COMPARATIVE STUDY REGARDING THE PRODUCTIVE PERFORMANCES OF TWO BREEDS OF BEEF CATTLE EXPLOITED IN THE MOUNTAIN AREA OF ROMANIA

V. Maciuc[1*]

[1]*Faculty of Food and Animal Sciences, Iasi University of Life Sciences, Romania*

Abstract

In this paper it is compared the productive performances of two breeds of beef cattle exploited in the mountain area. The studied population was 143 heads belonging to the Aberdeen Angus and Charolaise breeds. Statistical processing and testing was done using the SAVC (Statistics Analysis of Variance and Covariance) computer programs, respectively SPSS 16.00 for WINDOWS. At birth, the weight was on average 30 kg in the Aberdeen Angus breed, and in the Charolaise breed body weight at birth was on average 40 Kg. The average daily weight gain at 365 days for the studied breeds was 828 g, respectively 1153 g for the Charolaise breed. The weight at the age of 365 days for studied cattles from the two farms was 322 kg for the Aberdeen Angus breed and 461 kg for the Charolaise breed. The Aberdeen Angus breed has a low birth weight of 25–28 kg which makes subsequent development slower compared to the Charolaise breed. Optimizing the exploiting conditions will ensure good results up to 365 days and, for the Charolaise breed, good results will be obtained up to 18 month of exploiting. The studied breeds are valuable under optimized exploiting conditions that allow the expression of the genetic potential of animals.

Key words: *cattle, breeds, beef, mountain area, productions*

INTRODUCTION

Raising beef cattles for meat production and meat by-products requires incorporating a combination of factors that bring an increased level of profitability to a farm. In order to fulfill these wishes, it is necessary to take into account the following aspects: the genetic level of the population, respectively the choice of breeds or half-breeds suitable for this type of production; choosing the correct growing technological system; the type of nutrition applied; capitalization of the final production. The breeding of beef cattle is in continuous development, the population of more economically developed countries starting to familiarize themselves with the nutritional qualities of bull meat in relation to the price [1; 2; 3].

In Romania, the exploitation of specialized cattle for meat production represents a relatively new sector of zootechnical activity, for which it is unanimously necessary to know the genetic potential of the meat breeds, the role of the technological infrastructure, the technological flow, the specific annual operations, the adopted reproduction system and the technique nutrition [4; 5; 6; 7; 8].

Infrastructure has an essential role in determining the economic prosperity but also technologically functional of a meat bull farm, which is why these investments must be prioritized and chosen very carefully to be able to function feasibly. Also, the management of the technological flow and the organization of specific annual operations is extremely important because it

[*]Corresponding author: vmaciuc@uaiasi.ro
The manuscript was received: 03.10.2023
Accepted for publication: 14.04.2024

can influence in a favorable sense the operational functionality. Meat breeds were imported at the national level through a combination of favorable economic, human and social factors [9;10].

The Dornelor basin is the mountain area where the research was carried out and here is a tradition in raising animals, an activity that justifies the capitalization of pastures and hayfields in the related localities, due to the fact that all these localities are located at an altitude that argues for belonging to the mountain area in Romania. The profile of mountain areas, being a special one, involves a specific analysis from the perspective of economic activities. Both the existing activities, and especially the potential of their diversification, for the purpose of sustainable development, must be analyzed in the context of the constraints generated by the relief, the state of the existing infrastructure, the history and the specificity of the mountain areas and last but not least in a close correlation with the national and European strategies in field [11;12].

Considering the mentioned aspects, it is considered that is unanimously necessary a deep study regarding the specialized breeding of beef cattle (for meat production) raised in the mountain area, but also the way of approaching the breeds from the point of view of technological, reproductive, nutritional management in order to be able to reach the threshold of desired profitability [13;14;15].

MATERIAL AND METHOD

The research was carried out on a herd of 143 cattle belonging to the cattle breeds specialized for meat, respectively Aberdeen Angus and Charolaise, exploited in two farms in the mountainous area of the Dornelor basin, Suceava county. In both farms, the exploitation system practiced is of an extensive type, the cattle are maintained freely, in the winter they are maintained in a shelter with wooden structure and permanent bedding, and in the summer on pastures and in summer camps. Likewise, the barn for cattle, in the two studied farms, is structured into three areas: rest, exercise and forage. The bedding in the rest area is made of sawdust. Cattle are fed seasonally, from stock in winter and on pasture in summer.

