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RESEARCH ON THE MULTITRAIT ASSESSMENT OF THE GENETIC MERIT FOR MILK AND MEAT PRODUCTION IN THE ROMANIAN FRIESIAN USING A BLUP SIMPLIFIED MODEL

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Abstract

*The paper objective was to assess the genetic merit for milk and meat production using a sample of 16 Romanian Friesian bulls and a BLUP simplified model as well as the contemporary comparison method. The bulls' 730 daughters (half-sisters) registered during the 305 days first lactation 3,034.89 kg milk with 22.86 % variation coefficient, 3.79 % fat with 6.06 % variation and 115.72 kg fat with 23.49 % variation. The 249 sons (half-brothers) recorded 138.05 kg atthe age of 6 months with 19.31 % variation coefficient, 293.41kg at the age of 12 months with 4.33 % variation, and 881.97 g/day daily gain with 3.14% variation. The heritability was 0.505 for milk yield, 0.741 for fat %, 0.567 for milk fat, 0.524 for the weight at 6 months, 0.642 for the weight at 12 months and 0.372 for daily gain. The genotypic correlations have been -0.245 between milk yield and fat % and 0.465 between milk and fat yield, -0.287 between the weight at 6 months and 12 months and 0.850 between the weight at 12 months and daily gain. Breeding value varied from 637.6 and -68.1 for milk yield and between 26.26 and -2.07 for milk fat. The breeding value precision ranged between 92 and 58 in case of milk traits. Breeding value varied between 48.6 and -27.8 for the weight at 12 months and between 168.2 and 2.2. for daily gain. The accuracy of the breeding value for meat traits ranged between 76 and 60. Rank correlations between bull ranking for milk traits were 0.377** between milk fat and fat %, 0.974** between milk yield and fat yield. Rank correlations between bull ranking for meat traits were 0.766** between the weight at 6 months and at 12 months and 0.847** between the weight at 12 months and daily gain. The rank correlation between bull hierarchy by BLUP and contemporary comparison was 0.563 significantly for P=0.05 and P=0.01. As a conclusion, the high accuracy of BLUP model recommends it to be used for breeding value assessment. The position occupied by bulls in their ranking by BLUP was similar in some cases with the one set up by contemporary comparison. Some Friesian bulls could improve both milk and meat production but most of them have the best impact on the growth of milk yield.*

Key words**:** *BLUP, Friesian breed, multi trait assessment, Romania*

INTRODUCTION

Genetic gain in cow populations is assured by selection of dams and sires for milk production characters. Selection pressure by sire is an important tool in breeding experts' hand, as long as the bull is responsible of 70% of genetic gain [14,17].
For this reason, the identification of the best bulls has a major importance and needs corresponding methods for estimating breeding value. Across the time, the methods used in breeding value assessment have been improved from contemporary comparison to BLIP, mixed model, marker-assisted molecular genetics [4,22,24,25,28].
The "contemporary comparison" method, [44] was largely used in the previous decades but the need of a higher accuracy in breeding value estimation determined the setting up of new methods based on linear mathematical models, deeply supported by the computers development [47, 54].
Selection is usually based on a mixture of traits of major economic importance. In case of milk production, the main characters taken into consideration in the selection schemes are: milk yield, fat percentage, fat yield and protein yield for a 305 days lactation, and in case of meat production: weight at birth, at the age of 6 and 12 months and weight daily gain. [2, 3,8, 13, 27, 35,36, 41, 49]
Heritability show in what measure those traits could be inherited by the future offspring and

the correlations between various characters reflect that the selection of some characters is enough to improve or decline the performance for other characters. [14, 26, 41]

Selection efficiency depends of genetic variability, heritability and correlations exiting between various production traits [33, 34, 35]

Also, the group size of descendants used in bull testing has a deep influence on the precision of breeding value assessment. [44]

The increased precision is closely related to the development of estimation methods for a specific purpose. [50]

The best linear unbiased prediction (B.L.U.P.) and then "mixed model" have been created to assure a minimum variance and a high precision of the breeding value by the successful combination of the advantages of the selection indices and the least square method, and also by largely using the techniques development. [11,18,28,35,46].

