, and between TMYAFC and TMYASC at the 3- parity. The high rG among PET as stated later were favorable and the genetic improvement in one trait can bring about simultaneous genetic improvement in other traits. Thus, there are good chances of satisfactory correlated response if selection is directed towards one of these traits. Estimates of r_G among PET across all lactations were positive and varied from moderate to high (Table 5). These estimates ranged from 0.88±0.02 to 0.99±0.00. The highest and lowest r_G estimates were found between TMYDM and each of TMYCI and TMYAFC (0.99±0.00 and 0.88±0.02, respectively). As listed in Table (5) the estimates of r_G between each of TMYDM and TMYCI and the other PET were generally higher than those between TMYAFC and TMYASC traits. Estimates of r_G between TMYCI and each of TMYAFC and TMYASC (ranging from 0.91±0.02 to 0.93±0.01) were higher than those between TMYDM and the same traits (ranging from 0.88±0.02 to 0.91±0.01). The relationship between TMYASC and TMYCI (r_G = 0.93±0.01) was higher than those between TMYASC and all of TMYDM, and TMYAFC (0.91±0.01 and 0.88±0.02, respectively).

Phenotypic correlations (r_p):

Estimates of r_p among TMYT were high and positive in the ${}_1$st four parities. Estimates r_p between TMY and other yield traits ranged from 0.89 to 0.94 for the 1^{st} parities (Table 2). These ranges generally fall within the range of the available literature on Fleckvieh cattle (e.g Soliman and Khalil, 1993; Hamed and Soliman, 1994, Afifi *et al.,* 1995 and Genena, 1998). The highest r_p estimates among TMYT were obtained in the ${}_1$st parity relative to the other parities (e.g. Soliman and Hamed, 1994). At different parities (Table 2) the r_p between TMY and TPY (0.93-0.94) are higher than those between TMY and TFY (0.89-0.92). The r_p estimates among TMYT generally decreased with advance of parity. Estimates of r_p among TMYT across all lactations were generally, positive, high and ranged from 0.88 to 0.95 (Table 2). This range generally falls within the range of 0.81 -0.98 estimated by Afifi *et al.* (1995) and Genena, (1998).

Estimates of r_p between AC and TMYT were positive, low and ranged from 0.09 to 0.14 for the 1^{st} four parities (Table 2). This range generally falls within the range of 0.08±0.15 estimated by Gen (1998). The r_p estimates between AC and TMYT, generally increased from the 1st to the 2nd parity and decreased thereafter. The ranges of previous rp estimates between AC and TM at 1st and 2nd parities were higher than the ranges of -0.04-0.01 and 0.06-0.08 at the 1st and 2nd parity, respectively, estimates by Soliman and Khalil (1991) and it is similar to the ranges 0.11 and 0.13-0.15 obtained by Genena (1998) with Fleckvieh. Cattle the r_p estimates between both DO and CI and TMYT were generally moderate and positive and ranged from 0.40 to 0.54 for the 1st four parities (Table 2). These estimates are higher than those of (0.18 to 0.21) given by Genena (1998) in Fleckvieh cattle. The rp estimates between either DO or CI and TMYT at the 1st four parities decreased with advance of parity. Positive and moderate estimates of r_p between both of DO and CI with TMYT across all lactations ranged from 0.47 to 0.50 (Table 2). The highest and lowest r_p estimates were obtained between either DO or CI and TPY (0.50) and TFY (0.47), respectively.

Positive and low to moderate r_p estimates were generally observed between AC and both DO and CI. These estimates ranged from 0.06 to 0.13 between AC and both DO and CI and around 1.0 between DO and Cl in the 1st four parities (Table 2). These finding were exactly the same as those given by Genena (1998). The rp estimates between AC and both DO and CI increased steadily with the advance of parity. The estimates of r_p between AC and DO (0.06 and 0.09) at the first two parities, respectively, were exactly the same as those given by Soliman and Khalil (1991), and Genena (1998), but lower than 0.32 and 0.38 obtained by Soliman and Hamed (1994) at the same parities. Estimates of r_p between DO and Cl across all parities was found to be high and positive (1.00).

