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ECONOMIC WEIGHT OF PRODUCTION TRAITS FOR ROMANIAN BUFFALO

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Abstract

The paper aimed to present the economic weights of milk yield, fat and protein percent estimated in the population of Romanian Buffalo from Șercaia Research and Development Station. A total 609 milk yield and associated characters records, belonging to 87 females, which coming from 11 sire families, for 7 lactations were analysed. The method used was multiple linear regression, and as a global indicator the „mozzarella index" was used. The economic values for milk yield, fat and protein percent in seven lactations were calculated as: € 0.9636, € 0.1367, € -0.0974; € 0.9729, € 0.0912, € -0.0661; € 0.9948, € 0.1978, € -0.1935; € 0.9922, € 0.1506, € -0.1452; € 0.9932, € 0.2691, € -0.2645; € 0.9891, € 0.1454, € -0.1352; € 0.9890, € 0.1708, € -0.1597. Results indicated that a major weight should be given to milk yield and fat percent. Negative value associated with protein percent suggest that the fat had a higher price compared to protein, and the payment system should be based on milk yield and fat percent for mozzarella production.

Key words*: economic weight, milk yield, fat and protein percent, Romanian Buffalo.*

INTRODUCTION

In Romania, the buffalo entered with the invasion of the Huns and Avars in the Carpatho-Danubian area. It found the good pedo-climatic conditions and so, in our country, has developed a buffalo population which had its own evolutionary path as a result of reproductive isolation (Vidu et al., 2008). The Romanian Buffalo is one of the most important genetic resources for milk and meat production.
Worldwide, in countries where milk production is ensured by buffalo milk, the population of buffalo increased numerical because of the demographical growth of the human population. In Europe, the main country that exploiting buffalo is Italy, the main production being mozzarella type soft cheese. In 2004, Romania ranked in Europe in terms of breeding buffalo, with 100,000 heads (Vidu et al., 2008). Consequence of the lack of supportive policies in the area of buffalo, herd showed a decreasing trend in Romania, FAO estimating that there are 70,000 heads in 2006 and Vidu (2007) estimated a population of about 64,000 heads.
At present, the buffalo herds in Romania have fallen further, reaching about 14,000 heads (personal estimation from the National Institute of Statistics data). In our country, buffalo is predominantly grown in individual subsistence households, with a maximum of 5 heads. Romania has a tradition of growing this species, but with the aging and biological disappearance of the rural population, the species is vulnerable. Also, the vulnerability of the Romanian buffalo is generated by the lack of financial aid, the low milk price, the lack of strong associations of breeders that protect farmers' interests in recent years.
However, Romania has the major advantage of the existence of a research station in the field of buffalo breeding, which has an extremely valuable breeding nucleus.
Increasing the economic efficiency of buffalo production and developing a breeding program are keys to actively conserving of this genetic structure.
The buffalo is a species with remarkable quality, of which we can remember: high percentage of milk fat, meat with exceptional taste qualities, resistance to diseases and heavy environmental conditions, good valorization of poor quality feeds. On the international market, the main product obtained from buffalo milk is Mozzarella, a cheese specialty. The amount of Mozzarella is closely related to the quantity and

quality of milk (Popa et al., 2014) and is a criterion for the selection of buffaloes.

Enormous advantage of exploitation of this species for characters associated with milk production, compared with cows and sheep, is the lower cholesterol content of milk and Mozzarella cheese type, despite higher values of the constituents (Zicarelli, 2004).

Compared with cows, buffalo milk has quality parameters with higher values. The fat percentage range between 6.87 to 8.59% (Rosati and Van Vleck, 2002; Tonhati et al., 2000), protein percentage between 4.13 to 4.55% (Macedo et al., 2001; Rosati and Van Vleck, 2002). In Romania, Velea and Mărginean (2004) specifies that buffalo's milk production falls in to the following parameters: average milk yield 1111.11 kg/lactation, average fat yield 82.10 kg (7.39%), and average protein yield 46.21 kg (4.23%).

So far, no breeding program related to this species has been developed in our country. The genetic improvement of the Romanian buffalo for the characteristics of milk production can increase the attractiveness of this species and thus preserve it.

Animal breeding addresses only useful economic characters. The economic value of the characters is dictated by the market and quantified by different statistical methods. Depending on the relative economic importance, the weight to be given in the selection of each character is determined (Grosu, 2003). Basically, the weight given in the character selection is determined by the impact of each attribute on the profit. The economic value of a character is defined as the relative effect that it is expected to have its increase with one unit on the per capita income (Hazel, 1943, quotet by Grosu, 2003). In other words, the contribution of genetic improvement of a character to increasing production efficiency is called the economic value or economic weight (Gibson, 1987; Groen, 1989).

