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SELECTION INDICES FOR FRIESIAN COWS USING TWO METHODS OF CALCULATING RELATIVE ECONOMIC VALUES FOR SOME IMPORTANT PRODUCTIVE AND REPRODUCTIVE TRAITS

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ABSTRACT

A total of 598 first lactation records of Friesian cows progeny of 30 sires and 535 dams were used in this study. Analysis was carried out using Maximum Likelihood procedures with the model used including month and year of calving as fixed effects and sires as random effects.

The estimates of phenotypic and genotypic variances and co variances of, 305 day milk yield, 305 day fat yield, 305 day protein yield, calving interval and age at first calving and their relative economic values derived by two methods were used for constructing selection indices, method 1,actual relative economic values (REV(1) and method 2,relative weights(REV(2)). Heritability estimates were 0.31, 0.12, 0.17, 0.19 and 0.44, respectively. Genetic correlations between milk traits were high, positive and significant (p<0.01) ranging from 0.85 to 1.00 and their corresponding phenotypic correlations from 0.60 to 0.97.

Twenty-six selection indices for each method of relative economic value derivation (REV) were constructed. The selection index I_{1A} or I_{1S} which in corporated 305 days milk yield, 305days protein yield,calving interval and age at first calving, was the best (had the highest accuracy (R_{IH}) and relative efficiency values) and were recommended, if the selection was exercised at the end of the first lactation. Rank correlation coefficient between the ranking of 598 Friesian cows by the both methods of relative economic valus was 0.95 . thus ,the second method of relative economic values was recommended for ease of calculation .

Keywords: Selection Indices, Friesian cows, relative economic values, Genetic and phenotypic parameters, milk yield ,fat yield, protein yield, calving interval and age at first calving.

INTRODUCTION

Various studies in dairy cattle showed that the aggregate breeding value of an animal under selection can be predicted with increased accuracy by using selection index, which leads to the most efficient genetic improvement.

. Hazel (1943) showed that the selection index is designed to maximize genetic merit or aggregate genotypic value for several traits among individuals in a population.

The traits to be considered in selection may not be equally important and this requires some kinds of weightings. The amount of weight given to each trait depends up on its relative economic value and genetic and phenotypic variances and co variances among traits considered.

Weller (1994) concluded that doubling the economic value for one of the traits decreased selection efficiency by only a few percent and losses in efficiency were also affected by the genetic and phenotypic correlations, with the genetic correlations having the greater effect and loss of efficiency was usually greater with negative genetic correlations among the traits, but in this case the total response possible is low in any event. Similarly, Smith (1983) indicated that attempts to achieve precise estimates of economic weights were not productive, since the gain in selection efficiency would be minimal.

Because of selection objectives and management conditions vary from farm to farm and from time to time and because of the difficulty of obtaining the actual relative economic values of various economic traits, the present study was designed to find out relative weights which can be used to overcome this difficulty.

The objective of this study was to construct selection indices for Friesian cows in Egypt, by using two methods of relative economic values and to select the best combination of two, three, four and five traits on the basis of their accuracy and their relative efficiency, which maximize the genetic improvement.

MATERIALS AND METHODS

Data

Data on 598 normal first lactation records of Friesian cattle raised at Sakha Experimental station, Animal Production Research Institute, Ministry of Agriculture, Egypt .Records covered the period from 1996 at 2002.Number of sires and dams were 30 and 535, respectively. Abnormal records affected by disease or by disorders such as abortion were excluded, lactation records with less than 150 days lactation period were also discarded. Traits studied were 305 days milk yield (MY) ,305 days fat yield (FY) ,305 days protein yield (PY) in kilograms,calving interval (CI) in days and age at first calving(AFC) in months.

Analysis

Due to the limitation of MTDFREML procedure to analyse more than three traits, data were analysed using Mixed Model Least Squares and Maximum Likelihood Computer Program,(LSMLMW of Harvey ,1990),The model used included month and year of calving as fixed effects and sires as random effect . Estimates of sire (σ^2s) and residual (σ^2e) components of variance and co variance were computed according to Henderson (1953). Heritability and genetic and phenotypic correlations were estimated according to formula of Harvey (1990).