Estimates of r_p between TMYT and PET at the 1st four parities were positive and varied from moderate to high (Table 3). Results in Table (3) evidenced that the 1st parity had the highest r_p estimates between TMYT and PET relative to other parities and those estimates ranged from 0.62 to 0.81. The highest r_p estimates were generally found between TMYDM and TMYT, particularly with TMY which recorded the highest r_p estimate (0.76) at the different four parities, while, the lowest r_p estimates were between TMYT and each of TMYAFC and TMYASC at the 1- up to 3- parities. Estimate of r_p between TMYDM and TMY at 1st parity (0.76) is similar the estimate (0.78) obtained by Murdia and Tripathi (1991), and lower than (0.99) estimated by Genena (1998), while r_p estimate between TFY and TMYDM at 1st parity (0.67) is lower than (0.81 and 0.88) estimated by Murdia and Tripathi (1991) and Genena (1998), respectively. Estimates of r_p between TMY and TMYCI at ± parity (0.68) is similar to 0.68 estimated by Genena (1998) but is higher than those recorded by Javek *et al.* (1990) and Dull and Taneja (1994) which were 0.62 and 0.65, respectively and lower than 0.88 given by Murdia and Tripathi (1991). The estimate r_p between TFY and TMYCI and 1st parity (0.59) is nearly similar to 0.61 and 0.62 estimated by Murdia and Tripathi (1991) and Genena (1998), respectively. The r_p estimate between TMY and TMYASC (0.81) at the 1st parity is similar 0.81 given by Javek *et al.* (1990), but is higher than 0.08 and 0.73 obtained by Deshpande *et al.* (1988) and Genena (1998), respectively. The r_p estimates between TMYT and PET generally decreased gradually as parity advanced. From the results of the present study, we predict that comparing estimates of r_G with their corresponding estimates of r_p (Table 3), it seems that at the 1st parity, the estimates of r_G ere higher than the corresponding estimates of r_p, while we noticed that the estimates of r_G decreased gradually as parity advanced and recorded higher estimates than the corresponding r_p's. Thus the higher r_G's estimated at this study in practice, reflect and gives a considerable advantage in culling policy and management practice for any breed of dairy cattle. Estimates of r_p between TMYT and PET across all lactations were found to be positive and varied in magnitude from moderate to high (Table 3). These estimates ranged from 0.66 (between TMYCI and TPY) to 0.83 (between TMYAFC and TMY). Estimates of r_p between TMY and PET were generally higher than those between other TMYT and PET.

