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EFFECTIVENESS AND COMPARISON OF THREE METHODS OF COW EVALUATION TO IMPROVE MILK TRAITS OF FLECKVIEH CATTLE

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SUMMARY

Cow transmitting abilities (CTA) were estimated by three different methods for 6018 Fleckvieh cows. A total of 16042 lactation records extracted from 53040 records were used for this evaluation. All cows whose had at least two records up to five were used. Records of 305-day lactation involving yields of milk (MY), fat (FY), protein (PY), fat-plus-protein (FPY) and carrier (CY) were used. The evaluation methods included best linear unbiased prediction (BLUP), selection index for MY (SI1), selection index for CY (SI2) and most probable producing ability (MPPA). Criteria for judging the merits of different methods of cow evaluation involved the Product-moment correlation (r_{PM}), Spearman rank correlation (r_S) and Kendall rank correlation (r_K). To assess the accuracy of different methods of cow evaluation, the standard error (SE) of each method was calculated along with the percentage of reduction in standard error (RSE) due to using one method instead of another. The last criterion for judging the difference between methods is the sum of square of difference between methods (SSD).

For all milk traits, the largest differences in estimates of CTA were recorded by MPPA and the lowest differences by the selection index (SI). The differences in estimates of CTA using SI1 (for milk) and SI2 (for

carrier) were nearly the same. Therefore, both indices have the same trend in the evaluation of cows. The dif ferences in estimates of CTA for BLUP were much larger than those for SI. Among all methods of cow evaluation, BLUP recorded the lowest percentages of cows with negative estimates of CTA followed by SI and MPPA for all milk traits. The estimates recorded by BLUP, SI1 and/or SI2 and MPPA respectively were 52.0, 52.7 and 53.5% for MY; 50.9, 52.0, 50.3 and 52.0% for FY; 47.8, 48.8, 48.6 and 49.4% for PY; 51.5, 51.7, 51.7 and 52.2% for FPY and 51.1, 52.5 and 53.3% for CY. In judging the merit of cow evaluation methods, estimates of r_{PM} between the two types of SI were near to unity, while r_{PM} between SI and MPPA were greatly lower (0.50-0.627). Estimates of rPM between BLUP and SI (0.664-0.720) were less than estimates between BLUP and MPPA (0.588 to 0.813). With regard to accuracy of each method, BLUP across all milk traits had the lowest estimates of SE followed by SI and MPPA in a descending order. For all traits, percentages of RSE from using BLUP instead of MPPA were also large and ranged from 57.7 to 65.1%, while they ranged from 38.9 to 55.8% from using BLUP instead of any one of the two types of SI. Estimates of SSD between BLUP and both types of SI were smaller than those between BLUP and MPPA, i.e. accuracy of SI was nearer to BLUP than MPPA.

Keywords: Fleckvieh, methods of evaluation, milk traits

INTRODUCTION

For making genetic progress in dairy cattle for any breeding objective, identifying of elite cows and superior sires to be propagated (through their use in artificial insemination, AI) is essential. Developments in sire and cow evaluation in the last two decades were reviewed briefly by Freeman (1988). Comparison of different methods of cow evaluation in real life data is always a troublesome task. Criteria to define the best method are not uniform from one research report to another (Hargrove et al., 1974). In practice, the most important features of the methods used for cow evaluation are the reliability in ranking of evaluated cows. If the ranking appeared to be the same, it might be concluded that the differences between the methods

were small enough to be neglected.

The objectives of present study were: (1) to evaluate the genetic merit of Fleckvieh cows for the same milk traits of all available lactations using different methods of cow evaluation, (2) to quantify the differences between these methods, and (3) to detect which method is the best under our data set structure. Special emphasis of cow evaluation was paid for data collected for short periods (i.e. less than five years).

MATERIALS AND METHODS

Data

Data on performance of 305-day lactation of Fleckvieh cattle were obtained from Official Test Federation of Austrian Cattle Breeders (ZAR) in lower Austria. Detailed descriptions of these data have been presented by Hartmann et al. (1992). Records were begun between 1977 and 1982. Lactation records involving yields of milk (MY), fat (FY), protein (PY), fat-plus-protein (FPY) and carrier (CY) were used. All normal records of less than 305 day milk along with those reaching 305 days were included.