The relative economic values for all traits studied were derived by two methods:

(1) Actual relative economic values (Actual REV,(1)), which was based on the net profit from one unit of each trait, according to estimates of animal husbandry section, Sakha station and the prices of some commercial farms in Northern Delta, which were calculated as:(i)cost of production of one kg milk at the farm was estimated as £E 1.48 and selling price as £E 2.00, giving a net profit per kg of milk of £E 0.52, (ii)cost of production of one kg fat

was £E 8.7 and selling price as £E 15.00 ,giving a net profit per kg fat of £E 6.30,(iii)net profit per kg of protein of £E 3.15(half of one kg fat),(iv)net profit for the maintenance of the animal per day of calving interval of £E 3.12;and (v)cost of raising the animal per month from birth till AFC as £E 106.75.

(2) Relative weights (REV (2)), calculated as $1/\sigma_p$, where σp is phenotypic standard deviation of each trait(Sharma(1982),Sharma and Basu(1986), Falconer(1989) and Cameron(1997)).

A prorate sign was attached to these values, positive to MY, FY, and PY and negative for CI and AFC. Finally, setting the economic value of MY as unity the REVs of other traits were calculated as shown in table 1.

Table1: The relative economic values of various traits studied by the two methods studied

Trait	Net profit	Actual REV(1)	$1/\sigma_p$	Relative weights REV (2)
305day milk yield,kg	0.52	1.00	1/754.09	1.00
305day fat yield, kg	6.30	12.12	1/36:02	20.94
305day protein yield, kg	3.15	6.06	1/24.47	30.82
Calving interval, day	3.12	-6.00	1/84.11	-9.65
Age at first calving, month	106.75	-205.29	1/4.21	-179.12

σ_p as phenotypic standard deviation

The index value was calculated as :

$I = b_1p_1 + b_2p_2 + \ldots\ldots + b_np_n = \sum b_ip_i$

Where :

b_i= partial regression coefficient of the index on p_i ,and

p_i= phenotypic value of the ith trait

The phenotypic and genotypic variance and covariance matrices were utilized along with the REV to estimate b_i values and various selection indices were constructed according to Matlab 6.5 program .

In matrix notation this is as follow:

$\underline{P}\ \underline{b} = \underline{G}\ \underline{a}$ or $\underline{b} = \underline{P}^{-1}\ \underline{G}\ \underline{a}$

Where:

$\underline{P}$= phenotypic variance – covariance matrix;

$\underline{G}$= genotypic variance – covariance matrix;

$\underline{b}$ = vector of partial regression coefficients to be used in the index ;

$\underline{a}$ = vector of relative economic values;and

$\underline{P}^{-1}$= inverse of phenotypic variances – covariance matrix.

Values of partial regression coefficients and phenotypic variance – covariance matrix ($\underline{p}$) were used to calculate the index variance as $\sigma^2_I = \underline{b}'\ \underline{P}\ \underline{b} = \underline{b}'\ \underline{G}\ \underline{a}$, where $\underline{b}'$ is the transpose of ($\underline{b}$) vector of partial regression coefficients. Variance of the total aggregate genotypic value was estimated as $\sigma^2_H = \underline{a}'\ \underline{G}\ \underline{a}$, where σ^2_H is the aggregate genotypic variance, and $\underline{a}'$ is the transpose of economic value column vector.

Accuracy of the index (defined as correlation between the aggregate genotypic value($_H$) and the index value($_I$)),was calculated as $R_{IH} = \sigma_I / \sigma_H = \sigma_{IH} / (\sigma_I * \sigma_H)$,since $\sigma_{IH} = \sigma^2_I$.

The expected genetic change (EG) in any trait was calculated according to Tabler and Touchberry(1955), $EG = \sigma_I * i * B_{YI}$,where i is the selection intensity for a trait which assume to be 1.00 only for the purpose of comparisons and B_{YI} is the regression of each trait in the index on the index value and calculated as $B_{YI} = \underline{b}' G / \underline{b}' P \underline{b}$ and Cunningham *et al .,* (1970).

To determine which trait and how many traits combine best in an index, relative efficiencies (RE) of various selection indices constructed were ranked on the basis of their R_{IH} values, and the efficiency (RE) of different indices relative to the original index which included all the five traits studied.

Spearman's rank correlation coefficient was estimated between the ranking of the 598 Friesian on the bases of the full index by the two methods of selection indices.

RESULTS AND DISCUSSION

Means, standard deviations (S.D) and coefficients of variation (CV %) of first lactation economic traits ,305day milk yield(MY), 305day fat yield, 305day protein yield(PY), calving interval(CI)and age at first calving(AFC) of Friesian cows in Egypt are presented in Table 2.