The estimates of r_p between RT and PET at the 1st four parities were presented in Table (4). The r_p estimates between AC and PET were low; varied in magnitude and direction, and generally ranged from -0.04 to 0.12. Through the ₁st parity the r_p estimate between AC and TMYDM (0.1) is similar to 0.1 reported by Dull and Taneja (1994) and Genena (1998), while it was higher than 0.04 recorded by Murdia and Tripathi (1991). The r_p estimate between AC and TMYCI (0.06) at the 1st parity is nearly similar to 0.04 obtained by Murdia and Tripathi (1991) and Genena (1998), however, it is lower than 0.1 recorded by Dull and Taneja (1994). The negative r_p estimates between AC and each of TMYAFC and TMYASC ranged from -0.04 to -0.18 (Table 3) at the 1st four parities. Estimates of r_p between both DO and CI with PET as listed in Table (4) varied in direction and magnitude from low to moderate. These estimates ranged from 0.00 to 0.38 at the st four parities and the highest negative estimates of r_p were obtained between TMYCI and both of Do and CI, while the lowest positive ones were found between TMYASC and both of DO and CI at the ₁st four parities. The r_p estimate between DO and TMYDM at the 1st parity (-0.05) was lower than (-0.17 and 0.20) which estimated by Murdia and Tripathi (1991) and Genena (1998), respectively, and also the negative r_p between DO and TMYCI (-0.24) was higher than (-0.13) recorded by the same workers and lower than (-0.54) estimated by Genena *(1998)*. Generally as shown in Table (4) negative r_p estimates were found between both DO and CI with TMYDM and TMYCI. However, positive $_{rp}$ estimates were obtained with other PET at the ₁st four parities. The negative r_p estimates between both DO and CI and TMYDM and TMYCI was increased as parity advanced, while with TMYAFC and TMYASC, generally decreased with the advance of parity. Estimates of r_p between both DO, CI and PET across all lactations varied in direction and magnitude from low to moderate. Those estimates ranged from -0.04 to 0.40 (Table 4). The highest and lowest r_p estimates were obtained between either DO or CI and TMYAFC and TMYDM (0.40 and 0.04, respectively). Estimates of r_p's among PET were generally positive and varied from low to moderate (Table 5). Those estimates ranged from 0.09 to 0.96 at the ₁st four parities. Generally, the 1st parity recorded the highest r_p estimates among PET and these estimates ranged from 0.44 to 0.76 between TMYDM and other PET; from 0.49 to 0.65 between TMYCI and others and 0.76 between TMYAFC and TMYASC. At other parities, the same trend was observed but with a decreasing magnitude. The r_p between TMYDM and TMYCI at ₁st parity 0.76, is similar to 0.77 obtained by Dull and Taneja (1994), was lower than 0.85 estimated by Murdia and Tripathi (1991), but higher than 0.55 and 0.67 estimated by Singh *et al.* (1989a), respectively. The r_p estimates among PET (Table 5), generally decreased as parity advanced except between TMYDM and TMYCI and those between TMYAFC and TMYASC. Estimates of r_p among PET across all lactations were generally positive and ranged from 0.58 to 0.81 (Table 5). The highest r_p estimates were found between TMYDM and TMYCI (0.81), while the lowest was obtained between either TMYDM or TMYASC and TMYAFC (0.58).

Environmental correlations (r_E)

Estimates of r_E among TMYT were generally positive and high in magnitude. They ranged from 0.90 to 0.95 in the 1st four parities (Table 2). Estimates of r were generally in agreement with the estimates reported in Austrian dairy cattle (e.g. Soliman and Hamed, 1994, Afifi *et al.*, 1995 and Genena, 1998). Estimates of rE between TMY and TPY at different parities were higher than those between TMY and TFY (Table 2). These were generally confirmed with other studies (e.g. Hamed and Soliman, 1994, Afifi *et al.*, 1995 and Genena, 1998). The estimates r_E between TMY and TPY, generally took constant valuesat the 1st four parities. Estimates of r_p and r_E were higher than their corresponding estimates of r_G at different parities for the relationships among TMYT. These results were in agreement with the findings of Soliman and Khalil, (1993); Zahed (1994) and Genena (1998). These results revealed that these relationships were affected by additional environmental factors on subsequent lactations. Among TMYT, the r_p estimates were nearly equal in magnitude and similar in direction with r_Es (Table 2). These results were supported by the results of Weller *et al.* (1985) and Genena, (1998). Estimates of both r_G's and r_E's among IMYT were close to each other and reflect that yield traits were influenced by both genetic and environmental sources of variation through different physiological mechanisms (Falconer, 1989). These explanations indicate that any improvement in environment (management, feeding, housing etc..) may have its reflection on genetic progress achieved through selection programs. Estimates of r_E among TMYT across all parities were generally high and positive and ranged from 0.91 to 0.94 (Table 2). This range generally falls within the range of 0.86 to 0.97 which obtained by Genena (1998).

Estimates of r_E between AC and TMYT were positive and varied from low to moderate (Table 2). They ranged from 0.07 to 0.19 at the 1st four parties. The ranges for r_E estimates between AC and TMYT at the first two parities were generally lower than (0.75 to 0.82 and 0.86 to 0.99) obtained by Soliman and Hamed (1994). The trend of r_E estimates between AC and TMYT were increased up to the 2- parity, decreased at the 3rd parity and increased thereafter. Estimates of rE between both DO and CI with TMYT were positive and moderate in magnitude as reported in Table (2). These estimates ranged from 0.41 to 0.53 at the 1- four parities. These results of r_G were higher than those obtained by Soliman and Hamed (1994) and Genena (1998). Positive estimates of r_E between both of DO or CI and TMYT across all lactations were found to range from 0.50 to 0.52 (Table 2). The highest and lowest estimates were found between both DO or CI and TPY and MY (0.52 and 0.50, respectively).

