

# RESEARCH ON THE PRODUCTIVE PERFORMANCE OF BEEF CATTLE BREEDS EXPLOITED IN THE DORNELOR BASIN

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## Abstract

*In this paper, we followed the productive performances of a herd of cattle belonging to the Charolaise and Aberdeen Angus beef breeds exploited in the Dornelor Basin. It is well known that both internal factors, exploitation and environmental factors influence the productive level of cattle. The research was carried out in four farms of the mentioned mountainous area, two populated with the Charolaise breed, with a total of 116 heads, and two populated with the Aberdeen Angus breed, with a total of 60 heads. The exploitation technology was studied and several indicators were followed: weight at birth (kg), average daily gain and weight at 200 days (g, kg), 300 days (g, kg), and 365 days (g, kg).*

*The analysis by breed showed that the Aberdeen Angus breed had a birth weight of 29 kg, compared to 40 kg for the Charolaise breed, which are significant differences. The average daily gain at the age of 200 days was 966 g in the Aberdeen Angus breed, lower compared to the same gain in the Charolaise breed (1136 g). Weight at 200 days of age was 216 kg for the Aberdeen Angus breed compared to 268 kg recorded for the Charolaise breed. At the age of 365 days, the cattle from the Aberdeen Angus breed registered a body weight of 323 kg, lower compared to the weight obtained in the cattle from the Charolaise breed, respectively 460 kg. The average daily gain obtained at the age of 365 days was 835 grams in the Aberdeen Angus breed and 1153 g in the Charolaise breed. The study shows that the Charolaise cattle breed has the best results in terms of birth weight, average daily gain and body weight at 200 days, 300 days and 365 days.*

**Key words:** cattle, meat, productive performance, mountainous area

## INTRODUCTION

Beef is a complete food, rich in protein and special organoleptic properties. It contains 34.9% dry matter, of which 18.7% protein, 15.3% fat and 0.9% mineral salts, with an energy value of 2270 kcal/kg. It also contains all the essential amino acids - lysine 1.78 g/100g meat, leucine 1.68 g, arginine 1.32 g, valine 1.14 g, isoleucine 1.04 g, phenylalanine 0.80 g, threonine 0.80 g, histidine 0.58 g, methionine 0.46 g, and tryptophan 0.22 g/100 g meat (Navarrete-Molina et al., 2019; Roque et al., 2009; Vale et al., 2019).

The average biological value of meat proteins is 74%, the coefficient of net utilization of proteins 70%, the digestibility

97%, the coefficient of protein efficiency 2.3 g growth rate/g ingested protein.

Cattle provide a convenient meat in terms of cost, because they utilize a wide range of forages, generally by volume, such as: pastures, roughages, industrial residues, etc., which are more commonly found and are very cheap. Last but not least, beef contributes to a rational and balanced human diet, ensuring a good state of health and fighting undernutrition, malnutrition, phenomena encountered on a large scale in many countries around the world. As a result of the mentioned qualities, we appreciate that it is a product of particular importance for man, which requires a quantitative and qualitative development simultaneously with the increase of its economic efficiency (Gagaoua et al., 2019; Malimood et al., 2019, Panea et al., 2018).

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The manuscript was received: 10.10.2022

Accepted for publication: 01.11.2022

Considering the presented, we proposed to do the present research in which we followed the productive performances of beef cattle breeds exploited in the Dornelor Basin.

## MATERIAL AND METHOD

The research was carried out on a herd of cattle belonging to the Charolaise and Aberdeen Angus meat breeds exploited in the mountainous area of Dornelor Basin. It is known that both internal factors, exploitation and environmental factors influence the productive level of cattle. Four farms from the mentioned mountain area were studied, two populated with the Charolaise breed, with 116 heads and two populated with the Aberdeen Angus breed, with 60 head of beef cattle. The total population studied was 176 cattle.

The following indicators were analyzed on this biological material: weight at birth (kg), average daily weight gain at the age of 200 days (g), 300 days (g) and 365 days (g), body weight at the age of 200 days (kg), 300 days (kg) and 365 days (kg).

The data resulting from observations and direct determinations on the farm as well as from the primary data of the farm, but also from the records of the Official Production Control (COP) carried out by the Animal Breeders' Association were systematized and statistically processed (Cucu et al., 2004; Ekakoro et al., 2019): (arithmetic average),  $\pm s$  (error of the average),  $s$  (standard deviation),  $V\%$  (coefficient of variation) respectively the Fisher, Tukey and  $p$  significance tests. The obtained results were synthesized in tables and figures.