Table 2: Means, standard deviation (S.D) and coefficients of variation (CV %) of various traits studied

Trait	Mean	S.D	CV%
MY (kg)	2589	807.8	31.2
FY (kg)	100	36.5	36.6
PY (kg)	77	27.6	35.8
CI (days)	427	84.3	19.8
AFC (months)	33	4.3	13.2
Total number of records was 598			

The estimates of genotypic and phenotypic variances and co variances of and among various traits studied which were used for obtaining the genetic and phenotypic parameters as well as for construction of selection indices are shown in Table3.

Genetic parameters

Heritability(h^2) estimates of MY,FY , PY , CI and AFC *were 0.31, 0.12 , 0.17 , 0.19 and 0.44 ,respectively(Table 4). The h^2estimate of MY (0.31) was in consonance with that of Suzuki and Van vleck (1994)(0.30), Albuquerque et al.,(1995)(0.30)and El-Arian et al.,(2003)(0.32)* on the same breed.

The h^2 estimate of PY *(0.12) was lower than that of Cue et al.,(1987)(0.25),de Jager and Kennedy (1987)(0.20)and Ashmawy and Khalil 1990)(0.23).*

Table 3: Estimates of genotypic and phenotypic variances (on diagonal), and co variances(below diagonal)for various traits studied

Trait	305day milk yield (MY)	305day fat yield (FY)	305day protein yield (PY)	Calving interval (CI)	Age at first calving (AFC)
MY	(177463.12) 568650.24				
FY	(4840.24) 16353.44	(150.03) 1297.36			
PY	(4079.00) 12746.81	(142.23) 960.21	(129.60) 754.81		
CI	(3309.56) 12107.06	(192.32) 533.98	(108.76) 389.39	(1144.72) 6101.18	
AFC	(103.76) 468.90	(-5.91) 10.69	(-6.62) 7.67	(54.56) 4.94	(7.76) 17.74

Figures in parentheses indicate genotypic variances and co variances

The h^2 estimate of CI(0.19) was higher than those reported for CI by Dong and Van Vleck (1988)(0.15), El-Awady (1998)(0.09) and Khattab and Atil (1999)(0.05) and also that of AFC (0.44) was higher than that of Khattab and Sultan (1991)(0.38)for AFC , in Friesian cattle.

Table (4): Estimates of heritability ± SE (on diagonal), Genetic ± SE (below diagonal) and phenotypic correlation (above diagonal) between various traits studied

Trait	MY	FY	PY	CI	AFC
MY	0.31± 0.12	0.60	0.62	0.21	0.15
FY	0.94 ± 0.19	0.12 ± 0.09	0.97	0.19	0.07
PY	0.85 ± 0.16	1.00 ± 0.03	0.17 ± 0.10	0.18	0.07
CI	0.23 ± 0.35	0.46± 0.44	0.28 ± 0.411	0.19 ± 0.10	0.02
AFC	0.09 ± 0.30	- 0.17 ± 0.40	- 0.21 ± 0.35	0.58 ± 0.31	0.44 ± 0.14

Genetic correlations (r_g) between yield traits MY, FY and PY were positive, high and significant ($p< 0.01$). These estimates of genetic correlations indicate that these traits were likely to controlled mainly by the same number of genes, so that these traits could be improved simultaneously through selective breeding.

The corresponding estimates of phenotypic correlations (r_p) were 0.60; 0.62 and 0.97, respectively (Table 4). All these estimates were in desirable direction and in close agreement with the corresponding literature averages reported by Van Vleck and Dong (1988),Campos *et al.,(1994),* Dematawewa *et al.*,(1998)and El-Awady *etal.*,(2002) on the same breed. Estimates of r_g and r_p between calving interval and milk traits, CI ,MY ; CI ,FY and CI ,PY were positive ,small and nonsignificant (Table 4).

The corresponding estimates between AFC and milk traits, AFC, MY; AFC, FY and AFC, PY were very small and nonsignificant.

Selection indices

Tables 5 and 6 show the ranking of the selection indices ($I^{'s}$) on the basis of their accuracy (R_{IH}).b's partial regression coefficients , relative efficiency (RE) and the expected genetic change (EG) per generation of various traits studied by the two methods of relative economic value studied.