In the winter period, beef cattle are fed with mountain hay - baled in round bales, large, discretionary, juicy feed - 3 kg of fodder beet/head and the meed with a mixture of concentrates. During the summer, the bulls from the meat breeds are taken to the pasture, and in the evening and morning they are given hay and concentrates [16].

On this biological material, it was analyzed the following characteristics: birth weight (kg), average daily weight gain – ADWG (g) and at 200 days, body weight (BW) at 200 days (g), ADWG at 300 days (g), BW at 300 days (kg), ADWG (g) at 365 days and BW at 365 days (kg).

For the study of the productive performances of the cattle herd studied, data were taken from the Genealogical Register of Breeds and processed statistically, within the discipline of Cattle Breeding Technology of FIRAA Iaşi, using the SAVC computer program (Statistics Analysis of Variance and Covariance) to determine the arithmetic mean ($\bar{X}$), the error of the arithmetic mean ($\pm s_{\bar{x}}$), the standard deviation (S), the coefficient of variation (V%), the Fisher test, the Tukey test and including the SPSS 16.00 for WINDOWS program for the Pearson correlation, Chi-Square, ANOVA Tests and the regression line [17].

The parameters that characterize a normal distribution are, on the one hand, the average, and on the other hand, the dispersion indices represented by the variance and the standard deviation of the tracked characters. Statistics are written with Latin letters: arithmetic mean ($\bar{X}$), variance (s^2), standard deviation (s).

Depending on the value of the coefficient of variation, it is determined whether a population is homogeneous (when V% is less than 10%), with medium homogeneity (when V% is between 10 and 20%) or very heterogeneous (when V % is greater than 20%).

The ANOVA test compares the means of several samples at the same time.

The regression line, together with the standard deviations of the X and Y variables, or the correlation coefficient, can constitute a reasonable summary of the joint distribution of the two variable.

RESULTS

Aberdeen Angus and Charolaise, are two valuable cattle breeds specialized for meat production, appreciated by farmers and meat consumers, for their fine "marbling", which makes their meat more tender, juicier and more aromatic than in other cattle breeds. In the USA, but also in Europe, the two breeds are among the first breeds appreciated by farmers. In our study, the results obtained are presented in Table 1 and Figure 1.

Table 1 Meat production statistics on farms and breeds in the studied cattle herd

Breed	Character	n	$\overline{X}$	$\pm s_{\bar{x}}$	S	V%	Minimum	Maximum
Aberdeen Angus	Birth weight (kg)	58	30.97	0.666	4,052	13,081	25	38.00
	ADWG 200 days (g)	58	907.53	26,079	149,814	16,508	616.44	1395
	BW 200 days (kg)	58	214.56	9,847	55,705	25,963	122.53	295
	ADWG 300 days (g)	58	885.06	45,989	79,656	9	818.53	973.33
	BW 300 days (kg)	58	298.29	15,741	27,265	9,140	275.56	328.52
	ADWG 365 days (g)	58	827.90	35,948	164,735	19,898	602.74	1230
	BW 365 days (kg)	58	321.90	8,093	37,086	11,521	257.91	408.29
Charolais	Birth weight (kg)	58	40.32	0.648	3,780	9,373	35	55
	ADWG 200 days (g)	58	1203.89	76,056	228,169	18,953	795.00	1435
	BW 200 days (kg)	58	280.22	14,953	44,860	16,009	201.00	327
	ADWG 300 days (g)	58	0.00	0,000	0,000	0,000	0.00	0.00
	BW 300 days (kg)	58	0.00	0,000	0,000	0,000	0.00	0.00
	ADWG 365 days (g)	58	1153.04	21,771	108,853	9,440	874.00	1254
	BW 365 days (kg)	58	460.56	7,747	38,733	8,410	362.00	490

BW – body weight;