Methods and Models

Cow transmitting abilities (CTA) were estimated for 6018 cows who had at least two records and up to five. A total of 16042 lactation records extracted from 53040 records were used for such cow evaluation. Estimates of heritability of all lactations and variance components given by Afifi et al., (1994) were used. In the present study, three methods of cow evaluation described below were used.

Most Probable Producing Ability (MPPA)

Records of cow across lactations were used for estimating MPPA. The method of MPPA can be computed under the assumptions: (1) lactations have multivariate normal distribution, (2) variances among lactations within cows are equal, and (3) no correlation exists between cow effects within sires. Data were analysed using the following mixed model:

$$Y_{ijklmn} = \mu + S_i + C_{ij} + YS_k + A_l + D_m + e_{ijklmn} \quad \ldots\ (1)$$

where Y_{ijklmn}= 2X-305 milk record expressed as a deviation from herd average, μ= the overall mean, S_i= the random

effect of ith sire, C_{ij}= the random effect of jth cow nested within the random effect of ith sire, YS_k= the fixed effect of kth year-season combination (k=16), A_l= the fixed effect of lth age at calving (in terms of three-month intervals starting from <24 month, till 77 month), Dm= the fixed effect of mth days open (subclasses starting from <45 days as a first subclass and an interval of 30 days thereafter) and e_{ijklmn}= the random error (0, σ^2_e). Using different sets of correction factors of age at calving and days open derived from polynomial regression coefficients, records of all lactations of the cow were adjusted for these non-genetic effects. Herd and year-season adjusted records were used for estimating the MPPA for each trait. Then the following equation (Carter et al., 1963) was used:

$$MPPA = [nt/(1+(n-1)t)] (\mu_c - \mu_p) \quad \ldots\ldots\ldots (2)$$

where n= the number of cow records, t= repeatability estimate, μ_c= the average performance of cow records, and μ_p= the population average.

Selection Index (SI)

Herd-adjusted data of the first lactation were analyzed to derive the estimates of genetic and phenotypic variance-covariance matrices whose elements were needed to construct the selection index. The following model was used:

$$Y_{ijkl} = \mu + S_i + Y_j + SE_k + (YSE)_{jk} + bl_L(X1_{ijkl}-X1_\mu) + bl_Q(X1_{ijkl}-X1_\mu)^2 + b2_L(X2_{ijkl}-X2_\mu) + b2_Q(X2_{ijkl}-X2_\mu)^2 + e_{ijkl} \quad \ldots\ldots (3)$$

where Y_j= the fixed effect of the jth year of calving, SE_k= the fixed effect of the kth season of calving, $(YSE)_{jk}$= the effect of the interaction between year and season, bl_L & bl_Q= the partial linear and quadratic regression coefficients of yield trait on age at calving, $X1_{ijkl}$= the age of cow at calving in months for the corresponding Y_{ijkl} record, $X1_\mu$= the mean of age at calving, $b2_L$ & $b2_Q$= the partial linear and quadratic regression coefficients of yield trait on period of days open, $X2_{ijkl}$= the length of days open for the corresponding Y_{ijkl}, $X2_\mu$= the mean of days open, and the remaining symbols were described in the previous model (1). Traits considered for constructing a cow genetic index were 305-day yields of milk (MY) or carrier (CY),

fat (FY), protein (PY) and fat-plus-protein as a composite trait (FPY). Theory and procedures for construction of the selection index were described by Cunningham and Mahon (1977). A series of indices (SI's) were constructed to maximize the gain in a specific trait and not the aggregate genotype. Indices to improve MY are called SI1, while indices to improve CY are called SI2. Each index was used to select for just one trait (as a criterion of selection). The partial regression coefficients for indices (b's) were computed as $b=P^{-1}G$ where P^{-1} = the inverse of phenotypic variance-covariance matrix, and G= genotypic covariance matrix.

Best Linear Unbiased Predictor (BLUP) procedure

Data of all lactations were used for estimating BLUP. One set of crossclassified non-interacting random effect (cow) is absorbed (Harvey, 1990). In this procedure, BLUP estimates for random cow effects absorbed by maximum likelihood were obtained. The following model (in matrix notation) was used:

$$y = X\beta + Tc + e \quad \ldots\ldots\ldots \quad (4)$$

where ß= a column vector of the fixed effects (sires, year-season, age at calving and days open), T is n x p matrix, c is the vector of size p representing the unknown cow random effect, and all other symbols were previously described. A matrix with dimension of 62 x 62 was used. Representing this model by matrix notation could be as follows:

$$\begin{bmatrix} X'X & X'T \\ T'X & T'T+IK \end{bmatrix} \begin{bmatrix} \beta \\ c \end{bmatrix} = \begin{bmatrix} X'y \\ T'y \end{bmatrix} \quad \ldots (5)$$

where $k = \sigma^2_e/\sigma^2_c$ and solution to c is called BLUP of c.