Comparisons between all the twenty-six indices constructed (by each of the two methods) showed that the selection index I_{1A} and I_{1S} which incorporated 305day milk yield (MY),305day protein yield (PY),calving interval (CI) and age at first calving (AFC)was the best index (RE=101.5 and 101.8, respectively), followed by the index I_{2A} and I_{2S} (RE=100.0 and100.2, respectively), combining MY ,FY ,CI and AFC.

These indices would be recommended, if the selection applied was based on any combination of these four traits in the end of the first lactation.

The suggested indices in this would be:

I_{1A} = 0.44* MY+5.08*PY-3.02*CI-121.61*AFC

or

I_{1s} = 0.65*MY=9.92*PY-3.28*CI-139.99*AFC.

The expected genetic change in one generation through index I_{1A} or I_{1S} will be , MY increase of 119.17or148.18kg,FY increase of 4.69 or 5.42kg ,PY increase of 4.59 or 5.16kg,CI decrease of 12.76 or 10.59 days and AFC decrease of 1.73 or 1.55 month, respectively (tables 5 and 6), followed by the index:

I_{2A} = 0.50*MY+1.78*FY-2.98*CI-122.17AFC

or

I_{2S} = 0.75*MY*1.92*FY-3.21*CI-140.79*AFC

The expected genetic change in one generation through this index, MY increase of 119.02 or 148.93 kg, FY increase of 4.51 or 5.25 kg, PY increase of 4.42 or 4.97 kg, CI decrease of 12.87 or 10.78 days and AFC decrease of 1.70 or 1.52 month, respectively (Tables 5 and 6).

The full or original index which included all the five traits I_{3A} or I_{3S} was ranked third (RE=100) by the both methods, this index was:

I_{3A} = 0.54*MY+0.25*FY+0.14*PY-2.93*CI-122.36*AFC

or

I_{3S} = 0.79*MY+0.34*FY+0.14*PY-3.16*CI-141.41*AFC

The expected genetic change in one generation through this index, MY increase of 119.96or 149.70kg, FY increase of 4.52 or 5.25 kg, PY increase of 4.38 or 4.94kg, CI decrease of 13.07 or 10.93 days and AFC decrease of 1.69 or 1.51month, respectively.

The results showed negligible increase in the relative efficiencies (RE) values of the selection indices in the both methods when FY or PY was dropped from the original index.

While, the dropped of MY only from the original one, resulted in a decline in the (RE) value of the index (79.4 and 70.3, respectively) and its ranking became I_{13A} and I_{13S}, respectively .

Table (5) Ranking of the selection indices (I's A) on the basis of their accuracy (R $_{IH}$),b's partial regression coefficients , relative efficiency (RE) and the expected genetic change (EG) per generation of various traits studied by using the first method of relative economic value(actual REV(1)).