Positive and low r_E estimates were generally found between AC and both DO and CI. These estimates ranged from 0.02 to 0.08 at the 1st four parities (Table 2). Estimates of r_E between Ac and DO (0.02 and 0.08) at the first two parities, respectively, were generally similar to obtained by Genena (1998) but lower than (0.22 and 0.29) obtained by Soliman and Hamed (1994). The magnitude of the r_E estimates between AC and both DO and CI generally increased up to the 2nd parity and had a consistent value at other parities. The r_E estimates between DO and CI through the different parities were stable (1.0). Estimate of r_E between DO and CI across all lactations was high and positive (1.0).

Estimates of r_E between TMYT and PET at the 1st four parities were positive but generally, differed from moderate to high (Table 3). These estimates ranged from

0.05 to 0.79 at the 1st four parities, the highest estimates were obtained between TMY and TMYT, while the lowest estimates were found between TMYAFC and TMYT. The r_E estimates between TMY and PET were higher than those estimates between PET and other TMYT. The magnitudes of the r_E between TMYT with both TMYDM and TMYCI were generally, consistent in the 1st four parities. The magnitude of the r_E between TMYT and both of TMYAFC and TMYASC decreased as parity advanced. The estimates of r_p and r_E were generally higher than the corresponding estimates of r_G at 2nd and 3rd parity between TMYT and TMYAFC and TMYASC and this reflects that those traits were affected by many additional environmental factors in 2nd and 3rd parity. Thus, for the improvement of such traits, the breeder should improve the environmental circumstances for his herd such as feeding, housing, management, etc. Estimates of r_E between TMYT and PET across all lactations were positive and ranged from 0.56 to 0.83 (Table 3). The highest r_E was found between TMY and TMYAFC (0.83), while the lowest (0.56) were obtained between TPY and TMYCI. The r_E estimates between TMY and all PET were generally higher than that between other TMYT and PET.

The r_E estimates between AC and PET generally varied in directions and in magnitude from low to moderate. Those estimates ranged from -0.01 to 0.21 in the 1st four parities (Table 4). Generally, the negative r_E were found between AC and both TMYAFC and TMYASC. The highest estimates at the 1st two parities were found between AC with TMYDM (0.21 and 0.18, respectively) and is similar to 0.20 and 0.21 estimated by Genena, (1998). However, the lowest r_E's were obtained between AC and TMYASC (-0.01) at the 3rd parity. At the 2nd parity the highest estimate was observed between AC and TMYASC (0.15). The magnitude of the estimates of r_E between AC and both TMYDM and TMYCI were generally consistent at high values in the 1st two parities and decreased with the advance of parity. The magnitude of the r_E estimates between AC and both TMYAFC and TMYASC generally increased up to the 2nd parity and decreased thereafter. Negative estimates of r_E between DO or CI with of TMYDM generally decreased up to 2nd parity and increased thereafter. However, negative estimates of r_E between DO or CI and with TMYCI generally increased with a parity advanced. Positive estimates of r_E between DO or CI and with both of TMYAFC and TMYASC generally decreased with a parity advanced. Estimates of r_E between both of DO and CE with PET across all lactations varied in magnitude and direction, and ranged from -0.15 to 0.41 (Table 4). The highest and lowest relationships were obtained between both of DO and CI with TMYAFC and TMYDM (0.41 and 0.15, respectively). The estimates of r_E among PET were positive and varied from moderate to high estimates (Table 5). Those estimates ranged from 0.07 to 0.94 at the 1st four parities. The relationship between TMYDM and with TMYCI generally consistent in magnitude across the 1st four parities. The relationships between TMYDM and both of TMYAFC and TMYASC generally decreased with advance of parity. The relationships between TMYCI and both TMYAFC and TMYASC generally decreased with a parity advanced. Relationship between TMYAFC and TMYASC generally increased up to the 2nd parity, decreased at the 3rd parity and increased thereafter. Estimates of rE among PET across all lactations were generally positive and varied in magnitude and ranged from 0.48 to 0.74 (Table 5). The highest relationships were found between TMYDM and TMYCI. While, the lowest was obtained between TMYDM and TMYAFC and also, between TMYAFC and TMYASC.