At present, the modern molecular and quantitative genetics looks to more and more utilized. [15]. However, marker-assisted selection implemented in practice have proved that its use could lead to bias and high standard errors [31].

Friesian is recognized as a specialized breed for milk production, but also in some countries it is selected both for milk and meat characters taking into account the need to improve the both productions. [1,6,7]

In this context, the paper purpose was to estimate breeding value of Friesian bulls both for milk and meat characters using a simplified mathematical model of BLUP. Also, the contemporary comparison method was used in order to comparatively analyze the effect of these methods on the bulls ranking.

MATERIALS AND METHODS

A number of 127 Friesian bulls grown Romania were used for determining their breeding value for dual purpose based on the specific characters of milk and meat production.

For this purpose, a sample consisting of 5,817 offspring, including a number of 4,112 daughters (half-sisters) belonging to 98 bulls and 1,705 sons (half-brothers) belonging to 105 bulls was used.

This sample represents 24.94 % of the 425 bulls tested for milk production and 10.33 % of 1,026 bulls tested for meat production during a period of 11 years in Romania.

In order to determine their breeding value, the bulls were tested based on their offspring performance recorded in 221 farms belonging to 35 counties of Romania.

In this study, it was used only a sample of 16 bulls, and their offspring consisting of 730 daughters (half-sisters) and 249 sons (half-brothers) as presented in Table 1.

Table 1. Number of offspring per tested bull, used in this research work

Crt.No.	Bull Code	No. of daughters used for bull testing for milk production characters	No. of sons used for bull testing for meat production characters
1	6841	24	21
2	4083	52	14
3	4094	23	13
4	5338	78	13
5	5329	198	15
6	6014	27	16
7	4837	25	13
8	4076	22	12
9	5435	28	18
10	5184	21	12
11	5347	98	17
12	5105	21	11
13	5650	29	23
14	5349	21	23
15	5204	40	15
16	6499	23	13
	Total	730	249

Source: Selection made by author from the data based used in a research project.

The bull daughters were born at a maximum 60 days interval between them, their age at the 1st parturition varied between 23 and 35 months. The average number of daughters per bull was 39, varying between minimum of 19 and maximum of 198 average daughters, important figures for assuring a high selection precision in dairy herds similar to the one assured by daughters assessed in stations as mentioned Robertson and Rendel (1954) [14].

The daughters were tested for milk production for 305 days of lactation obtained in their herds using the specific characters: milk yield, fat percentage and fat quantity. The data were corrected for birth month, age at the 1st parturition, calving interval, their distribution among herds. [37,38,39].

The average number of sons per bull was 15, ranging between minimum 9 and maximum 61. The bull sons were evaluated based on their performance for meat production, using the specific characters: weight at the age of 6 months and 12 months and daily weight gain. A correction for birth month of the fattened steers was carried out [40].

For all the characters taken into consideration, both for milk and meat production, there were determined the following statistical parameters: average, standard deviation, variation coefficient and heritability.

The average, Standard Deviation and Variation Coefficient for each production parameter were calculated according to the formulas given below:

Average, $\overline{X} = \frac{X_1 + X_2 + ...X_n}{n}$, ... (1)

where n = number of variables and X= production character

Standard Deviation, S=

$$\left(\sqrt{\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{n-1}} \right) \quad ......(2)$$

Variation Coefficient, $V_{\%} = \frac{S}{\overline{X}}$ x 100 ..(3)

The heritability for milk and meat production characters, and also the genotypic and phenotypic correlations among milk characters as well as among meat characters were determined using the following formulas:

Heritability, $h^2 = \frac{B_V}{P_V}$ ....(4)

where B_V is breeding value and P_V is phenotypic value.

$$S_{h2} = (h^2 + \frac{4}{n_i})\sqrt{\frac{2}{S}} \quad ....(5)$$

where h^2 i heritability, S_h^2 is heritability error.