ADWG – average daily weight gain

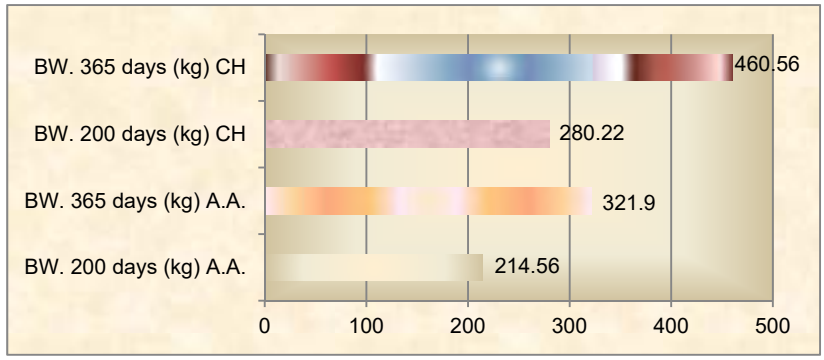

Figure 1 Body weight (BW) in the two breeds studied

Table 2 Correlation coefficients for meat production parameters

Correlations		Birth weight	ADWG 200 days	BW 200 days	ADVG 300 days	Gr 300 days	ADWG 365 days	BW 365 days
Birth weight	Pearson Correlation	1	**,313** *	**,351** *	**.249** *	**.365** *	**.245** *	**.350** *
	Sig. (2-tailed)		,038	,048	,049	.029	,048	,013
	N	174	174	173	174	174	174	174
ADWG 200 days	Pearson Correlation	**,313** *	1	**.763** **	**-,102**	**-,076**	**-.624** **	**-.657** **
	Sig. (2-tailed)	,038		,000	,183	,321	,000	,000
	N	174	174	173	174	174	174	174
BW 200 days	Pearson Correlation	**,351** *	**.763** **	1	**-,106**	**-,083**	**-.623** **	**-.668** **
	Sig. (2-tailed)	,048	,000		,164	,280	,000	,000
	N	173	173	173	173	173	173	173
ADWG 300 days	Pearson Correlation	**-.249** *	**-,102**	**-,106**	**1**	**.788** **	**-,121**	**-,123**
	Sig. (2-tailed)	,049	,183	,164		,000	,113	,107
	N	174	174	173	174	174	174	174
BW 300 days	Pearson Correlation	**.365** *	**-,076**	**-,083**	**.788** **	**1**	**-,122**	**-,124**
	Sig. (2-tailed)	.029	,321	,280	,000		,107	,102
	N	174	174	173	174	174	174	174
ADWG 365 days	Pearson Correlation	**.245** *	**-.624** **	**-.623** **	**-,121**	**-,122**	**1**	**.886** **
	Sig. (2-tailed)	,048	,000	,000	,113	,107		,000
	N	174	174	173	174	174	174	174
BW 365 days	Pearson Correlation	**.350** *	**-.657** **	**-.668** **	**-,123**	**-,124**	**.886** **	**1**
	Sig. (2-tailed)	,013	,000	,000	,107	,102	,000	
	N	174	174	173	174	174	174	174

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
BW – body weight;
ADWG – average daily weight gain

Table 3 shows the main correlations between birth weight and the main indicators studied, the correlations being positive and, in general, of medium to high intensity. Figures 2 and 3 show the regression line for birth weight and body weight respectively average daily gain. In figure 2 we cand see that the regression coefficient has a low to average value and, in figure 3 the value is high, which indicates a strong intensity.

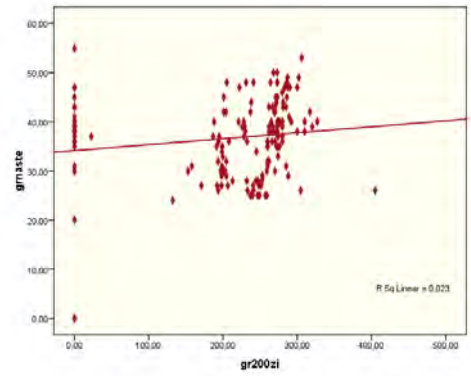

Fig. 2 Regression line for birth weight and weight at 200 days

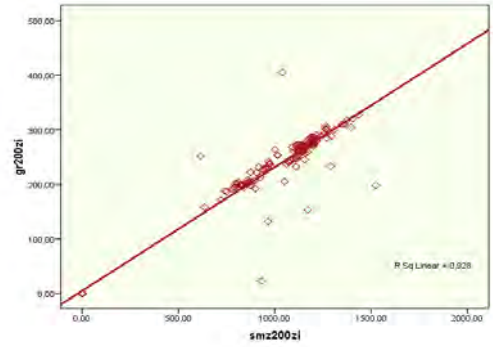

Fig. 3 Regression line for weight and average daily weight gain at 200 days

DISCUSSIONS

The study of meat production on farms and according to the breeds exploited has led to important results for breeders looking at farm efficiency. In Table 1 and Figure 1, there are present the results obtained and find that at birth, the weight was 30 kg in the Aberdeen Angus breed and a body weight at birth of 40 Kg in the Charolaise breed

