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RESEARCH ON THE MEAT PRODUCTION DIFFERENCES DETERMINED BY THE BIRTH MONTH OF THE FATTENED STEERS

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Abstract

The purpose of the paper was to assess the effect of the birth month on some meat production characters such as live weight at the age of 180 days, live weight at the age of 365 days and daily gain during the fattening period in progeny testing for bulls' breeding value estimation in order to correct the biases determined by this environmental factor. In this purpose, the following linear mathematical model was used: $x_{ij}=m \cdot a_i \cdot e_{ij}$*, where* x_{ij} *- the live record of the "j" steer in the month "i" (i=1,2,....12), m- geometrical average of the meat production characters taken into account,* a_i*- the multiplicative effect of the birth month "i" and* e_{ij} *– the residual multiplicative effect. A number of 1,705 half-brothers belonging to 105 Friesian bulls from Romania was included in this progeny testing. In order to eliminate the biases* $\hat{a}_{i,}$ *adequate multiplicative adjusting factors were calculated as* $1/\hat{a}_{i.}$*. The conclusion was that the effects of birth month on the meat production in terms of live weight at the age of 180 days, live weight at the age of 365 days and daily gain during the fattening period should not be ignored, on the contrary, they should be eliminated by correcting the real data using corresponding adjusting factors. Therefore, adjusting factors are justifed to be used in order to improve the accuracy of the bulls' breeding value estimation for meat production.*

Key words: *adjusting factors, birth month, high precision breeding value, meat production, progeny testing, steers fattening*

INTRODUCTION

The development of cattle meat production involves a series of technological factors such as: animal breeding, reproduction, nutrition, raising, housing, and farm management in order to increase the live weight at slaughter and improve beef quality in order to better cover consumer's needs.

Genetic improvement is based on breeding programmes which have to be scientifically based on the use of pertinent and more precise data regarding the performance of the individuals taken into consideration [6, 11, 26].

The influence of various environment factors on the accuracy of the data used in animal breeding imposed the setting up of various adjusting factors in order to eliminate their biases which trend to obscure the true genetic ability of sires.

Because of the small amount of data at the herd level, correction factors are usually calculated from the data collected from many herds existing in a region or a country and then they are used in all the herds of that environment.

In order to avoid the biases caused by the different number of groups where the simple group average is calculated, it is imposed to involve more individuals and divide them into subclasses based on various criteria [8, 11, 19, 27]. However, it is also needed to chose a standard to which to adjust various specific characters for beef steers, e.g. birth weight, weaning and post-weaning weight, daily gain etc, which are commonly used in the developed countries. In some countries, besides these factors, there are additionally considered more environmental factors such as: herd and year, season age of dam, previous parous state, calving interval in order to get a higher precision in bull's breeding value assessment, because it is know that bulls assure the highest selection pressure in

transmitting high value genes to a larger proportion of the progeny than a female [9].
Most of the breeding programmes are supported by the application of various linear models whose evolution has deeply performed across the time [13,21, 25, 28].
The scientists who approached the problem of progeny testing for meat production were dealing with various characters which could be divided into three categories:(a) live characters such as: birth weight, weaning and post-weaning weight, weight at various ages of the young steers used in the progeny testing [1, 3, 4, 12, 23, 24]; (b) carcass characters such as: carcass weight, composition, lean meat yield, muscle-bone ration, eye muscle volume index [5, 6, 14]; (c) both live and carcass characters [2, 15, 16,17, 22, 29].
In the recent decades, genomics has been deeply involved in the increasing the accuracy of the estimated breeding value [20].
Also, bioeconomic models were set up linking the biological characters of animals with the financial results of the production system in order to support the development of beef production in low input family-based beef cattle production system [18].
In this context, taking into consideration that in Romania there are few results regarding the effect of birth month on meat production [5,7,23], the present paper aimed to give its contribution to the setting up of adjusting factors for birth month of the steers used in progeny testing in order to increase the accuracy of bull's breeding value estimation.

MATERIALS AND METHODS

The biological material was represented by 1,705 half-brother steers belonging to 105 Friesian bulls from Romania. The steers were fattened in various testing herds for 12 months. The selection characters taken into consideration were the steer live weight at 180 days and 365 days as well as the daily gain during the fattening period.
The average, standard deviation and variation coefficient for the meat production characters mentioned above were calculated using the following mathematical formulas:

Average Weight (AW),

$$AW = \frac{X_1 + X_2 + ... X_n}{n}, \qquad (1)$$

where n = the number of steers cows and X= weight (kg/head) at different ages;

Weight variance, S^2, $$S^2 = \frac{\sum_{i=1}^{n}(X_i - \overline{X})}{n-1}, \qquad (2)$$

Standard Deviation, S, S =

$$\left(\sqrt{\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{n-1}}\right) \qquad (3)$$