Genotypic correlation, $r_G = \frac{\text{cov}_{G\,XY}}{\sqrt{S^2_{G_X} S^2_{GY}}}$... (6)

where: cov_G is genotypic variance, S^2 is variance.

Phenotypic correlation, $r_F = \frac{\text{cov}\,F_{XY}}{\sqrt{S^2_{FX_x} . S^2_{FY}}}$,.................(7)

where: cov_F is phenotypic variance, and S^2 is variance.

Bull breeding value was estimated using two methods: (a)BLUP - Best Linear Unbiased Prediction in a simplified version and (b)CC-Contemporary Comparison.

The simplified variant in monofactorial classification model, used in this research work, was based on the mixed model established by Henderson in 1949, cited by Popescu Agatha, 2014a. The mathematical formula of this simplified model was:

$Y_{ij} = \mu + s_i + e_{ij}$, ... (8)

where: Y_{ij} – the performance of the „j" daughter of the „i" bull, μ is a fixed unknown parameter, a_i – the effect of the „i" bull, with the value s_i = ½ g_i, where: g_i – the „i" bull's breeding value, e_{ij} - residual effect (j=1, ..., n_{ij}); a and e are uncorrelated variables with the averages equal to zero and variances $\sum_s^2$ and $\sum_e^2$.

Considering $\sum(e_{ij}) = 0, \text{cov}(e_{ij}, e_i, j,) = o$ if i ≠ i', or at least j ≠ j' and $\sum_{ij}^2 = \sum_e^2$. The linear model did not considered that bulls are relatives among them, $\text{cov}(s_i, s_i) = 0, \sum_{si}^2 = \sum_s^2 = 1/4 \sum_A^2$.

Taking into consideration that n_i represents the number of daughters of the "i" bull, then the equations of the mixed model are:

The breeding value of the "i" bull, s_i, will be:

s_i= 2(n_i/$n_{i.}$ + a) ($y_{i.}$ – μ) ....(9)

where: s = $\sum_e^2 / \sum_s^2$. If we consider n_i/(n_i.+a) = w_i, then $\overline{\mu} = \sum w_i \overline{y}_{i.} / \sum w_i$.

The estimated breeding value precision, R^2, was determined based on the formula:

$$R^2 = w_i - \frac{w_i}{\sum w_i} \quad \text{....................................(10)}$$

When n_i has a high value, then $R^2 = w_i(1 - \frac{1}{\sum w_i})$, where $\sum w_i$ goes to infinity and $1/\sum w_i$ goes to zero.

$$\hat{V}A = 2b\left[(\bar{Y} - \bar{A}y) - 1/2h^2(\bar{X} - \bar{A}_X) + h^2{}_A(\bar{A} - \bar{P})\right] + \bar{P}, \quad \text{...... (11)}$$

where: $\bar{A}$ - herd average, and $\bar{P}$ - breed average, $\bar{Y}$ - mothers average performance, $\bar{A}_X$ - contemporary average performance, and ½ h^2- mother genetic contribution.

The factor b had the formula:

$$b = \frac{W}{W + \frac{4}{h^2} - 1}, \quad \text{.... ....(12)}$$

where: W = $\sum_{i=1}^{k} w_i$ and K – number of herds.

$$w_i = \frac{n_1 . n_2}{n_1 + n_2}, \quad \text{................ ....(13)}$$

where: n_1- number of daughters and n_2 – number of contemporaries.

Points Method was used to classify the bulls according to their breeding value determined by the two methods and for the both production types. Each bull received points from 1 to n, based on its position in the classification. For establishing their final positions for the both productions, the points were summed and then a new bull ranking was required based on Point Methods to identify which bull is the best for dual purpose. Bull ranking was set up in the increasing order of the total number of obtained points. The bull which received the least number of points was situated on the 1st position as the best improving bull.