The purpose of this research was to identify which meat cattle breeds are raised in Dornelor Basin and which are the best regarding the farmers needs for this production.

## RESULTS AND DISCUSSIONS

The analysis of the results obtained in the ancestry (figure 1) highlighted the following aspects: in the Aberdeen Angus breed, the ancestry had an average birth weight between 32-35 kg, the average daily gain at the age of 200 days between 886-916 g for the father, the weight at the age of 200 days was 207 kg

for the mother and 219 kg for the father. Correspondingly, the average daily gain at 365 days of age was 1019 g in the father and 1009 g in the mother, and body weight was 410 kg in the father and 460 kg in the mother.



Figure 1 Meat production statistics by ancestry

In the Charolaise breed, the ancestry had an average birth weight of 44 kg for the father and 40 kg for the mother, average daily gains at the age of 200 days of 1190 g for the father, 1184 g for the mother, respectively body weight of 286 kg for father and 277 kg in mother at the same age. At the age of 365 days, gains of 1304 g in the father and 1233 g in the mother were recorded with body weights at the same age of 517 kg in the father and 489 kg in the mother.

Following the analysis of the ancestry, we found that the best birth weights, gains at the age of 200 days, respectively body weights at this age are obtained in the Charolaise breed. Also, gains and weights at 365 days of age are greater in Charolaise ancestry than in Aberdeen Angus ancestry.

The results obtained for the offspring are presented in Table 1. We find that the Aberdeen Angus breed recorded an average birth weight of 29.696 kg with limits between 20-48 kg and a coefficient of variation of 16%, which implies an average variability. The Charolaise breed recorded an average birth weight of 40.66 kg with limits between 29-55 Kg, and the coefficient of variation was 12%.

Table 1. Meat production statistics by breed, in the offspring of the studied cattle herd

Breed	Character	n	$\bar{X}$	s	V%	Minimum	Maximum
Aberdeen Angus	Birth weight (kg)	55	29.96	4.819	16.082	20.00	48.00
	Average daily gain at 200 days (g)	50	966.70	179.796	18.599	616.44	1525.00
	Weight at 200 days(kg)	49	216.70	50.620	23.359	22.53	405.00
	Average daily gain at 300 days (g)	6	763.60	153.789	20.140	546.01	973.33
	Weight at 300 days (kg)	6	295.79	21.372	7.225	273.00	328.52
	Average daily gain at 365 days(g)	29	835.00	165.323	19.799	576.67	1390.00
	Weight at 365 days(kg)	30	323.68	45.408	14.029	204.00	424.00
Charolaise	Birth weight(kg)	116	40.66	5.029	12.366	29.00	55.00
	Average daily gain at 200 days (g)	91	1136.99	131.018	11.523	740.00	1435.00
	Weight at 200 days(kg)	91	267.97	26.221	9.785	188.00	327.00
	Average daily gain at 300 days (g)	0	0.00	0.000	0.000	0.00	0.00
	Weight at 300 days (kg)	0	0.00	0.000	0.000	0.00	0.00
	Average daily gain at 365 days(g)	25	1153.04	108.853	9.440	874.00	1454.00
	Weight at 365 days(kg)	25	460.56	38.733	8.410	362.00	500.00

Average daily gain at 200 days had an average value of 966.7 g in the Aberdeen Angus breed, and an average value of 1136.99 kg in the Charolaise breed. Correspondingly, the body weight at 200 days was 216.7 kg in the Aberdeen Angus breed and 267.97 kg in the Charolaise breed.

At 300 days, the average daily gain of the Aberdeen Angus breed had an average value of 763.6 g, and the body weight was 295.79 kg with limits between 273-328 kg.

In the same context, at 365 days the average daily gain had an average value of 835 g for the Aberdeen Angus breed and 1153 g for the Charolaise breed. The maximum limit for this indicator was 1454 g for the Charolaise breed and 1390 g for the Aberdeen Angus breed. In both cores there are plus variants that can be used in genetic improvement programs. At 365 days, the Aberdeen Angus breed had an average body weight of 323.68 kg compared to the Charolaise breed which had a body weight of 460.56 kg. Body weight at 365 days ranged

between 204-424 kg in the Aberdeen Angus breed and 362-500 kg in the Charolaise breed.

