RESEARCH ON MEAT PRODUCTION MANAGEMENT IN A COW FARM

V. Maciuc[1*], M. Doliş[1], Maria Ciocan-Alupii[1], Mariana Nistor-Anton[1]

[1]Faculty of Animal Sciences, University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

Abstract

In this paper we present the results of research on a herd of 120 Aberdeen Angus cattle in which the management and indicators of meat production were followed. The objectives of the research were: the origin of adult cattle, birth weight, weight during fattening, average daily gain in descendants, comparative analysis of meat production indicators by sex. The studied staff had a valuable ascendants. The descendants, for the weight at weighing, had the average value of 239.01 Kg, with the limits between 154 - 340 Kg, and the average daily gain was on average 790 g with the limits between 600 and 1400 g. The explanation lies in the fact that the herd was imported from different countries, areas and farms, but also in the fact that the exploitation system is extensive, on pasture, and in winter it is maintained in semi-open shelters and fed with natural hay, semi-hay or corn silage, wheat bran and sunflower meal. Birth weight is positively and intermediate to strong correlated with weighing weight r = 0.459 (45%) being very significant for p <0.01. Calves that have a high body weight at birth and are vigorous will record good average daily gains, and at the end of the fattening period, very good body weights.

Key words: beef, meat, average daily gain, holding, Aberdeen Angus

INTRODUCTION

Beef has an important role in terms of energy and plastic, being a complete food with a high nutritional and biological value. In terms of chemical composition, beef contains protein 18.7%, fat 15.3%, caloric value of 1800 kcal / kg, but also all essential amino acids.

Exploitation technologies are grouped according to the age of the animals subjected to fattening, but also to the maintenance or feeding system. The criteria according to which the technologies are grouped by age, body mass, average daily gain, level and feeding regime, specific consumption, technological flow of exploitation, as well as cutting efficiency [6], [7], [10], [11], [12], [14]. In Romania, the raising of beef cattle implies certain requirements listed by the Ministry of Agriculture and Rural Development: the increase of the cutting weight which will determine the high yield of meat in the carcass; integrating cattle breeding activity into EU norms and standards; promoting the activity of improving the cattle herd in the direction of increasing and improving meat production; financial support for the organization of holdings in associations, in order to represent the interests in relation to the suppliers of inputs and beneficiaries of the realized products; ensuring own revenues by capitalizing on the production of goods for export; ensuring the necessary conditions for the externalization of the animal's production potential and stimulating the increase of the herds in the mountainous areas that present opportunities in the breeding of cattle for meat [1], [2], [5]. [8], [9], [13], [15].Given the above, we set out to do this research in which we followed the management of meat production and the results obtained in a cattle farm.

MATERIAL AND METHOD

The study was carried out on a herd of 120 Aberdeen Angus cattle, which were exploited within the Dincu Elena Individual Enterprise, in the eastern part of the Suceava county, on the territory of Liteni locality. On this biological material, 60 adult cattle, 33 females and 27 males, the genetic and

*Corresponding author: vmaciuc@yahoo.fr
The manuscript was received: 12.10.2020
Accepted for publication: 12.04.2021

exploitation factors influencing the meat production were studied. The information regarding the origin of the herd and the performances achieved were extracted from the farm records, and the study of the exploitation factors was carried out on the farm [3], [4], [11].The objectives of the research were: the origin of adult cattle, birth weight, weight during fattening and average daily gain in descendants, comparative analysis of indices by sex.

The data thus obtained were systematized, processed and interpreted by the specific methods of such research. The statistics, respectively the parameters, which characterize a normal distribution, are on the one hand the average or median, and on the other hand the dispersion indices represented by the variance and the standard deviation of the pursued character. For this purpose, the computer program S.A.V.C. (Statistics Analysis of Variance and Covariance 2003) to determine the arithmetic mean, the error of the arithmetic mean (± s) the standard deviation (s), the coefficient of variation (V%), and for the ANOVA significance tests respectively p and the Pearson correlation, am used the computer program SPSS 16.The correlation coefficient (Pearson) 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 line. Noting with X and Y the two variables and with xi, yi, i = 1,…, n, the values of the variables, the calculation formula is:

$$r_{XY} = \frac{\sum (x_i - \overline{X})(y_i - \overline{Y})}{\sqrt{\left(\sum (x_i - \overline{X})^2\right)\left(\sum (y_i - \overline{Y})^2\right)}}$$