CONCLUSION AND GENERAL CONSIDERATIONS

Generally, high and positive r_G estimates obtained here among TMYT, reflect that selection for any of the TMYT, will lead to substantial positive correlated genetic gain in the other TMYT. A selection programe could be developed to increased TPY and TMY therefore, selection for TPY would be worthy of consideration in this respect. Consequently, the initial decision of selection could be done on the basis of TPY in the first parity (the highest estimates of r_G among TMYT) by using progeny test for sires that should be used in Al service. The greater relationship of TMY and TPY than that of TMY and TFY, suggested that correlated responses due to single-trait selection of TMY ought to be greater for TPY than for TFY. High estimates of r_E among TMYT are of interest for the purposes of herd management. Thus any r_E relationships among them were relatively important within a given herd (Soliman and Khalil, 1993). These high estimates of r_E emphasize the large influence of environmental factors on cow's performance, which must be considered in the selection program to achieve more genetic progress along the time.

Negative r_G between AFC and TMYT were favorabl, because selection for AFC would result in genetic response without impairing TMYT, thus the breeder must choose the young cows, which had lower AC within the same parity. However, posiand moderate r_G estimates between TMYT and both DO and CI were unfavorable for selection of high TMYT, such relationships may lead to an increase in DO or CI, and consequently, decreasing cow's life time production.

Moderate and positive relationships between AC and both DO and CI were unfavorable because as AC increased, the lengths of both DO and CI will be increased also, and this has a negative influence on the length of productive life and the farmer's income.

Moderate to high, positive r_G estimates for the relationships between TMYT and PET decreased with advance of parity. Therefore a better approach would be for the genetic improvement if selection was practical based on the performance of the first parity rather than on other parities. Because at that parity, the genetic variabilities were at the highest values, and so it can be expected to obtain the highest correlated responses through such relationships. Thus it is better to choose TMYDM as selection criterion at the first parity because it, generally, recorded the highest estimates of r_G through the first four parities with TMYT.

One of the first indications of a sire's breeding value can be obtained by calculating the average daily milk yield (TMYDM) of his daughters. It is therefore of interest to know how much will be gained or lost when the selection is based on this criterion compared with a selection based on yearly or standard lactation yield. A selection on TMYDM may render a shorter generation interval. At any rate, it is likely that the information of TMYDM can be used to practice a pre-selection among cows and bulls. Because maintenance costs of cows on time dependent, it would seem that some measures of production per unit of time should be the predictand. Milk yield of the first parity is commonly used for selecting dairy animals, but a better approach would be if selection is based on a production efficiency traits rather than simply on TMY.

For the relationships between RT and PET, it seems favorable to choose

TMYASC as a selection criterion, because it recorded negative and high r_G estimates with AC, through all parities. Thus, this relationship would increase the cow's productive life time and improve production traits, when the cow was chosen as young as possible. Also, TMYASC is very important trait (a composite trait) as it includes AFC and both first MY and CI, therefore, it could be used as an index and ideal trait for selection programmes under field conditions for comparing the economic merit of dairy cattle. Also, it is better to choose TMYCI as a selection criterion at the $_3$Ld parity for its negative and moderate r_G estimates with both DO and CI, to shorten the lengths of them parallel with an improvement in conception rate, and prolong the productive life time of the cows. Therefore, if we select for the previous traits (MPASC and MPCI), the length of dry period will be decreased, and this will result in increasing the productive life time of the cow. Thus, we should use them in this respect, as selection criteria rather than the other PET.