Spearman's Rank Correlation was used to identify the relationship between the bull classification based on the breeding value assessed by the simplified BLUP model and the classification set up using the contemporary comparison. The formula of rank correlation is given below:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)} \quad \text{................................(14)}$$

This simplified mixed model was utilized for estimating the bulls breeding value and its precision both for milk and meat production characters.

Contemporary Comparison Method used in this research work was based on the formula:

Fisher Test was used to evaluate the significance of the rank correlation for the probabilities P = 0.05 and P = 0.01.

The data were provided by the National Center for Animal Reproduction, Selection and Breeding.

RESULTS AND DISCUSSIONS

Average and variability of milk production characters is presented in Table 2. Milk yield registered 3,034.89 kg per 305 days of lactation with a variability of 22.86 %. Milk yield found in this research is lower than the one found by Freking et al., 1992 (7,803kg) and Rekik, 2009 (3,871 kg). [16, 42] Fat percentage was in average 3.79 with a low variation of 6.06 %. And milk fat recorded an average of 115.72 kg per lactation with a variation coefficient of 23.49 %.

Table 2. Average and variation coefficient for milk production characters (N=2,237)

Character	$\bar{X} \pm s\bar{X}$	$V_{\%}$
Milk yield	3,034.89 ± 14.670	22.86
Fat %	3.79 ± 0.004	6.06
Milk fat	115.72 ± 0.590	23.49

Source: Own calculations.

Average and variability of meat production characters is presented in Table 3.

Bulls weight at the age of 6 months recorded an average of 138.050 kg with a variation coefficient of 19.31 %. At the age of 12 months, the average weight was 293.410 kg with a very low variation coefficient of 4.33 %.

Table 3. Average and variation coefficient for milk production characters (N=1,705)

Character	$\overline{X} \pm s\overline{X}$	$V_{\%}$
Weight at the age of 6 months	138.050 ± 6.04	19.31
Weight at the age of 12 months	293.410 ± 1.04	4.33
Weight daily gain	881.977 ± 4.24	3.14

Source: Own calculations.

For the weight daily gain, the average was 881.977 g/day also with a low figure for the variation coefficient, 3.14 %.

Heritability for milk production characters is given in Table 4. Heritability for milk production was 0.505, higher compared to the values registered by other authors: 0.21 (Yaeghoobi et al, 2011 in Iranian Holstein), 0.22 (Yousefi-Golverdi et al, 2012 in Iranian Friesian), 0.26 (Hashemi, 2009 in Iranian Holstein, Nixon, 2009 in Canadian Holstein), 0.28 (Dedkova et al., 2001), 0.29 (Chauchan et al., 1991 in Canadian Holstein), 0.37 (Boichard et al, 1987), 0.38 (Hardie et al., 1978 in 0.41 (Rotschild et al., 1979 in American Holstein). [5,10,12,19,21,32,45,53, 54]

However, the heritability determined in this research work was close to other results obtained by other authors: 0.43 (Robertson and Rendel in United Kingdom in 1957, Bradford in the USA in 1964), 0.5 (Muresan in Romania in 1984) [35].

Heritability for fat % was 0.741, which is close to the one obtained by other authors:0.708 (Nixon, 2009 in Canadian Holstein), 0.81 (Johanson in Denmark in 1954), 0.7 (Stahl in Germany in 1973) [29,35].

Also, it was higher compared to heritability for fat % found by some other authors: 0.53 (Robertson in United Kingdom in 1957), [43], 0.52 (Muresan in Romanian Friesian in 1984), 0.58 (Ujica in Romania in 1974), [29,35] and 0.36 (Hashemi et al, 2009 in Iranian Holstein), 0.23 (Khanzadeh et al, 2013 in Iranian Holstein), 0.28 (Yousefi-Golverdi et al, 2912 in Iranian Holstein). [21,23,54]

Milk fat had 0.567 heritability, a value similar or close to the ones registered by other authors: 0.56 (Johanson in Denmark, 1954), 0.52 (Muresan, 1984, Negrutiu, 1973, in Romanina Friesian), 0.5 (Temisan in Romania in 1975).[29,35]