Evaluation and accuracy of methods

The correlations between the three methods of cow evaluation are used as the first criterion for judging the merits of these methods. The product-moment correlation (r_{PM}) is a measure to calculate the correlation among estimates of cow merit.

Spearman's rank-order correlation coefficient (r_S) is a parametric measure to calculate the correlation among ranks of the cow. For the Spearman rank correlation, the data are first ranked. The Spearman correlation was then computed among ranks (SAS Procedure Guide, 1988).

Kendall's correlation (r_k) is a measure calculated from concordances and discordances (SAS Procedure Guide, 1988). Concordance is measured by determining whether values of paired observation (e.g. BLUP, SI and MPPA) vary together (in concord) or differently (in discord).

The criteria for judging the merits of different methods of cow evaluation are the correlations between these methods such as Product-moment correlation, Spearman-rank correlation and Kendall-rank correlation (Har grove et al. 1974; Danell and Eriksson, 1982; Kemp et al., 1984; et al., 1987; Vig and Tiwana, 1988; Tajani and Rai, 1990). Another criterion useful and helpful in judging the merits of alternatives of cow evaluation methods is the standard error (SE) of each method. Such estimate was used by many investigators as a measure of accuracy of the evaluation method (Henderson, 1974; Ufford et al., 1979; Jensen, 1980; Kumar and Narian, 1980; Eriksson and Danell, 1984; Raheja, 1992). Sums of square of difference (SSD) between the chosen (ideal) and the other methods were also calculated (Kemp et al., 1984).

RESULTS AND DISCUSSION

Estimates of cow transmitting ability (CTA)

The minimum and maximum estimates of cow transmitting abilities (CTA) estimated by the three methods (BLUP, SI and MPPA) are presented in Table 1. Szkotnicki et al (1978) found that differences in estimates of CTA for MY were 116 and 173 Kg for Brown Swiss and Canadian cattle, respectively. The differences for FY were 5.0 and 8.6 Kg for the same two breeds. Hintz et al. (1978) reported higher differences in CTA for MY where they were 757, 520, 580, 487 and 907 Kg for Ayrshire, Guersey, Holstein, Jersey and Brown Swiss, respectively. The differences between minimum and maximum values of CTA for different methods are also illustrated in Table 1. For all milk traits, the largest differences in CTA estimates were recorded by MPPA and the lowest differences were presented by SI (Table 1). The differences in CTA using SI1 (for milk) and SI2 (for carrier) were nearly the same (Table 1). Therefore, both indices have the same trend in the evaluation of cows.

The differences in CTA for BLUP were often larger than those for SI (Table 1). This may be due to that all

available records of the cow were used in BLUP, while SI used only the first record of the cow. Van Der Werf et al. (1989) reported that SI values are underestimated since young cows are compared with selected older cows. As expected, the differences between CTA estimated by MPPA were much larger than those estimated by SI (Table 1). These large differences don't introduce a good tool for having the correct culling decision since these large differences may be due to disadvantages in this method; like assuming that the genetic correlation among lactations equal unity (Maijala and Hanna, 1975; Strandberg, 1985).

Table 1. Minimum and maximum values for cow transmitting abilities (CTA) estimated by Best Linear Unbiased Predictor (BLUP), Selection Index for milk (SI1), Selection Index for carrier (SI2), and Most Probable Producing Ability (MPPA).

Trait+	Minimum	Maximum	Difference
MY			
BLUP	-992	1561	2553
SI1	-793	867	1660
MPPA	-1584	2121	3705
FY			
BLUP	-52	65	117
SI1	-38	45	83
SI2	-33	40	73
MPPA	-63	82	145
PY			
BLUP	-42	49	91
SI1	-24	31	55
SI2	-24	31	55
MPPA	-48	53	101
FPY			
BLUP	-99	118	217
SI1	-58	80	138
SI2	-58	80	138
MPPA	-116	136	252
CY			
BLUP	-994	1490	2484
SI2	-733	797	1530
MPPA	-1665	2037	3702

+ Number of cows evaluated were 6018.