Average daily weight gain (ADWG) at the age of 200 days was 907 g in Aberdeen Angus with a range of 616 g to 1395 g and 1203 g in Charolaise with a range of 795 g to 1435 g. Correspondingly, the body weight (BW) at 200 days of was 214 kg in the Aberdeen Angus breed, the maximum limit was 295 kg and 280 kg in the Charolaise breed, with a maximum limit of 327 kg. The ADWG at 365 days for the two studied breeds was 828 g and 1153 g for the Charolaise breed.

The BW at the age of 365 days of the studied cattle from the two farms was 322 kg for the Aberdeen Angus breed and 461 kg for the Charolaise breed. At 365 days we find that we have plus variants that reached the weight of 408 kg in the Aberdeen Angus breed and 490 kg in the Charolaise breed.

Analyzing the information in Table 1, we find that the Charolaise breed, exploited in the same environmental conditions, has better results than the Aberdeen Angus breed, with larger ADWG, better growth speed, higher slaughter yield, becoming appreciated by farmers from the mountain area. Of course, the Aberdeen Angus breed has its qualities and should not be neglected.

Tests of the significance of the differences for the ADWG at the age of 200 days indicate highly significant differences for $p < 0.01$ and CI = 95 % in favor of the Charolaise breed. Considering that the ADWG is positively and intermediately correlated with BW, we found significant differences for $p < 0.05$ and CI = 95% at 200 days of 70 kg and at 365 days a difference of 139 kg in favor of the Charolaise breed.

To see how the characters for meat production are correlated, it was determined the Pearson correlation, and the results are shown in Table 2. The (Pearson) correlation coefficient is a measure of the linear association between two variables, in other words the degree to which the bivariate representation in the form of a scatter plot approaches a straight line. Noting with X and Y the two variables and with x_i, y_i, i=1,...,n, the values of the variables.

Following the main links between the studied characters, we find that between the birth weight and the rest of the studied characters there are correlations with intermediate intensity, positive and an upward evolution. Birth weight correlates with average daily gain at 200 days r_p= 0.313 (31%) for $p<0.05$ and CI= 95%. From this, we understand that a heavy heavy birth weight will later determine later very good ADWG and BW. Birth weight is positively and intermediately correlated with BW at 200 days and at 365 days r_p= 0.351 (35%) – 0.350 (35%) for $p<0.05$ and CI= 95%. We find other significant correlations between the rest of the analyzed characters. When two characters or two indicators are negatively correlated (-) it means that when one character increases the other will decrease or when one indicator increases the other will decrease.

The regression line (Figure 2 and 3), together with the standard deviations of the X and Y variables, or the correlation coefficient, can constitute a reasonable summary of the joint distribution of the two variables. The fit of the linear model is better when the scatterplot is elliptical in shape.

In Figure 2 the right has an upward trend with points located near the right, indicating a positive and intermediate relationship. A good birth weight can lead later to good weights at 200 or 365 days. From here, we can find explanations for the difference between the two breeds studied. The Aberdeen Angus breed has a low birth weight of 25–28 kg so the subsequent development could be slower compared to the Charolaise breed. Of course, the optimization of the exploitation conditions will ensure very good results up to 365 days, and with the Charolaise breed good results can be obtained up to 18 months of exploitation.

In Figure 3, the regression line has an upward trend with points on the right, indicating a strong and positive relationship between average ADWG at 200 days and BW at 200 days. Therefore, high ADWG at 200 days will result in high BW at 200 days.

Both beef breeds studied have pluses and minuses so that farmers have to decide which of the two breeds best meets the requirements and is to their preferences.

CONCLUSIONS

Following the research on the productive performance of two breeds of meat exploited in the mountain area, we can conclude:

1. The exploitation in the mountain area of beef cattle breeds is done in an extensive system, and the possibilities of capitalizing the animals at an advantageous price are limited, so it is recommended that the production be processed in the own household, and the capitalization of the production be done by practicing agrotourism.

2. Both studied breeds are valuable under well-optimized operating conditions to allow the externalization of genetic potential. Farmers must decide which of the two breeds best meets their needs, requirements and is to their liking.