Also, the heritability estimated in this study was higher compared to the one found by other authors: 0.38 (Hardie et al., 1978), 0.31 (Chauchan et al., 1991), 0.24 (Hashemi et al, 2009, Yousefi-Golverdi et al, 2012 in Iranian Holstein), 0.086 (Yaeghoobi et al., in Iranian Holstein). [10,19,21,53,54]

Table 4.Heritability for milk production characters

Character	$h^2 \pm S_h^2$
Milk yield	0.505 ± 0.069
Fat %	0,741 ± 0.101
Milk fat	0,567 ± 0.077

Source: Own calculations.

Heritability for meat production characters is given in Table 5. Hertability for the weight at the age of 6 months was 0.524 close to the one obtained by other authors: 0.53 (Blackmore in 1958, Muresan, 1983, Romania), 0.56 (Cundiff, 1971, Langholtz, 1964, Mirita, 1982 in Romania), 0.59 (Linner, 1973, Vlaic, 1979 in Romania). [35].

Heritability for the weight at the age of 12 months was 0.642 while the value for weight daily gain was 0.372, lower compared to the one found by other authors: 0.73 (Langholtz, 1964 in Germany), 0.52 (Trappman, 1972), 0.50 (Averdunk, 1950 in Germany), but close to the one found by a few other authors:0.44 (Calo, Mc Dowell, 1973, Negrutiu, 1975 in Romania), 0.45 (Langlett, 1967). [35]

The heritability obtained in this reserach was higher compared to the one found by other authors: 0.17 (Vostry et al.,2012 in Czech Republic). [51]

Table 5.Heritability for meat production characters

Character	$h^2 \pm S_h^2$
Weight at the age of 6 months	0.524 ± 0.072
Weight at the age of 12 months	0.642 ± 0.088
Weight daily gain	0.372 ± 0.051

Source: Own calculations.

Genotypic and phenotypic correlations for milk production characters are shown in

Table 6. The genotypic correlation between milk production and fat % is a negative one, showing that selection for increasing milk yield will lead to a lower fat percetage. In this reserach work, this correlation was -0.245, similar or close to the one mentioned by other authors: -0.27 (Forester, 1971 in Germany), -0.21 (Hartman,1960 in Germany), -0.22 (Legates,1957 in the USA), -0.27(Rendel, 1957 in United Kingdom), -0.20 (Tabler et al., 1959), -0.27 (Alexoiu, 1983 in Romania), -0.20 (Ujica, 1974, Popescu-Vifor, 1978 in Romania), [35] and -0.3 (Wilcox et al, 1971 in Canadian Holstein). [52] But this correlation was lower than the one found by some other authors: -0.43 (Boichard et al, 1987), -0.49 (Chauhan et al., 1991 in Canadian Friesian), -0.98 (Yousefi-Golverdi et al., 2012 in Iranian Holstein) [5,10,54]

The genotypic correlation between milk production and milk fat was 0.465, figure which is smaller compared to the one found by some authors: 0.99 (Yousefi-Golverdi et al., 2012 in Iranian Holstein), [44] 0.93 (Popescu-Vifor, 1978, Ujica, 1974 in Romania), [35] 0.9 (Bergman, 1969 in Switzerland), 0.89 (Harville, Henderson, 1966), 0.88 (Alexoiu, 1983, Negrutiu, 1973 in Romania), [35], 0.743 (Campos et al, 1994), [9], -0.36 (Petre, Negrutiu, 1975 in Romania) [35].

Table 6.Genotypic and phenotypic correlations among milk prodruction traits

Genotypic correlations			Phenoptypic correlations		
	Fat %	Milk Fat		Fat %	Milk Fat
Milk yield	-0.245	0.971	Milk yield	-0.181	0.964
Milk Fat	0.465	-	Milk Fat	0.240	-

Source: Own calculations.