Table (2). Percentages of negative estimates of cow transmitting ability (CTA) in different methods of cow evaluation

Trait	BLUP	SI1	SI2	MPPA
MY	52.0	52.7	a	53.5
FY	50.9	52.0	50.3	52.0
PY	47.8	48.8	48.6	49.4
FPY	51.5	51.7	51.7	52.2
CY	51.1	a	52.5	53.3

a SI1 is the index to select for MY, while SI2 to select for CY.

Among all cows, BLUP recorded the lowest percentages of cows having negative estimates of CTA followed by SI and MPPA for all milk traits (Table 2).

Distribution of absolute differences of CTA

Absolute differences (in Kg) distributed as percentages in different methods of cow evaluation are presented in Table 3. One method of improving the production of a dairy herd is to cull the low producers of the 25-30% of the cows (O'Bleness and Van Vleck, 1962; Carter et al., 1963). Accordingly, percentage of culling of cows depending on their CTA mainly include the inferior 25-30% of cows (Table 3). Comparing SI relative to BLUP, we found that this percent will cull those cows having CTA < 100 Kg for MY or CY (Table 3). When using MPPA as a method for estimating CTA and comparing their estimates with those estimates of BLUP, we found that percent of culling (25-30%) will include those cows having CTA greater than 100 Kg till 200 Kg for MY or CY. Using CTA estimates of FY, PY and FPY as a criteria for culling decision, the appropriate culling percent (25-30%) will include those cows having CTA equal to zero and those having 10 Kg or less in comparison of SI1 vs BLUP or SI2 vs BLUP or MPPA vs BLUP (Table 3). For FPY trait, the appropriate culling percent will include those cows having 10 Kg or less in comparison of SI1 vs BLUP and SI2 vs BLUP but it will include those cows having 20 Kg or less in comparison of MPPA vs BLUP.

Criteria for judging merits of methods

For all milk traits, the product-moment correlations (r_{PM}) between all combinations of two methods of BLUP, SI and MPPA were greater than 0.50 (Table 4). Estimates of rPM between two types of SI were near to unity. These figures fairly demonstrate the closeness between both two types of SI. Consequently, any type of SI may be effective in the evaluation of cows using only the first cow record. The product-moment correlations between SI and MPPA were considerably lower than those estimates between any two types of combination (Table 4). The estimates ranged from 0.50 to 0.627. This means lack of agreement between SI and MPPA. It may also indicate that the largest differences in ranks of cows were between these two methods of evaluation. Schaeffer et al. (1982) reported that r_{PM} between BLUP and CC for CTA of MY and FY were 0.88 and 0.65, respectively. Van Der Werf et al. (1989) reported that rPM between animal model (AM) and SI were very high (0.98).

Table 3. Distribution of absolute difference (%) among estimates of CTA calculated by SI1, SI2 and MPPA relative to BLUP

Trait	Absolute difference(Kg)	BLUP vs SI1	BLUP vs SI2	BLUP vs MPPA
MY	>300	24.6	a	33.6
	>200-300	17.2	a	24.2
	>100-200	25.9	a	28.3
	>0-100	32.0	a	13.9
	=0	0.3	a	0.0
FY	>20	5.8	6.1	6.7
	>10-20	23.4	24.4	44.3
	>0-10	66.8	65.8	48.1
	=0	4.0	3.7	0.9
PY	>20	1.1	1.1	4.3
	>10-20	12.6	12.5	36.28
	>0-10	80.2	80.6	59.4
	=0	6.2	5.8	0.02
FPY	>30	9.1	8.8	9.8
	>20-30	15.3	16.3	30.3
	>10-20	29.1	32.3	36.3
	>0-10	44.3	40.8	23.3
	=0	2.2	1.8	0.3
CY	>300	a	26.5	31.0
	>200-300	a	18.3	30.7
	>100-200	a	24.7	27.7
	>0-100	a	30.4	10.5
	=0	a	0.1	0.1

a SI1 is the index to select for MY, while SI2 to select for CY.