Variation Coefficient, $V_{\%}$, $$V_{\%} = \frac{S}{\overline{X}} \text{ x } 100 \qquad (4)$$

The evaluation of the birth month effect on meat production parameters was based on the following linear mathematical model:

$x_{ij} = m \,.\, a_i \,.\, e_{ij}$ (5)

where x_{ij} – meat production character of the „j” half-brotther steer in the birth month „i” (i=1,2,....12), m – geometrical average of the meat production character, a_i –the effect of the birth month „i”, e_{ij} – the multiplicative residual effect.
An addititional model was attached to this model presented above, as follows:

$Y_{ij} = M + A_i + E_{ij}$, (6)

by using logarithms as follows: $Y_{ij} = \lg X_{ij}$, $M = \lg m$, $A_i = \lg a_i$, $E_{ij} = \lg e_{ij}$.
Also, the least square method was applied, resulting the effect of the birth month, symbolized $\hat{a}_i = 10^{Ai}$ and the corresponding adjusting factor $1/\hat{a}_i$.

RESULTS AND DISCUSSIONS

The average live weight at the age of 180 days by birth month varied between 162.0 ± 3.81 kg registered by the steers born in November and 116.4 ± 1.80 kg recorded by the steers born in July.

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Table 1.Parameters for the live weight at the age of 180 days by birth month

Birth month	N	$\overline{X} \pm s_{\overline{X}}$	S	V%
1	283	141.4±1.52	25.6	18
2	189	129.6±1.56	21.5	17
3	225	138.1±1.77	26.6	19
4	268	118.9±1.33	21.7	18
5	183	128.1±1.86	25.2	20
6	131	123.7±1.45	16.6	13
7	57	116.4±1.80	13.6	12
8	11	119.3±4.23	14.0	12
9	152	137.8±1.83	22.5	16
10	94	140.4±2.48	24.1	17
11	51	162.0±3.81	27.2	17
12	61	146.0±3.43	26.8	18

Source:Own calculations

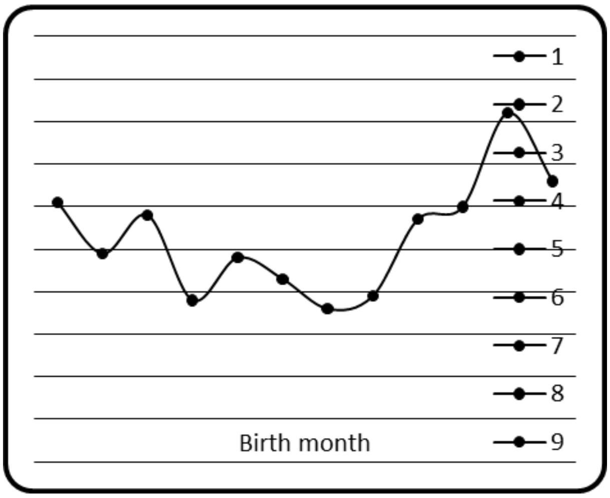

Fig.1.The evolution of steer live weight at the age of 180 days by birth month

Looking at the other figures presented in Table 1, one can see that the individuals born in the months of November, December and January, that is during the winter season were heavier than the ones born in June, July and August, that is in the Summer season.

The variation coefficient varied between 12 % in July and 20 % in May showing that there were no large differences between steers for the studied meat production character in relation to the birth month.

The effect of the birth month and correction factors for the live weight at the age of 180 days are presented in Table 2.

The average live weight at the age of 365 days by birth month varied between 311.5 ± 3.82 kg registered by the steers born in December and 273.8 ± 3.11 kg recorded by the steers born in May.

Table 2. The multiplicative effect of the birth month and the adjusting factors for the live weight at the age of 180 days

Month of birth	Effect of Birth Month	Correction Factors
1	1.056	0.947
2	0.990	1.010
3	1.057	0.946
4	0.940	1.064
5	0.983	1.017
6	0.938	1.066
7	0.896	1.128
8	0.912	1.097
9	1.008	0.992
10	1.020	0.980
11	1.168	0.856
12	1.075	0.930

Source:Own calculations

Looking at the other figures presented in Table 3, one can see that the individuals born in the Fall and Winter seasons registered higher live weights at the age of 365 days in compariosn with the ones which were born during the Summer season.

The variation coefficient varied between 11 % in February and November and 16 % in April showing lower differences between steers for the birth month at the age of 365 days compared to the case at the age of 180 days (Table 3).

The effect of the birth month and correction factors for the live weight at the age of 365 days are presented in Table 4.