Genotypic and phenotypic correlations for meat production characters are shown in Table 7. The genotypic correlation between weight at the age of 6 months and weight at the age of 12 months was a negative one, -0.287 and also the genotypic correlation between the weight at 6 months and weight daily gain, -0.307. This reflects that selection is not so important to be done based on the trait weight at the age of 6 months because this could have a negative impact on the second trait taken into consideration. But, the correlation between the weight at the age of 12 months and daily gain was very strong, 0.850, showing how important is this trait in bull selection and breeding.

Table 7.Genotypic and phenotypic correlations among meat prodruction traits

Genotypic correlations			Phenoptypic correlations		
	Weight at the age of 6 months	Weight at the age of 12 months		Weight at the age of 6 months	Weight at the age of 12 months
Weight at the age of 12 months	-0.287	-	Weight at the age of 12 months	-0.189	-
Weight daily gain	-.0307	0.850	Weight daily gain	-0.726	0.771

Source: Own calculations.

Estimated breeding value (BV) and its precision ($R^{2)}$ in Friesian Bulls testing for each milk production characters using BLUP simplified model is presented in Table 8. In case of milk production, breeding value varied between 636.7, the maximum value for the bull 6841 and -68.1, the minimum value for the bull 6499. Its precision ranged between 92, the maximum value in case of the bull 5329 and 58, the minimum value in case of the bulls 5184, 5105 and 5349.

Regarding fat %, the estimated breeding value varied between 0.264, the maximum value for the bull 4094 and -0.121, the minimum value for the bull 5329. Its precision ranged between 93, the maximum value in case of the bull 5329 and 62, the minimum value in case of the bulls 5184, 5105 and 5349.

Concerning milk fat, the estimated breeding value varied between 26.26, the maximum value for the bull 5349 and -2.07, the minimum value for the bull 5347. Its precision ranged between 92, the maximum value in case of the bull 5329 and 58, the minimum value in case of the bulls 5184, 5105 and 5349.

From the 16 bulls taken into consideration in this research, a number of 13 bulls had a positive breeding value for milk production and 3 had a negative one. Regarding the fat %, only 14 bulls had a positive breeding value for this character and 2 had a negative one. In case of milk fat, only one bull had a negative breeding value for this trait and all the others had a positive breeding value.

Table 8.Breeding value (BV) and its precision (R^2) determined by BLUP for each milk production traits

Crt No	Bull Code	Milk production (kg)		Fat %		Milk Fat (kg)	
		BV	R^2	BV	R^2	BV	R^2
1	6841	636.7	61	0.006	65	24.26	61
2	4083	619.5	77	0.072	80	25.47	77
3	4094	262.1	60	0.264	64	17.82	60
4	5338	370.2	83	0.039	85	14.52	83
5	5329	559.2	92	-0.121	93	17.06	92
6	6014	58.2	63	0.118	68	5.25	63
7	4837	523.2	62	0.158	66	23.92	62
8	4076	102.1	59	0.057	63	5.13	59
9	5435	-0.4	64	0.023	69	0.36	64
10	5184	420.0	58	0.184	62	21.47	58
11	5347	-37.6	86	0.010	88	-2.07	86
12	5105	130.1	58	-0.041	62	3.94	58
13	5650	275.0	65	0.115	69	14.28	65
14	5349	601.8	58	0.102	62	26.26	58
15	5204	301.8	72	0.267	75	18.84	72
16	6499	-68.1	60	0.122	64	0.02	60

Source: Own calculations.

Estimated breeding value (BV) and its precision ($R^{2)}$ in Friesian Bulls testing for each meat production characters using BLUP simplified model is presented in Table 9.

For the weight at the age of 6 months, the maximum breeding value was 38.1 registered by the bull 6014 and the minimum breeding value was -36.1.

Its precision varied between 79 recorded by the bulls 5650 and 5349, the maximum value and 65 in case of the bull 5105.

For the weight at the age of 12 months, the maximum breeding value was 48.6 recorded bythe bull 6014 and the minimum breeding value was -27.8. Its precision varied between 71 registered by the bulls 5650 and 5349, the maximum value and 54 in case of the bull 5105.