Ranking Of selection Indices (I's A) (1)	Traits										R $_{III}$	RE
	MY (kg) x1		FY (kg) X2		PY (kg) X3		CI (days) X4		AFC (months) X5			
	b	E.G	b	E.G	b	E.G	b	E.G	b	E.G		
I1A	0.44	119.17	-	4.69	5.08	4.59	-3.02	-12.76	-121.61	-1.73	0.700	101.5
I2A	0.50	119.02	1.78	4.51	-	4.42	-2.98	-12.87	-122.17	-1.70	0.692	100.0
I3A	0.54	119.96	0.25	4.52	0.14	4.38	-2.93	-13.07	-122.36	-1.69	0.690	100.0
I4A	0.55	120.15	-	4.51	-	4.37	-2.92	-13.12	-122.42	-1.68	0.690	100.0
I5A	0.40	125.31	-	5.43	4.32	4.98	-	-8.17	-120.87	-1.56	0.652	94.5
I6A	0.48	126.06	0.22	5.27	0.09	4.79	-	8.55-	-121.52	-1.53	0.645	93.5
I7A	0.45	125.51	1.12	5.27	-	4.81	-	8.38-	-121.38	-1.54	0.645	93.5
I8A	0.49	126.21	-	5.26	-	4.77	-	-8.60	-121.56	-1.53	0.644	93.3
I9A	-	50.26	-	3.26	12.16	3.51	-2.61	-13.50	-113.24	-1.90	0.641	92.9
I10A	-	32.09	7.81	2.44	-	2.86	-2.52	-13.61	-112.71	-1.91	0.610	88.4
I11A	-	59.32	-	4.05	10.82	3.95	-	-9.18	-113.38	-1.74	0.602	87.2
I12A	-	40.65	6.77	3.25	-	3.30	-	9.36-	-112.78	-1.77	0.572	82.9
I13A	-	20.17	0.86	1.05	0.91	1.50	-1.97	-16.00	-109.06	-1.94	0.548	79.4
I14A	-	36.09	-	0.59	-	1.08	-1.84	-16.69	-108.19	-1.96	0.529	76.7
I15A	-	9.07	0.78	1.86	0.81	1.99	-	-12.15	-109.52	-1.82	0.521	75.5
I16A	0.32	184.05	-	4.71	5.79	4.52	-2.93	-4.36	-	-0.43	0.423	61.3
I17A	0.39	188.69	2.17	4.45	-	4.26	-2.88	-4.38	-	-0.35	0.405	58.7
I18A	0.43	192.10	0.28	4.47	0.17	4.20	-2.83	-4.75	-	-0.31	0.401	58.1
I19A	0.45	192.95	-	4.47	-	4.18	-2.81	-4.82	-	-0.30	0.399	57.8
I20A	-	108.61	-	3.18	11.02	3.42	-2.63	-5.44	-	-0.65	0.368	53.3
I21A	0.27	221.94	-	6.56	5.05	5.68	-	4.67	-	-0.02	0.343	49.7
I22A	0.34	231.35	1.52	6.40	-	5.48	-	4.84	-	0.09	0.325	47.1
I23A	0.38	234.34	0.25	6.42	0.11	5.43	-	4.47	-	0.13	0.322	46.7
I24A	-	87.12	6.88	1.91	-	2.46	-2.53	-5.50	-	-0.62	0.316	45.8
I25A	-	1.33	0.78	0.86	0.80	0.04	-2.05	-11.13	-	-0.64	0.209	30.3
I26A	-	61.21	0.71	2.00	0.69	1.86	-	2.07	-	-0.09	0.113	16.4

Table (6): Ranking of the selection indices (I's S)on the basis of their accuracy (R $_{III}$),partial regression coefficients (b's), relative efficiency (RE) and the expected genetic change (EG) per generation of various traits studied by using the second method of relative weights (REV(2))

Ranking Of selection Indices (I's S) (2)	Traits										R III	RE
	MY ((kg) X1		FY (kg) X2		PY (kg) x3		CI (days) x4		AFC (month) x5			
	b	E.G	b	E.G	b	E.G	b	E.G	b	E.G		
I1s	0.65	148.18	-	5.42	9.92	5.16	-3.28	-10.59	-139.99	-1.55	0.672	101.8
I 2s	0.75	148.93	1.92	5.25	-	4.97	-3.21	-10.78	-140.79	-1.52	0.661	100.2
I3s	0.79	149.70	0.34	5.25	0.14	4.94	-3.16	-10.93	141.01-	-1.51	0.660	100.0
I 4s	0.81	149.91	-	5.25	-	4.93	-3.16	-10.97	-141.09	-1.50	0.660	100.0
I 5s	0.61	153.82	-	6.04	6.09	5.47	-	-6.50	-139.17	-1.39	0.638	96.7
I 6s	0.70	154.82	1.20	5.88	-	5.29	-	-6.77	-139.98	-1.39	0.629	95.3
I 7s	0.73	155.25	0.31	5.88	0.09	5.27	-	6.90-	-140.11	-1.35	0.629	95.3
I 8s	0.74	155.42	-	5.87	-	5.26	-	6.95-	-140.17	-1.35	0.628	95.2
I 9s	-	70.01	-	3.87	17.50	4.01	-2.67	-11.52	-127.48	-1.77	0.590	89.4
I 10s	-	77.97	-	4.52	16.12	4.36	-	-7.74	-127.63	-1.63	0.565	85.6
I 11s	-	48.78	10.99	2.94	-	3.27	-2.52	-11.79	-126.59	-1.82	0.546	82.7
I 12s	-	56.42	9.96	3.61	-	3.63	-	-8.04	-126.66	-1.68	0.521	79.9
I 13s	-	13.10	1.23	1.35	1.27	1.72	-1.75	-14.92	-179.12	-1.90	0.464	70.3
I 14s	0.52	205.27	-	5.44	7.73	5.03	-3.18	-1.98	-	-0.31	0.461	69.8
I 15s	-	4.03	1.17	1.98	1.18	2.10	-	-11.74	-121.88	-1.79	0.450	68.2
I 16s	0.62	210.94	2.37	5.24	-	4.80	-3.97	-1.97	-	-0.23	0.443	67.1
I 17s	0.67	213.16	0.38	5.25	0.18	4.74	-3.04	-2.21	-	-0.19	0.440	66.7
I 18s	0.69	213.84	-	5.24	-	4.73	-3.02	-2.27	-	-0.18	0.439	66.5
I 19s	-	33.77	-	0.78	-	1.20	-1.56	-15.97	-120.23	-1.95	0.438	66.4
I 20s	0.47	225.57	-	6.59	6.93	5.69	-	-4.67	-	0.01	0.413	62.6
I 21s	0.57	233.17	1.68	6.42	-	5.50	-	4.71	-	0.11	0.396	60.0
I 22s	0.61	234.70	0.35	6.42	0.12	5.43	-	4.46	-	0.13	0.394	59.7
I 23s	-	125.24	-	3.91	16.21	3.96	-2.70	-2.89	-	-0.56	0.383	58.0
I 24s	-	106.11	9.96	2.68	-	3.04	-2.53	-2.62	-	-0.52	0.315	47.7
I 25s	-	19.79	1.15	0.08	1.15	0.53	-1.83	-8.29	-	-0.54	0.177	26.8
I 26s	-	61.22	1.09	2.00	1.06	1.87	-	2.07	-	-0.09	0.131	19.8