The correlation coefficient takes values between –1 and +1, inclusive, with the meaning of positive / negative association after the coefficient sign and lack of association for rXY = 0. The statistical significance (approximate) is obtained by applying a Student test with statistics:

$t = r_{XY}\sqrt{\frac{n-2}{1-r_{XY}^2}}$ having n-2 degrees of freedom.

-|0 < r < 0,19| - very low association
-|0,20 < r < 0,25| - low association
-|0,26 <r < 0,40|- moderate association
-|0,41 <r < 0,69| - strong association
-|0,70< r < 1| - very strong association

RESULTS AND DISCUSSIONS

The herd exploited for meat production on the farm under study belongs to the Aberdeen – Angus breed and was imported from Ireland in number of 44 heads and 12 heads from the Czech Republic (table.1).

Table 1 Statistics for meat production indicators on the ascendants

Statistical indicators	Ascendants							
	Father				Mother			
	Weight at birth	Weight at 205 days	Average daily gain at 205 days	Height cm	Weight at birth	Weight at 205 days	Average daily gain at 205 days	Height cm
n	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
$\overline{X}$	38.97	314.37	1312.53	109.6	35.73	287.50	1195.63	105.03
$\pm s_{\bar{x}}$	0.34	0.79	2.90	0.17	0.89	6.05	2.48	0.14
s	1.05	3.89	28.30	1.23	4.89	33.14	23.44	1.37
V %	5.95	7.39	9.21	3.47	8.05	11.34	10.79	2.37
Min	29.42	271.45	1096.73	106.73	28.77	213.18	895.19	101.07
Max	41.57	368.17	1483.07	112.48	39.07	345.24	1377.35	109.28

The results obtained in table 1 show a very good birth weight for the studied breed, respectively an average value of 38.9 Kg for the father of the descendants and 35.73 Kg for the mother of the descendants. Regarding the weight at 205 days, it had an average value of 314.37 Kg in the fathers of the descendants and an average daily gain of 1312.53 g, and in the mothers of the descendants the weight was 287.50 Kg, with an average daily gain of 1195.63 g. We also find variants with a weight of 205 days of 368.17 and 345.24 Kg, and the average daily gain of 1483.07 g and 1377.35 g, respectively. The height at fathers was on average 109.6 cm and 105.03 cm in the mothers of the descendants. We can conclude that the ascendancy of the studied herd is valuable and that these qualities for meat production were also transmitted to the descendants. A similar analysis was performed on the descendants from the farm under study (Table 2).

Table 2 Statistics for meat production indicators on the descendants

Indicators	n	$\overline{X}$	$\pm s_{\bar{x}}$	s	V%	Minim	Maxim
Weight at birth (Kg)	60	36.53	0.254	1.743	4.77	35	42
Number of days to weight	60	262.53	7.106	35.569	18.166	150	348
Weighing weight (Kg)	60	239.01	5.453	24.238	15.666	154	340
Birth weight difference-weighing	60	202.51	5.39	23.805	16.847	124	302
Average daily gain (Kg)	60	0.79	0.018	0.122	15.806	0.6	1.4

The descendants from the holding under study had an average value for birth weight of 36.53 Kg, with limits between 35 and 42 Kg. It is a very good weight, if we consider that for the studied breed the weight mentioned in the literature is 28-30 Kg. Regarding the weight at 260 days, it had an average value of 239.01 Kg, with limits between 154 - 340 Kg, and the average daily gain was on average 790 g with limits between 600 and 1400 g. the indicators studied is average to high 15 -18%. The explanation lies in the fact that the herd was imported from different countries, areas and farms, but also in the fact that the exploitation system is extensive, on pasture, and in winter it is maintained in semi-open shelters and fed with natural hay, semi-hay or corn silage, wheat bran and sunflower meal. The genetic potential of the descendants also reflected in the variants that had a body weight of 340 Kg, and an average daily gain of 1400 g. The analysis of the indicators for meat production was also made according to the sex of the animals, and the results are presented in tables 3 and 4.