The statistical processing of the entire analyzed population (Table 2) in the mountainous area of the Dornelor Basin highlighted the following aspects: the birth weight had an average value of 37 kg, the average daily gain at the age of 200 kg was 1076 grams, the weight at 200 kg was 250 kg, average daily gain at 365 days of age was 982 grams, and body weight at 365 days of age was 385 kg.

Due to the harsh conditions generated by the climate, sloping lands, in this area you can generally find breeds of bulls with organic resistance and good adaptability, respectively the breeds: Pinzgau, Brown, Romanian Băltată, but also breeds specialized for meat production as well as mestizos of these races. From these breeds, satisfactory production levels are expected that lead to the profitability of the farm and that justify the work of the farmer.

Table 2. Meat production statistics in the offspring of the studied cattle herd

Character	n	$\bar{X}$	s	V%	Minimum	Maximum
Birth weight (kg)	171	37.22	7.043	18.923	20.00	55.00
Average daily gain at 200 days (g)	141	1076.60	170.393	15.827	616.44	1525.00
Weight at 200 days(kg)	140	250.02	43.957	17.581	22.53	405.00
Average daily gain at 300 days (g)	6	763.60	153.789	20.140	546.01	973.33
Weight at 300 days (kg)	6	295.79	21.372	7.225	273.00	328.52
Average daily gain at 365 days(g)	54	982.24	213.142	21.700	576.67	1454.00
Weight at 365 days(kg)	55	385.90	80.657	20.901	204.00	500.00

The results certify that the mountain area has sufficient resources for raising and exploiting cattle breeds specialized for meat production.

## DISCUSSIONS

The Dornelor Basin, a mountainous area, has a tradition of raising animals, an activity that justifies the exploitation of pastures and hayfields, due to the fact that all these localities are located at an altitude that argues for their belonging to the mountainous area in Romania (Giro et al., 2019; Ciocan-Alupii et al., 2021).

Protecting biotopes and maintaining biodiversity are ecological objectives highlighted in European policies. The mountain area must adapt to these constraints and use natural processes and local resources rather than chemical inputs to ensure production, limiting the ecological footprint of animal and crop production systems (Giannoccaro et al., 2015; Morgan-Davies et al., 2017; Hotărăre nr. 506/2016; Legea nr.197/2018).

In Spain, studies have been done on the utilization of mountain and lowland pastures by cattle from local breeds and breeds specialized for meat production. The results highlighted the efficiency of these breeds, but also the quality of the productions obtained (Roman-Trufero et al. 2019).

In Italy, studies were done on consumer perceptions in relation to the well-being of beef and milk cows, in traditional mountain farms. The results of the study show that

consumers' perception is that mountain products are healthier because origin, location and small-scale production are the quality attributes of mountain products (Zucali et al., 2017; Zuliani et al., 2018).

This is how we explain that in the Dornelor Basin, specialized breeds are exploited for meat production, as well as local breeds resistant, with mixed milk-meat productions (Alvarez-Rodriguez et al., 2011; Biel et al., 2019; Maciuc et al., 2018).

From the present study we can conclude that the breed with the best meat production skills and therefore the best results in terms of birth weight, average daily gain and body weight at different ages is the Charolaise breed. At 365 days, the average daily gain had an average value of 835 g in the Aberdeen Angus breed and 1153 g in the Charolaise breed, and the body weight was 323.68 kg in the Aberdeen Angus breed and 460.56 kg in the Charolaise breed.

The Charolaise breed has a good growth rate, high average daily gains of 1100-1400 g until the age of 15-18 months produces the heaviest carcasses, usually at the age of 15-18 months, carcasses of about 420 kg are obtained. Charolaise cattle have the best forage utilization, especially coarse ones (Dufey et al., 2016; Maciuc et al., 2015).

The Aberdeen Angus breed has a very good growth rate in the first 12 months when it can achieve high performance at the carcass level, and the finishing of Angus cattle is faster than other breeds. The average daily weight gain in the first 12 months

varies between 1000-1350 g, and the body weight at 365 days can reach values of 450 kg. After this age, consumption increases and weight gain decreases (Dufey et al. 2016; Maciuc et al. 2015).

Both breeds make use of the mountain pastures and respond from a satisfactory productive point of view, so as to ensure the profitability of the holdings.

## CONCLUSIONS

In the breeds studied, the most valuable performances in ancestry are obtained at the age of 200 days, but also at the age of 365 days;

In Charolaise breed, gains and higher birth weights are found; at the age of 200 days and at 365 days compared to the Aberdeen Angus breed;

The Charolaise breed has good growth rate, high average daily gains even after twelve months of operation, while the Aberdeen Angus breed performs well in the first 12 months, when it can achieve high carcass performance and finishing cattle is faster.