A noticeable decline in (RE) value occurred when AFC was dropped from the complete index and the ranking of this index was decrease to be I_{17A} and I_{18S} (RE=58.7 and 66.5, respectively).

Further more, the decrease in the relative efficiency (RE) was very high when CI and AFC were dropped together from the best indices I_{1A} and I_{1S} or from the original one (I_{3A} and I_{3S}), since the ranking of these indices were declined to later orders.

The dairymen are interested in any decrease in the CI and AFC, because this will increase directly the income from milk and sale of calves, as well as the decrease in the cost of calve rearing; the selection of cows and evaluation of the sires will be earlier and the annual genetic gain will increase due to the reduction in generation interval. However, both traits being considerably influenced by better feeding and managerial practices.

When only three traits were combined, five selection indices were constructed by each method among them the index I_{4A} and I_{4S} which incorporate MY, CI and AFC was the top ranking (RE=100.0 and 100.0,respectivly), followed by the index I_{5A} and I_{5S} (RE=94.5 and 96.7, respectively), including MY, PY and AFC, followed by the index I_{6A} and I_{6S} in cooperating MY, FY and AFC ,the use of any one of them will be determined according to the type of the data available and the amount of the genetic gain expected .

A noticeable decrease in (RE) value was occurred when AFC as a trait was dropped from any of these indices and their ranking were declined to be I_{19A} and I_{18S}; I_{21A} and I_{20S} and I_{22A} and I_{21S}, respectively.

This result indicated the importance of the AFC, thus, every effort should be made to include the AFC in the selection indices and to reduce the AFC to an optimum age since considerable amount of expenditure is incurred in raising calves to maturity.

The suggested indices in this case would be:

I_{4A} = 0.55*MY -2.92*CI-122.42*AFC

Or

I_{4S} = 0.81*MY-3.16*CI-141.09*AFC

The expected genetic change in one generation through this index MY increase of 120.15 or 149.91 kg, FY increase of 4.51 or 5.25 kg , PY increase of 4.37 or 10.97days and AFC decrease of 1.68 or 1.50month, respectively.

Ten selection indices were constructed by each of the two methods when traits were included in the index at a time. the best one them was the index I_{8A} or I_{8S} (RE 93.3 or 95.2, respectively), comprising MY and AFC, followed by I_{11A} or I_{10A} and I_{12A} or I_{12S}, all these indices include AFC with one of the milk trait (PY and AFC and FY with AFC, respectively). This result showed also the important of the AFC as a trait in any selection index, thus, its inclusion in any selection index is recommended.

The lowest index by the two methods was I_{26A} or I_{26S}, which include FY and PY. The inclusion of AFC in this index resulted in considerable improvement in the relative efficiency (RE) of this index (59.1 and 48.4, respectively).

The maximum genetic improvement expected (234.34 and 234.70kg / generation, respectively) in the 305 day milk yield (MY), was realized when the selection indices I_{23A} or I_{22S} were used.