3. Cattle breeds specialized for meat make the best use of fodder, pastures and hayfields and can bring satisfaction and profit to the inhabitants of the mountain area.

REFERENCES

1. Brand, T; Hunerberg, M; McAllister, TA; Hey, ML; Saleem, AM; Shen, YZ; Miller, B; Yang, WZ Impact of a phytogenic feed additive on growth performance, feed intake, and carcass traits of finishing steers. *Translational Animal Science* **2019**, *3*, 1162-1172. doi: 10.1093/tas/txz109
2. Chambaz, A; Kreuzer, M; Scheeder, MRL; Dufey, PA Characteristics of steers of six beef breeds fattened from eight months of age and slaughtered at a target level of intramuscular fat II. Meat quality. *Archives of animal breeding* **2001**, *44*, 473-488.
3. Gudex, BW, McPhee, MJ, Oddy, VH, Walmsley, BJ Prediction of ossification from live and carcass traits in young beef cattle: model development and evaluation, *Journal of Animal Science* **2019**, *97*, 144-155. doi: 10.1093/jas/sky422
4. Maciuc, V; Leonte, C; Radu-Rusu, R Manual of good practices in cattle breeding. Iași, RO: Alfa Publishing House, **2015**. ISBN 978-606-540-148-8
5. Maciuc, V; Leonte, C; Tarasenko Lyudmyla Посибник з практического проспечение отчовуванная беликох рогатой худоби. Iași, RO: Alfa Publishing House, **2015**. ISBN 978-606-540-149-5
6. Maciuc, V; Cretu, D; Domnica Maciuc User management - milk-opc software. Iasi, RO: Alfa Publishing House, **2015**. ISBN 978-606-540-151-8
7. Maciuc, V; Cretu, D; Domnica Maciuc MILK-OPC software user manual. Iași, RO: Alfa Publishing House, **2015.** ISBN 978-606-540-150
8. Dubeski, PL; Aalhus, JL; Jones, SDM; Robertson, WM; Dyck, RS Meat quality of heifers fattened to heavy weights to enhance marbling. *Canadian Journal of Animal Science* **1997**, *77*, 635-643. doi: 10.4141/A96-052
9. Greenwood, PL; O'Rourke, BA; Brunner, J; Johns, WH; Arthur, PF; Cafe, LM Cellular development in muscle differs between Angus steers from low and high muscle score selection lines. *Journal of Animal Science* **2019**, *97*, 3199-3212. doi: 10.1093/jas/skz144
10. Lago, A; McGuirk, SM; Bennett, TB; Cook, NB; Nordlund, KV Calf respiratory disease and pen microenvironments in naturally ventilated calf barns in winter. *Journal of Dairy Science* **2006**, *89*, 4014-4025
11. Macdonald, KA; McNaughton, LR; Verkerk, GA; Penno, JW; Burton, LJ; Berry, DP; Gore, PJS; Lancaster, JAS; Holmes, CW A comparison of three strains of Holstein-Friesian cows grazed on pasture: growth, development and puberty. *Journal of Dairy Science* **2007**, *90*, 3993-4003
12. Maciuc, V; Nistor, EC; Bugeac T Research regarding reproduction capacity at dairy cows and the ways of improvement by application of biotechnologies. *European Congress on Biotechnology, Journal of Biotechnology* **2012**, *16,* 23.
13. Maciuc, V; Radu-Rusu, RM Assessment of Gray Steppe cattle genetic and phenotypic traits as valuable resources in preserving biodiversity. *Environmental Engineering and Management Journal* **2018**, *17*, 2741-2748.
14. Roy, JHB Factors affecting susceptibility of calves to disease. *Journal of Dairy Science* **1980**, *63*, 650-664
15. Walkom, SF; Jeyaruban, MG; Tier, B; Johnston, DJ Genetic analysis of docility score of Australian Angus and Limousin cattle. *Animal production science* **2018**, *58*, 213-223. doi: 10.1071/ AN16240
16. Trotz-Williams, LA; Leslie, KE; Peregrine, AS Passive immunity in Ontario dairy calves and investigation of its association with calf management practices. *Journal of Dairy Science* **2008,** 91(10), 3840-3849.
17. Cucu, GI; Maciuc, V; Domnica Maciuc Scientific research and elements of experimental technique in animal husbandry. Iași, RO: Alfa Publishing House, **2004**.