Table 3 Statistics for meat production indicators on the female descendants

Indicators	n	$\overline{X}$	$\pm s_{\bar{x}}$	s	V%	Minim	Maxim
Weight at birth (Kg)	33	35.76	0.194	0.97	2.711	35	38
Number of days to weight	33	265.12	10.955	54.777	20.661	88	348
Weighing weight (Kg)	33	236.44	8.266	41.33	17.48	160	340
Birth weight difference-weighing	33	200.28	8.161	40.805	20.374	124	302
Average daily gain (Kg)	33	0.77	0.03	0.151	19.544	0.6	1.2

Table 4 Statistics for meat production indicators on the male descendants

Indicators	n	$\overline{X}$	$\pm s_{\bar{x}}$	s	V%	Minim	Maxim
Weight at birth (Kg)	27	37.91	0.43	2.016	5.388	35	42
Number of days to weight	27	263.59	5.28	37.599	20.188	89	338
Weighing weight (Kg)	27	247.64	7.299	31.308	19.329	154	340
Birth weight difference-weighing	27	209.77	6.225	29.961	18.888	125	298
Average daily gain (Kg)	27	0.82	0.017	0.08	10.448	0.65	1.45

Tables 3 and 4 show an average birth weight of 35.76 Kg in females and 37.91 Kg in males, this difference in development was found at 260 days when weighing, females recorded an average weight of 236.44 Kg, and males an average weight of 247.64 Kg. Suitable, the average daily gain was on average 770 g in females with limits between 600 and 1200 g and in males the average daily gains was 820 g with limits between 650 g and 1450 g. In females, the weight when weighed had values between 124 - 302 kg, and in males it was weighed in the limits of 125 - 298 kg. The coefficient of variability for this indicator 17 - 19% is high and reflects the heterogeneity of the nucleus, but also large imbalances in animal feed.

Table 5 Testing the significance of differences in birth weight

Fusher Test: 5.8486 (F) > F0.01 (2; 91) 4.98 ** d.s. distinctly significant
Tukey Test:

Indicator 1	Indicator 2	Average difference	Q1	Q2	W1	W2	Meaning	Limit
Weight at birth Kg2	Weight at birth Kg	1.38	0	0	0	0	significant	0.05
Weight at birth Kg2	Weight at birth Kg1	2.15	0	0	0	0	significant	0.01
Weight at birth Kg1	Weight at birth Kg	0.77	3.38	4.24	1.03	1.39	insignificant	

Weight at birth Kg -Weight at birth for the whole herd
Weight at birth Kg1 -Weight at birth for the females
Weight at birth Kg2 -Weight at birth for the males

Significance tests indicate that we have significant differences in birth weights in all herds, females and males. Of course, the difference is in favor of males, with about 2.15 Kg. At 250 days after weighing (Table 6), differences in weight and mean daily gains were found, but these differences were no longer significant. It was normal that in optimal operating conditions the differences were significant in favor of males as well. The conclusion that emerges is that there are deficiencies in animal feed by age and weight.

Table 6 Testing the significance of differences in weight when weighing

Fusher Test:0.0042 (F) < F0.05 (2; 91) insignificant
Tukey Test:

Indicator 1	Indicator 2	Average difference	Q1	Q2	W1	W2	Meaning	Limit
Weight at birth Kg2	Weight at birth Kg	8.63	0	0	0	0	insignificant	
Weight at birth Kg2	Weight at birth Kg1	11.2	0	0	0	0	insignificant	
Weight at birth Kg1	Weight at birth Kg	2.57	3.38	4.24	27.75	34.81	insignificant	

Weight at birth Kg -Weight at birth for the whole herd
Weight at birth Kg1 -Weight at birth for the females
Weight at birth Kg2 -Weight at birth for the males

In statistics, dependency is a relationship between two random variables or two sets of data. The correlation refers to a wide class of statistical relationships involving dependence. Hence our desire to know the main correlations for the meat production indicators studied (Table 7).