Further more, from the economic point of view; the maximum return can be achieved by using the original index I_{3A} or I_{3S} since , the expected genetic gain (multiplied by the net profit/ unit) in one generation will be MY increase of 119.96 and 149.70kg, FY increase of 4.52 and 5.25kg, PY increase of 4.38 and 4.94kg,CI decrease of 13.07 and 10.93 days and AFC decrease of 1.69and 1.51month ,respectively(tables 5 and 6).

The rank correlation coefficient estimated between the 598 Friesian cows used in this study on the bases of the original index (full index) by the both methods of relative economic values was 0.95, which indicate that the order of ranking by the two method was in the same direction .Thus, it become clear from the above result that the use of second method of relative economic values REV (2), based phenotypic standard deviation of each trait for construction of selection indices may be used, to overcome the difficulties in obtaining the actual economic values..

Similar results about the second method of economic value were presented by Hussein (2004), using data on all parities in combinations of three traits only through MTDFREML, procedure of Boldman *et al.*,(1995).

Conclusions

The following conclusions can be drawn from the results of this study:

1. The selection index I_{1A} and I_{1S} which incorporated 305 days milk yield (MY),305 days protein yield (PY),calving interval (CI) and age at first calving (AFC)was recommended for Friesian cows, if the selection was exercised at the end of the first lactation.
2. Inclusion of age at first calving (AFC) in any selection index was recommended.

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REFERENCES

Albuquerque, L.G.; G. Dimov; J.F. Keown and L.D. Van Vleck(1995). Estimates using an animal Model of (co)variance for yields of milk, fat and protein for the first lactation of Holstein cows in California & New York. J. Dairy Sci., 78:1591.

Ashmawy, A.A. and M.H. Khalil(1990).Single and Multi trait selection for lactation in Holstein Friesian cows. Egypt. J. Anim. Prod., 27: 171.

Boldman, K.G.; L. D. Van Vleck and S.D. Kachman(1995).A manual for use Of MTDFREML of animal model. USDA-ARS.Clay center,NE,USA.

Cameron, N. D. (1997). Selection indices and predicted of genetic merit in animal breeding. Roslin Institute, Edinburgh,U.K.,CAB International, p.91.

Campos, M. S.; C. J. Wilco; C. M. Becerril and A. Diz(1994). Genetic parameters for yield and reproductive traits of Holstein and Jersey cattle in Florida. J. Dairy Sci., 77:867.

Cue, R. I.; H. G, Monardes and J. F. Hayes(1987). Correlation between production traits in first lactation Holstein cows. J. Dairy Sci., 70:2132.

Cunningham, E.P.; R.A. Moen and T. Gjedrem (1970). Restriction of selection indexes . Biometrics 26:67

Dematawewa, C. M. B.;P. J. Berger and B. E. Melton(1998). Optimization of sire selection based on maximization of guranted income and risk associated with sire merit. J. Dairy Sci., 81:807.

de Jager, D. and B. W. Kennedy (1987). Genetic parameters of milk yield and composition and their relationship with alternative breeding goals. J. Dairy Sci., 70:1258.

Dong, M. C. and L. D. Van Vleck (1988). Estimation of genetic (co)variance for production , survival , reproduction. (Dairy sci. abst., 50:2)

El-Awady, H. G. (1998). Genetic analysis of reproductive and productive performance of Friesian herd.Ph. D. Thesis, Fac. Agric. Tanta Univ., Egypt.

El-Awady, H. G.; M. N. El-Arian and A. S. Khattab(2002). Genetic improvement for milk traits of German Holstein through selection indices. J. Agri. Sci. Mansoura Univ. 27:8250.

El-Arian, M. N.; H. G. El-Awady and A. S. Khattab(2003). Genetic analysis for some productive traits of Holstein Friesian cows in Egypt through MTDFREML Program. Egyp. J. Anim. Sci., 40:99.

Falconer, D. S. (1989). Introduction to Quantitative Genetics 3rd editon, Longman Group(PE)LTD printed in Hong Kong,p294.

Harvey, W. R. (1990). User's Guide for LSMLMW, Mixed Model Least Squares and Likelihood Computer Program PC-2 version. Ohio State, University, Columus(Mimeograph).USA.

Hazel, L. N. (1943). The genetic basis constructing selection indices. Genetics, 28:476.