Regarding the breeding value for daily gain, the maximum value was 168.2 registered by the bull 5435 and the minimum value was 2.2 recorded by the bull 6499. Its precision ranged between 76, the maximum value registered by the bulls 5650 and 5349 and 60, the minimum value recorded by the bull 5105.

Table 9.Breeding value and its precision determined by BLUP for each meat production traits

Crt No	Bull Code	Weight at the age of 6 months (kg)		Weight at the age of 12 months (kg)		Daily gain (g/day)	
		BV	R^2	BV	R^2	BV	R^2
1	6841	-35.7	78	-26.1	69	12.8	74
2	4083	25.3	70	40.3	60	81.6	66
3	4094	6.8	69	24.1	58	82.5	64
4	5338	-15.5	69	-7.9	58	4.0	64
5	5329	-5.0	72	1.5	62	16.3	67
6	6014	38.2	73	48.6	63	60.6	69
7	4837	7.7	69	20.3	58	64.1	64
8	4076	1.0	67	14.3	56	64.9	62
9	5435	-14.4	75	19.8	66	168.2	71
10	5184	29.2	67	39.9	56	63.6	62
11	5347	-12.3	74	-5.2	64	14.2	70
12	5105	3.2	65	9.6	54	15.8	60
13	5650	-36.1	79	-27.8	71	11.4	76
14	5349	0.0	79	31.0	71	149.3	76
15	5204	7.4	72	14.8	62	21.5	67
16	6499	-9.9	69	-3.9	58	2.2	64

Source: Own calculations.

Rank correlations between bulls ranking for various milk traits are shown in Table 10. There were noticed significant correlations for the positions occupied by bulls for milk production and milk fat, showing that a bull improving one of thise characters will also have a positive impact on the other trait which will be improved at its offspring. Therefore, it is enough as in bull breeding value estimation based on daughters and bull mothers performance to take into consideration only milk fat or milk production at the first 305 days of lactation, depending on heritability. Weak correlations were found among the bull positions for milk production and for fat percetange as well.

Table 10.Rank correlations between bulls hierarchy for various milk characters

Character	Milk production	Fat %
Fat %	0.377**	-
Milk Fat	0.974**	0.467**

Source: Own calculations

Rank correlations between bulls ranking for various meat traits are shown in Table 11.

Table 11.Rank correlations between bulls hierarchy for various meat characters

Character	Weight at the age of 6 months	Weight at the age of 12 months
Weight at the age of 12 months	0.766**	-
Weight daily gain	0.393**	0.847**

Source: Own calculations

There were found significant correlations between the bull ranking established for the weight at the age of 6 months and the weight at the age of 12 months, but especially between the weight at the age of 12 months and daily gain. This shows that the weight at the age of 12 months and daily gain are the most important characters for the selection for bulls fattening performance. A low coorelation wsa found between the positions occupied by bulls for the traits weight at the age of 6 months and daily gain, proving that the selection based on weight at the age of 6 months does not assure a higher daily gain to the next offspring.

Bulls ranking according to their breeding value calculated for double purpose: milk and meat traits, using BLUP simplified model is shown in Table 12.

Taking into account all the studied characters both for milk and meat production, it was established a new bull ranking. Looking at the figures from thelast column of Table 12, one can see that the best bull for dual purpose coming on the 1st position has been the bull 5184. This bull was positioned on the 4th position for milk production characters and on the 3rd postion for meat production characters.

On the 2nd position it is situated the bull 4837, which is on the 1st position for milk production traits and on the 14th position for meat production characters. On the 3rd position is situated the bull 4083, which came on the 5th position for milk characters and on the 11th position for meat traits.