There are a number of studies showing estimates of economic weight related to milk yield and milk quality parameters for cattle (Gibson, 1989; Van Arendonk and Brascamp, 1990; Bekman and Van Arendonk, 1993; Vargas B et al., 2002; Komlosi et al., 2010 etc.), but very few related to buffalo (Bahareh T.D et al., 2011).

The objective of this study was to estimate economic weight for milk yield, fat and protein milk content, using "Mozzarella index" as an indicator of profitability, using a methodology that gives the maximum accuracy in conditions of the existence an inconsistent data.

MATERIALS AND METHODS

In order to estimate economic weight values, were used the data resulting following control milk production in females belonging Şercaia Research and Development Station. To analyze parameters in dynamic were included in the analysis only animals presenting records to an equal number of lactations.

A total 609 milk yield and associated characters records, belonging to 87 females, which coming from 11 sire families, for 7 lactations were analysed.

The traits studied were: milk yield per lactation, percent of fat and protein, and Mozzarella index as an indicator of profitability.

In control milk production, records with length greater than 270 days were truncated at this point, as suggested by Tonhati et al. (2008) and Aspilcueta-Borquisetal (2010).

The amount of Mozzarella was estimated using the relationship proposed by Altiero et al. (1989) and used in the national genetic evaluation in Italy:

$$MP\ (kg) = MY * \{[(3.5*\%P) + (1.23*\%F) - 0.88] / 100\}$$

In which:

MP is Mozzarella yield (accumulated at 270 days);

MY is milk yield;

%P is protein percent;

%F is fat percent.

The method used to estimate economic weights is based on the multiple linear regression proposed by Hazel in 1943 (Grosu, 2003, 2005). In the case of multiple linear regression, the dependent variable (Y) is the income per head, and the determination of economic weights implies calculating the partial regression of Y relative to each character that it depends on. Y is also called global indicator.

For the production characters analyzed in this paper, the global indicator used (Y) represents the total amount of Mozzarella on lactation

(Mozzarella index) multiplied by 9.5 euro / kg (average market price at the time of analysis):

$$Y(MP \times 9.5\ Euro/kg) = b_1 \times X_1(MY) + b_2 \times X_2(\%P) + X_3(\%F)$$

The global indicator depends directly on each character associated with milk production.

After solving the equation system, in order to obtain comparable economic weights, the partial regression coefficients were standardized by the formula:

$$v_i = b_i \times \sqrt{\frac{\sum x_i^2}{\sum y^2}}$$

For data characterization, the classical statistical method was used: average ($\overline{X} \pm s_{\overline{X}}$), standard deviation (s) and variability coefficient (V%) (Sandu, 1995).

RESULTS AND DISCUSSIONS

Data collected from 87 females were used to derive phenotypical characterization of sample. The results on the average performance of milk production traits and for mozzarella yield are presented in Tables 1, 2, 3 and 4.

Table 1. Descriptive statistics for milk yield

Specification	**U.M.**	**n**	$\overline{X} \pm s_{\overline{X}}$	**s**	**V%**
Lactation 1	kg	87	942.32 ± 41.01	382.53	40.59
Lactation 2	kg	87	1038.21 ± 44.50	415.05	39.98
Lactation 3	kg	87	1181.47 ± 49.72	463.79	39.25
Lactation 4	kg	87	1274.73 ± 47.58	443.78	34.81
Lactation 5	kg	87	1371.47 ± 51.31	478.59	34.90
Lactation 6	kg	87	1479.17 ± 55.46	517.31	34.97
Lactation 7	kg	87	1421.32 ± 50.51	471.14	33.15

Table 2. Descriptive statistics for fat percent

Specification	**U.M.**	**n**	$\overline{X} \pm s_{\overline{X}}$	**s**	**V%**
Lactation 1	kg	87	6.9834 ± 0.1082	1.0090	14.4492
Lactation 2	kg	87	7.0102 ± 0.1071	0.9994	14.2572
Lactation 3	kg	87	6.8664 ± 0.1039	0.9695	14.1196
Lactation 4	kg	87	6.8274 ± 0.1005	0.9375	13.7310
Lactation 5	kg	87	6.8297 ± 0.0814	0.7595	11.1203
Lactation 6	kg	87	6.8672 ± 0.0809	0.7550	10.9949
Lactation 7	kg	87	6.9446 ± 0.1052	0.9810	14.1264

Table 3. Descriptive statistics for protein percent

Specification	**U.M.**	**n**	$\overline{X} \pm s_{\overline{X}}$	**s**	**V%**
Lactation 1	kg	87	4.2749 ± 0.0342	0.3189	7.4593
Lactation 2	kg	87	4.1795 ± 0.0392	0.3656	8.7479
Lactation 3	kg	87	4.5051 ± 0.0289	0.2700	5.9939
Lactation 4	kg	87	4.1625 ± 0.0288	0.2683	6.4471
Lactation 5	kg	87	4.4572 ± 0.0181	0.1692	3.7954
Lactation 6	kg	87	4.1549 ± 0.0249	0.2321	5.5862
Lactation 7	kg	87	4.2976 ± 0.0243	0.2267	5.2751