Estimates of r_{PM} between BLUP and SI were less than between BLUP and MPPA (Table 4). The estimates ranged from 0.664 to 0.720 for BLUP vs SI1 or SI2, while they ranged from 0.588 to 0.813 for BLUP vs MPPA. The lower correlation between BLUP and SI may be due to the fact that SI constructed here included less information than BLUP (first lactation only for the former method vs all lactations for the later method). Consequently, young cows could be compared with those selected older ones (Van Der Werf et al., 1989). The latter authors added that BLUP showed an advantage over SI accounting for bias from selection for sequential records of the cows. Considering the other two types of correlation (r_S and r_K), the same trend was observed with the decrease of their estimates (Table 4). Standard error (SE) and sum of square of difference (SSD) between methods.

Table 4. Product-moment correlations (r_{PM}), Spearman's rank correlations (r_S) and Kendall's correlations (r_K) among methods of cow evaluation for different milk traits.

	Methods correlated+					
Trait	BLUP&SI1	BLUP&SI2	BLUP&MPPA	SI1&SI2	SI1&MPPA	SI2&MPPA
r_{PM}						
MY	0.709	a	0.813	a	0.611	a
FY	0.706	0.705	0.804	0.997	0.593	0.593
PY	0.664	0.664	0.588	0.997	0.502	0.500
FPY	0.701	0.701	0.779	1.000	0.574	0.574
CY	a	0.720	0.786	a	a	0.627
r_S						
MY	0.700	a	0.791	a	0.588	a
FY	0.684	0.684	0.771	0.997	0.566	0.566
PY	0.637	0.637	0.538	0.996	0.478	0.475
FPY	0.683	0.683	0.743	1.000	0.554	0.554
CY	a	0.709	0.762	a	a	0.600
r_K						
MY	0.514	a	0.604	a	0.415	a
FY	0.514	0.514	0.594	0.974	0.410	0.410
PY	0.480	0.480	0.403	0.979	0.346	0.345
FPY	0.508	0.508	0.563	1.000	0.398	0.398
CY	a	0.522	0.575	a	a	0.428

+ Standerd errors for all estimates were leass than of 0.0001.

a SI1 is the index to select for MY, while SI2 to select for CY.

With the clear disagreement among the three methods (BLUP, SI and MPPA) as compared by the three types of correlations of r_{PM}, r_S and r_K (Table 4), there would be other different bases for detecting which method is more accurate and which is more preferable over others. The other criteria to assess the accuracy of different methods of cow evaluation are the standard error (SE) of each method and the percentage of reduction in stan dard error (RSE) due to using one method instead of another. Estimates of these criteria of cow evaluation are presented in Table 5.

Table 5. The standard error of each method of cow evaluation for different milk traits

Method	MY	FY	PY	FPY	CY
BLUP	2.26	0.11	0.07	0.17	2.10
SI1	4.60	0.19	0.12	0.32	a
SI2	a	0.18	0.12	0.32	4.75
MPPA	6.08	0.26	0.18	0.43	6.01

a SI1 is the index to select for MY, while SI2 to select for CY.

Across all milk traits, BLUP had the lowest SE estimates, while MPPA had the largest estimates and SI was in between (Table 5). Bias owing to the genetic trend and the limited amount of information used in construction of SI may be the main causes for increasing SE of SI when compared with BLUP (Sorensen et al., 1988). When using BLUP, Ufford et al. (1979) reported that records additional to the first lactation would be expected to contribute more accuracy. Within-herd evaluation of cows, Schaeffer et al. (1982) reported that using BLUP is more accurate than traditional CC. Chyr et al. (1979) reported that BLUP (with or without A^{-1}) were more effective in eliminating temporary environmental effects relative to herdmate comparison in cow evaluation. They added that standard deviation (SD) of herdmate comparison was larger than that of BLUP without A^{-1} (1174 vs 1145). Estany et al. (1988) found that there was about 6% loss in efficiency due to use of SI instead of BLUP. However, using REML in estimation of variance components for BLUP will also increase the accuracy of estimates of CTA through the reduction of predicted error variance (Henderson, 1975; Jensen, 1980;

Carlson et al., 1984; Everett and Keown, 1984; et al., 1987). The only advantage of SI over the BLUP in cow evaluation is that, it can be used when the cost of computation effectively rules out the more sophisticated BLUP approach of simultaneously estimating the breeding values of all bulls and cows in the national herd (Henderson,1975; Dempfle, 1982; Hill and Swanson, 1983).