Table 12.Positions occupied by bulls according to their breeding value calculated both for milk and meat characters, by BLUP and Points Methods

Crt.No.	Bull code	Position for		Total points	Position fro double traits- milk and meat characters
		Milk traits	Meat traits		
1	6841	10	64	74	18
2	4083	5	11	16	3
3	4094	7	33	40	7
4	5338	14	57	71	17
5	5329	27	38	65	15
6	6014	17	2	19	4
7	4837	1	14	15	2
8	4076	25	2	27	6
9	5435	39	22	61	12
10	5184	4	3	7	1
11	5347	36	47	83	25
12	5105	37	27	64	14
13	5650	10	66	76	19
14	5349	2	21	23	5
15	5204	6	21	27	6
16	6499	30	48	78	21

Source: Own calculations

On the opposite side, there is the bull 5347 situated on the last position for the both characters.

Bulls ranking according to their breeding value calculated for double purpose: milk and meat traits, using Contemporary Comparison Method is shown in Table 13. Using C.C., the traditional method, the bulls registered a different ranking. On the 1st position itis situated the bull 6841, followed by the bulls 4083, 4094, 5338, 5329 and 6014. On the last position came the bull 6499.

The comparison concerning bull position occupied for dual purpose, determined by B.L.U.P. and C.C is presented in Table 14. As one can see, the bull came on different positions in their ranking due to the method used for breeding value estimation. However, a number of three bulls of the total of 16 bulls used in this study occupied almost similar positions, no matter the breding value estimation method. It is about the bull 4083 coming on the 3rd position by BLUP and on the 2nd position by CC, the bull 6014 situated on the 4th position by BLUP and on the 5th position by CC and the bull 4076 situated on the 6th position by BLUP and on the 7th position by CC.

Table 13.Positions occupied by bulls according to their breeding value calculated both for milk and meat characters, by Contemporary Comparison Methods and Points Methods

Crt.No.	Bull code	Position for		Total points	Position fro double traits- milk and meat characters
		Milk traits	Meat traits		
1	6841	9	10	19	1
2	4083	6	27	33	2
3	4094	7	26	33	2
4	5338	8	28	36	4
5	5329	16	22	38	5
6	6014	32	6	38	5
7	4837	23	16	39	6
8	4076	20	21	41	7
9	5435	39	4	43	8
10	5184	2	45	47	9
11	5347	11	36	47	9
12	5105	17	31	48	10
13	5650	3	48	51	11
14	5349	30	32	62	12
15	5204	27	47	74	13
16	6499	41	44	85	16

Source: Own calculations

Table 14.Bull ranking by BLUP versus CC for dual purpose

Crt.No.	Bull Code	Position for milk and meat production by BLUP	Position for milk and meat production by CC
1	6841	18	1
2	4083	3	2
3	4094	7	2
4	5338	17	4
5	5329	15	5
6	6014	4	5
7	4837	2	6
8	4076	6	7
9	5435	12	8
10	5184	1	9
11	5347	25	9
12	5105	14	10
13	5650	19	11
14	5349	5	12
15	5204	6	13
16	6499	21	14

Source: Own calculations

A large difference was noticed in case of the bull 6841 which came on the 18th postion by BLUP, but on the 1st position by CC.

The rank correlation between the bull ranking by BLUP and CC was 0.563, substantially significant for the probabilities P=0.05 and P = 0.01.

Therefore, the use of BLUP simplified model changes the positions occupied by bulls when CC was utilized. BLUP is well appreciated by breeding experts due to its higher precision compared to contemporary comparison method.

CONCLUSIONS

Friesian is well known as a breed specialized for milk production. However, some bulls are very good to improve both milk and meat production.

The contemporary comparison method has been less and less used in breeding value estimation, because the experts were looking to improve the mathematical models in order to get a higher precision.

BLUP is considered one of the best method in its different variants from a country to another. In case of Romania, BLUP was and is is successfully used in bull breeding value assessment.

BLUP has become a high efficient tool grace of its the highest accuracy with a deep impact on the correct ranking of the productive animals.

Dairy farmers should be aware that using a high breeding value bull they could get more production gain and higher incomes from marketed products: milk or live animals.

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