Table 4. Descriptive statistics for Mozzarella yield

Specification	U.M.	n	$\overline{X} \pm s_{\overline{X}}$	s	V%
Lactation 1	kg	87	213.11 ± 9.22	85.97	40.34
Lactation 2	kg	87	233.04 ± 10.41	97.13	41.68
Lactation 3	kg	87	276.78 ± 12.12	113.08	40.86
Lactation 4	kg	87	282.57 ± 11.16	104.06	36.83
Lactation 5	kg	87	318.21 ± 12.44	116.04	36.46
Lactation 6	kg	87	327.53 ± 12.65	117.96	36.01
Lactation 7	kg	87	323.30 ± 11.85	110.48	34.17

The data presented in Tables1-4 shows that the average values associated with milk production traits are characteristic of a buffaloes population. The values obtained are similar to those reported by Tonhati et al. (2000) and Sarubbi et al. (2012), but lower than those obtained by Malhado et al. (2007).

The variability is high for milk and Mozzarella yield, most likely due to human error associated with the measurement, without neglecting individual variation caused by various factors (genetic and environmental), but for the percent of fat and protein, variability is low. These values indicate that, at least for milk and Mozzarella traits, the population can constitute object of a breeding program with a sufficiently large field for action of artificial selection. The phenotypical homogeneity for fat and protein percent is an advantage for analyzed population because, at first side, effort must be channelled towards genetic improvement of milk yield.

The economic weight of the characters occupies an important place in the improvement decisions. It is closely related to the establishment of the selection objective and genetic improvement technology. When the objective is complex, setting the economic weight is very important for animal breeding as it determines the weight to be given in the selection of the different traits that contribute to the complex character (Drăgănescu and Grosu, 2003).

The economic weights calculated according to the described model for milk yield, fat and protein percent are presented in Table 5.

Table 5. The economic weights for milk yield, fat and protein percent

Specification	U.M.	Milk yield (kg)	Fat percent	Protein percent
Lactation 1	euro	0.9636	0.1367	-0.0974
Lactation 2	euro	0.9729	0.0912	-0.0661
Lactation 3	euro	0.9948	0.1978	-0.1935
Lactation 4	euro	0.9922	0.1506	-0.1452
Lactation 5	euro	0.9932	0.2691	-0.2645
Lactation 6	euro	0.9891	0.1454	-0.1352
Lactation 7	euro	0.9820	0.1708	-0.1597

The values presented in Table 5 show that an increase of average of milk production with one kilo in one lactation period, the income will be increase with approximatively 1 euro. Also, the unitary increase of fat percent (one percent per lactation) will be a positive effect to the income of farm.

Very interesting are the economic weights obtained for the percentage of protein. The negative values associated with this character indicate that, at least in the analyzed population, it is not desirable to increase the percentage of protein, but all the efforts should be directed towards the genetic improvement of the milk quantity and the percentage of fat.

Economic weights obtained for milk yield and fat percent indicates the importance of these traits for Mozzarella production and for analyzed herd.

Negative value associated with protein percent suggest that the fat had a higher price compared to protein, and the payment system should be based on milk yield and fat percent for Mozzarella production. These indicate that, in the first instance, genetic improvement should be directed to increasing milk quantity and fat percentage to increase the economic efficiency of buffalo exploitation. Once the desired level of production is reached, it may eventually improve the quality of the protein.

It is very clear that the economic weights of the analyzed traits are influenced by the obtained quantity of Mozzarella. In this way, a decrease in the cost of obtaining one kg of mozzarella, ie an improvement in the economic efficiency of the exploitation (increase of the feed conversion, decrease of the cost of obtaining the fodder) can lead to an increase of the economic weight for the milk quantity and the percentage of fat. However, this requires a more detailed analysis using other estimation methods with a higher accuracy (profit function).

Similar results have been obtained by other authors, but in dairy cattle. Thus, Gibson (1989) and Bekman and Van Arendonk (1993) obtain negative economic weights for protein.

Seno et al. (2007) in a study regarding economic values of milk production traits, reported positive economic weight for milk yield, and negative for fat and protein yield, but in a system in which milk is sold to diary industry. In other system, in which produce Mozzarella in the farm, the situation is radically changed, all economic weight being positive. This draws attention to the need for deeper analysis, but the lack of data has prevented us from doing so.

CONCLUSIONS

The results regarding economic weights for studied traits indicates that, in analyzed population and according to our available data, a major weight should be given to milk yield and fat percent in relation to genetic improvement program. Genetic improvement of the quantity of Mozzarella will be made only on account of milk and fat. We mention that is absolutely necessary a complex analysis of this topic according to production system, using a more accurate method, but additional data is required for this which we did not have access to in this paper. The results of the animal breeding work depend directly on the accuracy and complexity of the primary data.

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