Fusher Test: 5.8486 (F) > F0.01 (2; 91) 4.98 ** distinct significance
Tukey Test:

Table 7 Pearson correlation for the analyzed indicators

Correlations		Weight at birth(kg)	Number of days to weight	Weighing weight (Kg)	Birth weight difference-weighing	Average daily gain
Weight at birth (kg)	Pearson Correlation	1	.370*	.459**	.435**	.351*
	Sig. (2-tailed)		.010	.001	.002	.048
	N	47	47	47	47	47
Number of days to weight	Pearson Correlation	.370*	1	.862**	.862**	-.378**
	Sig. (2-tailed)	.010		.000	.000	.009
	N	47	47	47	47	47
Weighing weight (Kg)	Pearson Correlation	.459**	.862**	1	.998**	.187*
	Sig. (2-tailed)	.001	.000		.000	.045
	N	47	47	47	47	47
Birth weight difference-weighing	Pearson Correlation	.435**	.862**	.998**	1	.182*
	Sig. (2-tailed)	.002	.000	.000		.042
	N	47	47	47	47	47
Average daily gain	Pearson Correlation	.351*	-.378**	.187*	.182*	1
	Sig. (2-tailed)	.048	.009	.045	.042	
	N		47	47	47	47

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Between the weight at birth and the weight at weighing we find a positive and intermediate correlation towards strong r = 0.459 (45%) being very significant for p<0.01. We can conclude that calves that have a high body weight at birth and are vigorous will register good average daily gain, and at the end of the fattening period, very good body weights (fig. 1). Suitable, birth weight is positively and significantly correlated with mean daily gain r = 0.351 (35%), p = 0.05, C.I. = 95%. Regarding the highlighted aspects, we also present the regression line for birth weight and weighing weight.

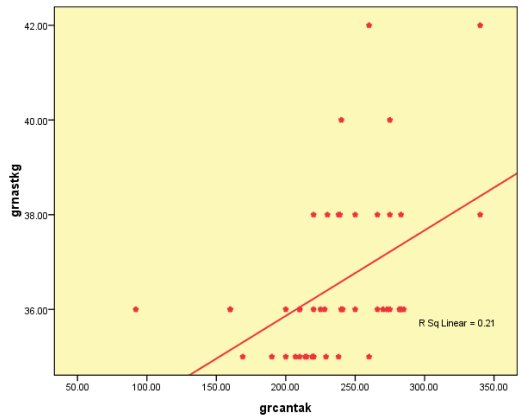

Fig. 1 The right of regression for birth weight and weighing

The evolution of the weight at weighing is positive and significant, the line having a bottom-up direction, and the points are distributed near and to the right of the regression.

CONCLUSION

In the ascendants, the weight at weighing had an average value of 314.37 Kg for the fathers of the ascendants and an average daily increase of 1312.53 g, and in the mothers of the ascendants the weight was 287.50 Kg, with an average daily increase of 1195,63 g. The studied herd had a valuable ascendants. The descendants, for the weight at weighing, had the average value of 239.01 Kg, with the limits between 154 - 340 Kg, and the average daily increase was on average 790 g with the limits between 600 and 1400 g. in the fact that the herd was imported from different countries, areas and farms, but also in the fact that the exploitation system is extensive, on pasture, and in winter it is maintained in semi-open shelters and fed with natural hay, semi-hay or silage corn, wheat bran and sunflower meal. The weight at weighing is positively and intermediate correlated strongly with the weight at weighing $r = 0.459$ (45%) being very significant for $p < 0.01$. Calves that have a high body weight at birth and are vigorous will record good average daily gains, and at the end of the fattening period, very good body weights.