Positive and moderate to high relationships among PET, especially at the first parity, indicated that its desirable to select such traits at early stage of life (parity), because phenotypically as well as genetically, these traits were influenced by the same set of genes. These high and positive r_G estimates will lead to obtain high genetic gain of correlated traits, if direct selection was applied on TMYCI. Therefore, it is clear, that high genetic relationships among PET as stated later were in a favorable and the improvement in one trait can bring about simultaneous genetic improvement in other traits. Thus, there are good chances of satisfactory correlated response, if selection is based on one of these traits.

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التحليل الوراثي لصفات الكفاءة الإنتاجية والتناسلية فى المواسم المختلفة فى ماشية الفلاكفيه. ٢- الإرتباطات الوراثية والمظهرية والبيئية

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استخدمت بيانات الأداء الإنتاجي والتناسلي لعدد ٥٨٠٥٠ سجل إدرار لأبقار الفلاكفيه النمساوية وذلك للأربعة مواسم إدرار الأولى ، استخدام لكل المواسم مجتمعة ٢٨٣١٦ سجل إدرار تمثل ١٠٠٠٧ بقرة لعدد ٦٤٣ طلوقه ، لتقدير التباينات والتغايرات الوراثية والمظهرية لجميع الصفات المدروسة وذلك للأربعة مواسم الأولى بالإضافة إلى كل المواسم مجتمعه.

كانت الصفات المدروسة هى : صفات إنتاج اللبن الكلى : محصول كل من اللبن والدهن والبروتين وطول فترة الحليب ، الصفات التناسلية : العمر عند الولادة ، طول فترة الأيام المفتوحة ، طول الفترة بين الولادتين، صفات الكفاءة الإنتاجية : محصول اللبن منسوب لطول فترة الحليب ، محصول اللبن منسوب لطول الفترة بين ولادتين - محصول اللبن منسوب للعمر عند أول ولادة - محصول اللبن منسوب للعمر عند ثاني ولادة.

تم تقدير معاملات الارتباطات الوراثية والمظهرية والبيئية بين مجاميع الصفات المدروسة وداخلها لكل المواسم الأربعة الأولى وللمواسم مجتمعة معا. وكان المدى لقيم الارتباطات الوراثية والمظهرية والبيئية للعلاقات المختلفة على الترتيب كالأتي :-

- لصفات إنتاج اللبن كانت قيم الارتباطات الوراثية والمظهرية والبيئية موجبة ومرتفعة وتراوحت بين ٠,٦٥ - ٠,٩٩ ، ٠,٨٧ - ٠,٩٨ ، ٠,٨٨ -٠,٩٨ على التوالي .

- كانت قيم الارتباطات الوراثية والمظهرية والبيئية بين صفات إنتاج اللبن والصفات التناسلية بصفة عامة متباينة فى الاتجاه والقيمة (منخفضة - متوسطة).
- كانت قيم الارتباطات الوراثية والمظهرية والبيئية بين صفات إنتاج اللبن وصفات الكفاءة الإنتاجية لإنتاج اللبن بصفة عامة موجبة ومتباينة فى القيمة (متوسطة - عالية) وتراوحت بين ٠,١٣- ١,٠٠ ، ٠,١٩- ٠,٩٩ ، ٠,١٧-٠,٩٩ على التوالي.
- كانت الارتباطات بين كل من الصفات التناسلية وصفات الكفاءة الإنتاجية لإنتاج اللبن بصفة عامة متباينة فى الاتجاه والقيمة.
- كانت تقديرات جميع الارتباطات بين صفات الكفاءة الإنتاجية لإنتاج اللبن موجبة ، وكانت قيم الارتباطات الوراثية والبيئية متباينة فى القيمة (متوسطة - عالية) وتراوحت بين ٠,١٣- ١,٠٠، ٠,١٣-٠,٧٦ على التوالي. بينما كانت الارتباطات المظهرية متباينة فى القيمة (منخفضة- متوسطة).