## ACKNOWLEDGEMENTS

I would like to thank the doctoral students and colleagues with whom I collaborated in this research.

## REFERENCES

- Alvarez-Rodriguez, J, Villalba, D, Cubilo, D, Molina, E., (2011)-Macromineral serum concentration in beef calves under organic production. *Itea-informacion tecnica economica agraria*, Volume: 107, Issue: 2, Pages: 94-101
- 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
- Cucu Gr. I., Maciuc V., Maciuc Domnica (2004): Cercetarea științifică și elemente de tehnică experimentală în zootehnie. Ed. Alfa, Iași
- Dufey, PA, Messadene, J, Silacci, P. (2016) - Beef Cattle on the Alp - Whey Consumption and Meat Quality. *Agrarforschung schweiz*, Volume: 7, Issue: 1, Pages: 30-39
- 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
- Giannoccaro, G, Viscecchia, R, De Gennaro, BC, (2015) - Influence of the CAP reform on livestock Outlook for selected European regions by 2020. *Outlook on agriculture*, Volume: 44, Issue: 4, Pages: 303-308, DOI: 10.5367/oa.2015.0218
- 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
- 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
- Maciuc V., Leonte C., Radu-Rusu R., (2015) - Manual de bune practici în creșterea bovinelor. 100 pp. Edit. Alfa, Iași, ISBN 978-606-540-148-8
- Maciuc, V, Radu-Rusu, Rm (2018) - Assessment of Grey Steppe Cattle Genetic and Phenotypic Traits as Valuable Resources in Preserving Biodiversity. *Environmental Engineering and Management Journal*, Volume: 17, Issue: 11, Pages: 2741-2748., Iasi
- Maria Ciocan-Alupii, VasileMaciuc, Mariana Nistor-Anton(2021) - The evolution of meat products which have benefited from the optional quality mention "Mountain Product" in the Mountain Area of Romania, during the period 2017-2020. *Scientific Papers, Animal Sciences*, Vol. 76, ISSN-L 1454-7368, ISSN 2067-2330, U.Ș.V. Iași
- Mahmood, S., Dixon, WT., Bruce, HL. (2019): Cattle production practices and the incidence of dark cutting beef .*Meat Science*, Volume: 157, Article Number: 107873
- Morgan-Davies, C, Wilson, R, Waterhouse, T., (2017) - Impacts of farmers' management styles on income and labour under alternative extensive land use scenarios. *AGRICULTURAL SYSTEMS*, Volume: 155, Pages: 168-178
- 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
15. Panea, B., Olleta, J.L., Sanudo, C., Campo, M.D., Oliver, M.A., 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
  16. Roman-Trufero, A., Garcia-Prieto, V., Martinez, A., Osoro, K., Celaya, R., (2019)- Beef steer production from two local breeds under two management systems differing in the utilisation of mountain pastures. *Italian journal of animal science*, Volume: 18, Issue: 1, Pages: 1174-1185
  17. Roque, O., Mieville-Ott, V., (2009) -The market for meat from the Herens breed in the Valais. Prospects for the organisation of the supply chain. *Agrarforschung*, Volume: 16, Issue: 6, Pages: 198-203
  18. 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
  19. Zucali, M, Tamburini, A, Sandrucci, A, Bava, L., (2017)- Global warming and mitigation potential of milk and meat production in Lombardy (Italy). *Journal of cleaner production*, Volume: 153, Issue: 1, Pages: 474-482
  20. Zuliani, A, Esbjerg, L, Grunert, KG, Bovolenta, S, 2018 - Animal Welfare and Mountain Products from Traditional Dairy Farms: How Do Consumers Perceive Complexity?. *Animals*, Volume: 8, Issue: 11, Article Number: 207
  21. \*\*\*Hotărâre nr 506/2016 privind stabilirea cadrului instituțional și a unor măsuri pentru punerea în aplicare a Regulamentului delegat (UE) nr. 665/2014 al Comisiei din 11 martie 2014 de completare a Regulamentului (UE) nr. 1.151/2012 al Parlamentului European și al Consiliului în ceea ce privește condițiile de utilizare a mențiunii de calitate facultative ”produs montan”
  22. \*\*\*Legea Muntelui nr. 197 din 20.07.2018