Percentage of reduction of estimates of SE (RSE) from using the ideal method instead of alternative ones are given in Table 6. Across all traits, RSE from using BLUP instead of MPPA ranged from 57.7 to 65.1% (Table 6), from 38.9 to 55.8% from using BLUP instead of any one of the two types of SI, while they ranged from 21.0 to 33.3% from using any type of SI instead of MPPA. The lowest estimates of RSE were between SI1 and SI2 (Table 6). In this respect, using SI1 instead of SI2 will lead to a reduction in estimates of RSE of 0.0 to 5.6%. This means that both indices are similar and there were no differences between them in ranking of cows. Schaeffer et al. (1982) concluded that evaluations of cows by BLUP are more accurate than traditional contem porary comparisons.

Table 6. Reduction of percent in standard error (RSE) gained from using BLUP instead of other methods and sum of squares of difference (SSD) between different methods of cow evaluation.

Comparison		MY	FY	PY	FPY	CY
(i) RSE+						
BLUP	vs SI1	50.9	42.1	41.7	46.9	a
	vs SI2	a	38.9	41.7	46.9	55.8
	vs MPPA	62.8	57.7	61.1	60.5	65.1
SI1	vs SI2	a	-5.6	0.0	0.0	a
	vs MPPA	24.3	26.9	33.3	25.6	a
SI2	vs MPPA	a	30.8	33.3	25.6	21.0
(ii) SSD						
BLUP	vs SI1	277498979	453949	206467	1327500	a
	vs SI2	a	472610	206537	1329120	303874108
	vs MPPA	303947115	561763	542120	1784282	332916884
SI1	vs SI2	a	6201	954	26210	a
	vs MPPA	607760656	1055520	628005	3187028	a
SI2	vs MPPA	a	1082979	627085	3196110	595819348

+ Percent of reduction in SE due to using BLUP instead of SI1; using BLUP instead of SI2; ... etc.

a SI1 constructed to select for MY, while SI2 constructed to select for CY.

In general, accuracy of SI was the nearer to BLUP than MPPA. This trend is clear since the sum square of differences (SSD) between BLUP and both types of SI were smaller than those between BLUP and MPPA (Table 6). This trend is more evidenced since SSD between MPPA and both types of SI were greater than estimates of SSD between MPPA and BLUP.

CONCLUSION

For all milk traits, the largest differences in estimates of cow transmitting ability (CTA) obtained by BLUP introduce the possibility of making the correct culling decision than simple methods (MPPA) do. Using BLUP procedure in cow evaluation may be more effective for improvement programmes than using MPPA due to MPPA having the largest percent of negative CTA estimates, i.e. using BLUP to select the best cows from those having positive estimates of CTA is quite possible. This leads to conclude that using BLUP may be more effective for improvement programmes than using SI and MPPA. In between, SI is better than MPPA in percentages of cows whose having positive CTA values. Using estimates of CTA to decide the culling percentage of cows leads to state that both BLUP and SI are coupled in identifying the inferior cows, while MPPA will include some cows whose having large CTA in the culling percent. Comparing the evaluation methods of Fleckvieh cows, in the point of the percentage of culled cows, we concluded that using BLUP or SI will lead to cull cows whose having CTA< 100 Kg for MY or CY. In case of using MPPA, the culled cows will include those cows having CTA greater than 100-200 Kg for MY and CY. Since large differences in ranks of cow using SI and MPPA were evidenced here, estimates of rank correlations are not effective, in practice, for comparison of culling schemes of cows. This could have a large practical consequence in the usage or culling of the cows. Correlations obtained here indicate also that cows were re-ranked when using any method of BLUP or SI or MPPA. Theoretically, the MPPA is biased due to the presence of genetic trend and non-random distribution of sires of herdmates (Chyr et al., 1979; Freeman, 1988). Also, SI is biased through no accounting for selection of ancestors, and not accounting simultaneously for fixed effects (Henderson, 1975; Van Der Werf, 1989).

Based on results obtained in the population under study, the continued use of MPPA method is not, therefore, recommended for evaluation of cows. Ranking these three methods of cow evaluation on the bases of their accuracy, BLUP recorded the first, followed by SI and MPPA in a descending order, i.e. computerized methods (BLUP and SI) are more preferable than the handy method (MPPA).