Henderson, C. R. (1953). Estimates of variance and covariance components. Biometrics, 9:228.

Hussein,A.M.,(2004). Genetic and phenotypic studies for Friesian cows in Egypt. Ph. D. Thesis , Fac. Agric. Mansoura, Univ., Mansoura, Egypt,p.66.

Khattab,A. S. and H. Atil (1999). Genetic study of fertility and productive in local Friesian cattle in Turkey. The International Congress of Animal Husbandry,'99' Izmir, Turkey.

Khattab,A. S. and Z. A. Sultan (1991). A comparison of different Selection indices for genetic improvement of some dairy traits in Friesian cattle in Egypt. J. Anim. Breed. Genet., 108:349.

Sharma, A. (1982). Breeding and selection methods for maximizing profit function in Buffaloes. Ph. D. Thesis, Kurukshetra Univ., Kurukshetra, India,p.114.

Sharma, A. and S. B. Basu (1986).Incorporation of profit variables for the maximization of genetic gain. Indian J. Dairy Sci.,39:35.

Smith, C. (1983).Effect of change in economic weights on the efficiency of Index selection. Anim. Sci.,56:1057.

Suzuki, M. and L. D. Van Vleck (1994). Heritability and repeatability for milk production traits of Japanese Holstein from an Animal Model. J. Dairy Sci., 77:583.

Tabler, K. A. and R. W. Touchberry (1955). Selection indexes based on milk and fat yield , fat percentage and type classification. J, Dairy Sci., 38:1155.

Van Vleck, L. D. and M. C. Dong (1988). Genetic (co)variances for milk ,fat and protein yield in Holsteins using an Animal Model. J.Dairy Sci., 71:3040.

Weller, J. I. (1994).Economic aspects of Animal Breeding.1st edition printed in Great Britain by TJ press (Padstow) Ltd, Padstow, Cornwall.Published by Chapman and Hall, pp.150.

ادلة إنتخابية لأبقار الفريزيان باستخدام طريقتين لتقدير الأهمية النسبية لبعض الصفات الإنتاجية والتناسلية الهامة

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استخدمت في هذا البحث بيانات ناتج لبن الموسم الأول لعدد ٥٩٨ بقرة فريزيان بنات ٣٠ طلوقةو ٥٣٥أم.

تم تحليل هذه البيانات باستخدام طريقة معظمة الناتج Maximum Likelihood procedureبالنموذج المشتمل على شهر وسنة الولادة كتأثيرات ثابتة والطلائق كتأثيرات عشوائية .

قدرت التباينات والتغايرات الوراثية والمظهرية لصفات ناتج لبن ٣٠٥ يوم وناتج دهن ٣٠٥ يوم وناتج بروتين ٣٠٥ يوم والفترة بين الولادتين و العمر عند أول ولادة وكذلك تقديرات الأهمية النسبية لهذه الصفات بطريقتين استخدما في تكوين الأدلة الانتخابية. كانت قيم تقديرات المكافئات الوراثية للصفات السابقة هي ٣١و٠ ، ١٢و٠ ، ١٧و٠ ، ١٩و٠ ، ٤٤و٠ على التوالى. كانت الارتباطات الوراثية بين صفات ناتج اللبن موجبة وعالية المعنوية وتراوحت قيمها بين ٨٥و٠ إلى ٠٠و١ وتراوحت قيم الارتباطات المظهرية لنفس الصفات بين ٦٠و٠ إلى ٩٧و٠

تم تكوين ٢٦ دليل انتخاب بكل طريقة من طريقتى التقدير للأهمية النسبية الإقتصادية . وكان دليل الإنتخا ب I_{1A}, I_{1S} الذى يشتمل على ناتج لبن ٣٠٥ يوم وناتج بروتين ٣٠٥ يوم والفترة بين الولادتين والعمر عند أول ولادة هو أفضل هذة الأدلة ، لذا ينصح بإستخدام هذا الدليل إذا ما أجرى الإنتخاب لأبقار الفريزيان فى نهاية لموسم الحليب الأول .

قدر معمل إرتباط الرتب بين ترتيب ال٥٩٨ بقرة فريزيان بطريقتى الأهمية النسبية الإقتصادية فكانت قيمته ٠,٩٥ ولذا فانه يمكن التوصية بإستخدام الطريقة الثانية لتقدير الأهمية النسبية للصفات فى تكوين الأدلة الإنتخابية لسهولة حسابها .