ACKNOWLEDGEMENT

Thanks to my masters for their collaboration

REFERENCES

[1]. Arguello-Rangel, J., Mahecha-Ledesma, L., Angulo-Arizala, J. 2019: Fodder shrubs: relevance in cattle systems of Colombian low altitude lands. Agronomia Mesoamericana, Volume: 30, Issue: 3, p. 899-915

[2]. Biel, W., Czerniawska-Piatkowska, E., Kowalczyk, A. 2019: Offal Chemical Composition from Veal, Beef, and Lamb Maintained in Organic Production Systems. Animals, Volume: 9, Issue: 8, Article Number: 489

[3]. Cucu Gr. I., Maciuc V., Maciuc Domnica 2004: Scientific research and elements of experimental technique in animal husbandry. Ed. Alfa, Iaşi

[4]. Ekakoro, JE., Caldwell, M., Strand, EB., Strickland, L., Okafor, CC. 2019: A survey of antimicrobial use practices of Tennessee beef producers. BMC Veterinary Research, Volume: 15, Article Number: 222

[5]. Gagaoua, M., Terlouw, C., Richardson, I., Hocquette, JF., Picard, B. 2019: The associations between proteomic biomarkers and beef tenderness depend on the end-point cooking temperature, the country origin of the panelists and breed. Meat Science, Volume: 157, Article Number: 107871

[6]. Giro, A., Pezzopane, JRM., Barioni, W., Pedroso, AD., Lemes, AP. et al. 2019: Behavior and body surface temperature of beef cattle in integrated crop-livestock systems with or without tree shading. Science of the Total Environment, Volume: 684, p. 587-596 [7]. Hommerich, K., Ruddat, I., Hartmann, M., Werner, N., Kasbohrer, A., Kreienbrock, L. 2019: Monitoring Antibiotic Usage in German Dairy and Beef Cattle Farms-A Longitudinal Analysis. Frontiers in Veterinary Science, Volume: 6, Article Number: 244

[8]. Koknaroglu, H., Hoffman, MP. 2019: Season affects energy input/output ratio in beef cattle production. Journal of Animal Behaviour and Biometeorology, Volume: 7, Issue: 4, p. 149-15

[9]. Li, A., Qin, Q., Xiao, H., Fang, X., Jiang, P., Zhao, Z., Yang, R. 2017: Association of two SUMO3 gene single nucleotide polymorphisms with carcass and meat quality traits of the Chinese Simmental Cattle. Journal of Animal and Plant Sciences, Volume: 27, Issue: 3, p. 756-76

[10]. Maciuc V., Radu-Rusu R.M., Popescu CE., Nacu G., Hoha GV. 2019: Study on Improving Beef Production Through Industrial Crossing. Scientific papers-series D-Animal Science, Bucharest, Volume: 62, Issue: 1, pp. 300-305

[11]. Maciuc V., Nistor C. E., Popescu E. C., 2019 - Research Regarding The Factors Influencing Meat Production at a Bovine Herd. Scientific Papers-Animal Husbandry Series vol. 72 (24), U.Ş.A.M.V. Iasi

[12]. Mahmood, S., Dixon, WT., Bruce, HL. 2019: Cattle production practices and the incidence of dark cutting beef . Meat Science, Volume: 157, Article Number: 107873

[13]. Navarrete-Molina, C., Meza-Herrera, CA., Herrera-Machuca, MA., Lopez-Villalobos, N., Lopez-Santos, A., Veliz-Deras, FG. 2019: To beef or not to beef: Unveiling the economic environmental impact generated by the intensive beef cattle industry in an arid region. Journal of Cleaner Production, Volume: 231, p. 1027-1035

[14]. Panea, B., Olleta, JL., Sanudo, C., Campo, MD., Oliver, MA., Gispert, M., et al. 2018: Effects of breed-production system on collagen, textural, and sensory traits of 10 European beef cattle breeds. Journal of Texture Studies, Volume: 49, Issue: 5, p. 528-535

[15]. Vale, P., Gibbs, H., Vale, R., Christie, M., Florence, E., Munger, J., Sabaini, D. 2019: The Expansion of Intensive Beef Farming to the Brazilian Amazon. Global Environmental Change-Human and Policy Dimensions, Volume: 57, Article Number: UNSP 101922.