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مقارنة فاعلية ثلاثة طرق لتقييم الأبقار لتحسين صفات إنتاج اللبن لماشية الفلاكفى

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تم تقييم الأبقار من خلال تقدير القيمة التمريرية لعدد ٦٠١٨ بقرة بالإستعانة ببيانات ١٦٠٤٢ سجل إنتاجى لها تم إستخلاصهم من عدد ٥٣٠٤٠ سجل بحيث يتوافر لكل بقرة سجلين على الأقل. تم ذلك بإستخدام ثلاثة طرق مختلفة هى: طريقة أفضل التقديرات الخطية الغير متحيزة (BLUP) - طريقة أدلة الإنتخاب للإنتخاب لمحصول اللبن (SI1) - أو للإنتخاب لمحصول اللبن الخالى من الدهن والبروتين (SI2) وطريقة أقصى مقدرة إنتاجية ممثلة (MPPA).

أجريت مقارنة بين الطرق المختلفة المستخدمة فى تقييم الأبقار وذلك بإستخدام: معامل الإرتباط العزومى (r_{mp}) - معامل إرتباط الرتب لسبيرمان (r_s) وكذلك معامل إرتباط الرتب لكندال (r_k). ولتقدير دقة الطرق المختلفة لتقيم الطلائق أو الأبقار إستخدم لذلك الخطأ القياسى (SE) لكل طريقة - نسبة الإنخفاض فى الخطا القياسى (RSE) الناتج من إستخدام أى طريقة بدلا من الأخرى - وتقدير مجموع مربعات الإنحرافات (SSD) بين الطرق المختلفة. ويمكن تلخيص النتائج المتحصل عليها من تلك الدراسة فيما يلى:

١- بالنسبة لجميع الصفات كانت الفروق بين أقصى وأدنى قيمة تمريرية للأبقار أكبر ما يمكن عند إستخدام طريقة MPPA بينما كانت هذه الفروق أقل ما يمكن عند إستخدام طريقة SI. كانت الفروق فى القيم التمريرية للأبقار عند إستخدام طريقة BLUP أكبر من مثيلاتها فى طريقة SI. كانت الفروق فى القيم التمريرية للأبقار عند إستخدام أدلة الإنتخاب لمحصول اللبن (SI1) مساوية تقريبا للأدلة المستخدمة للإنتخاب لمحصول اللبن الخالى من الدهن والبروتين (SI2).

٢- على مستوى جميع طرق التقييم للبقرة، سجلت طريقة BLUP أقل نسبة من الأبقار التى لها قيم تمريرية سالبة يليها فى ذلك طريقة SI ثم MPPA. ومن ثم كانت تلك النسب على التوالى هى ٥٢، ٥٣، ٥٤٪ لمحصول اللبن - ٥١، ٥٢، ٥٢٪ لمحصول الدهن - ٤٨، ٤٩، ٤٩٪ لمحصول البروتين - ٥٢، ٥٢، ٥٢٪ لمحصول الدهن والبروتين معا وكانت ٥١، ٥٣، ٥٣٪ لمحصول اللبن الخالى من الدهن والبروتين.

٣- عند تحكيم الطرق المستخدمة فى تقييم الأبقار من ناحية كفاءتها، وجد أن الإرتباطات العزومية بين نوعى دليل الإنتخاب لمحصول اللبن ودليل الإنتخاب لمحصول اللبن الخالى من الدهن والبروتين تقرب من الواحد الصحيح بينما كانت الإرتباطات بين طريقة دليل الإنتخاب وطريقة MPPA منخفضة كثيرا (٠,٥٠-٠,٦٢٧). كذلك وجد أن هذه الإرتباطات بين SI و BLUP أقل (٠,٦٦٤-٠,٧٢) من مثيلاتها بين MPPA و BLUP (٠,٥٨٨-٠,٨١٣).

٤- عند قياس دقة الطرق المستخدمة فى تقييم الأبقار لجميع الصفات المدروسة كانت طريقة BLUP أكثر الطرق دقة يليها طريقة SI ثم طريقة MPPA. كانت قيم RSE الناتجة من إستخدام طريقة BLUP بدلا من طريقة MPPA أكبر (٥٧,٧-٦٥,١٪) من قيم RSE الناتجة من إستخدام BLUP بدلا من SI (٣٨,٩-٥٥,٨٪) وذلك على مستوى جميع الصفات المدروسة. كذلك كانت قيم SSD بين طريقتى SI و BLUP أقل من مثيلاتها بين طريقتى BLUP و MPPA.

أوضحت نتائج هذه الدراسة أن طريقة BLUP هى أكثر الطرق دقة لتقييم الأبقار تلتها فى ذلك طريقة SI ثم طريقة MPPA.