Table 3.Parameters for the live weight at the age of 365 days by birth month

Birth month	N	$\overline{X} \pm s_{\overline{X}}$	S	V%
1	283	307.7±2.16	36.4	12
2	189	287.5±2.37	32.6	11
3	225	293.6±2.70	40.5	14
4	268	275.1±2.73	44.7	16
5	183	273.8±3.11	42.1	15
6	131	293.9±3.56	40.8	14
7	57	284.1±5.29	39.9	14
8	11	292.4±12.16	40.3	14
9	152	311.0±3.67	45.2	15
10	94	310.3±4.95	48.0	15
11	51	305.5±4.90	35.0	11
12	61	311.5±3.82	29.9	10

Source:Own calculations

The average daily gain during the fattening period birth month varied between 963.4 ± 56.6 g for the steers born in August and 772.0 ± 23.3 g for the ones born in November.The daily gain varied from a month to another but mainly for the steers born in the months of the Summer season.

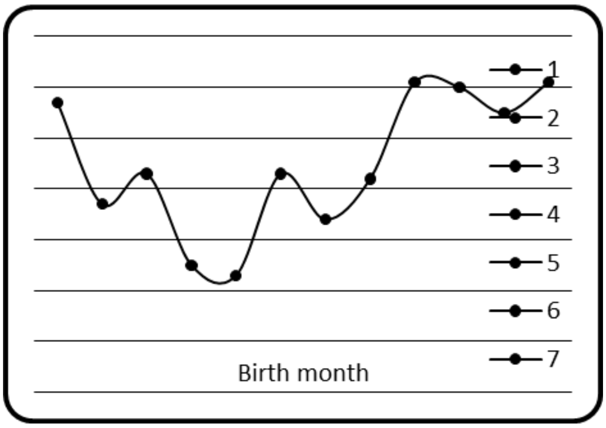

Fig.2.The evolution of steer live weight at the age of 365 days by birth month

Table 4. The multiplicative effect of the birth month and the adjusting factors for the live weight at the age of 365 days

Month of birth	Effect of Birth Month	Correction Factors
1	1.021	0.980
2	0.963	1.039
3	1.002	0.998
4	0.987	1.014
5	0.960	1.041
6	1.010	0.990
7	0.971	1.030
8	0.996	1.004
9	1.038	0.964
10	1.037	0.964
11	0.999	1.001
12	1.021	0.979

Source:Own calculations

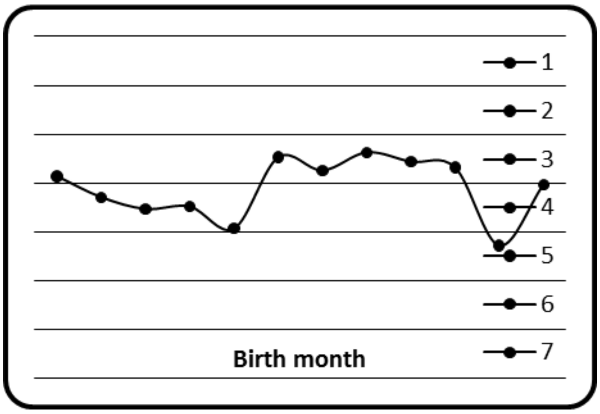

Fig.3.The evolution of steer daily gain during the fattening period by birth month

The variation coefficient varied between 13 % in January and 24 % in May (Table 5).

Table 5.Parameters for the daily gain during the fattening period by birth month

Birth month	N	$\overline{X} \pm s_{\overline{X}}$	S	V%
1	283	914.5±6.8	115.2	13
2	189	871.7±8.5	117.7	14
3	225	847.4±10.1	152.3	18
4	268	852.8±10.8	177.1	21
5	183	807.3±14.3	194.6	24
6	131	953.5±19.3	221.4	23
7	57	926.7±24.4	104.5	20
8	11	963.4±56.6	107.9	20
9	152	944.8±16.3	199.3	21
10	94	932.3±21.2	205.7	22
11	51	772.0±23.3	167.0	22
12	61	897.5±18.6	145.8	16

Source:Own calculations

The effect of the birth month and correction factors for the daily gain during the fattening period are presented in Table 6.

Table 6. The multiplicative effect of the birth month and the adjusting factors for the daily gain during the fattening period

Month of birth	Effect of Birth Month	Correction Factors
1	1.012	0.989
2	0.966	1.035
3	0.973	1.028
4	0.986	1.015
5	0.972	1.028
6	1.063	0.941
7	0.991	1.010
8	1.040	0.961
9	1.039	0.963
10	1.048	0.954
11	0.921	1.086
12	0.999	1.001

Source:Own calculations

CONCLUSIONS

The effects of birth month on the meat production records in terms of live weight at the age of 180 days, live weight at the age of 365 days and daily gain during the fattening period should not be ignored, on the contrary, they should be eliminated by correcting the real data using the corresponding adjusting factors.

The correction factors proposed to be used in the practice of animal breeding should be updated every year, so that the variations which could appear from a year to another to be avoided.

The application of the correction factors for the birth month is very important because it brings an additional precision in meat production assessment, bull breeding value estimation ranking based on their sons performance so that in the top the breeding pyramid to be retained only the best bulls.

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