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Breeding Qualities of Aberdeen-Angus Cows of Different Genotypes in Northern Kazakhstan

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Abstract: The Aberdeen-Angus breed of cattle is widely used to increase the number of breeding cores and beef production volumes and improve its quality in the Republic of Kazakhstan. The purpose of the research is to study the breeding and adaptive qualities of Aberdeen-Angus cattle in the conditions of the Kostanay region (Northern region of the Republic of Kazakhstan). To achieve this goal, we studied the breeding qualities of imported breeding stock Aberdeen-Angus cows and their breeding use as factors in the formation of productivity in future offspring. In the conditions of Northern Kazakhstan, the breeding qualities of this breed were studied depending on the country of origin. The experimental part of the work was carried out in 2019-2022. Two groups were formed: Group I (n = 288 heads) Kazakh breeding and Group II (n = 100 heads) Estonian breeding, which was grown under the same conditions of feeding and maintenance in "Kolos-firma" LLP of Kostanay region. According to all the considered breeding qualities, superiority was observed in cattle of Estonian breeding.

Keywords: Adaptation, Aberdeen-Angus Breed, Breeding Stock, Breeding Core Exterior

Introduction

The main task of breeding work in beef cattle breeding is the cultivation of highly productive animals, the continuous improvement of existing and the creation of new, more economical, intrabreed types of beef cattle (Chechenikhina *et al*., 2018; Nametov *et al*., 2022). Moreover, animals must have high adaptive properties of suitability for use in the conditions of industrial-type livestock enterprises (Bugasov, 2018).

World experience shows that meeting the demand for beef is impossible without developed specialized beef cattle breeding, the share of which in the total number of cattle in developed countries ranges from 40-85% (Osyanin *et al*., 2018).

In recent years, great attention has been paid to foreign breeding in the Republic of Kazakhstan, in connection with which work continues on the import of specialized beef cattle as a source of production of high-quality "marble meat", which serves as a strategic direction of Kazakhstan animal husbandry (Lastovets, 2018).

Monitoring of beef cattle breeding by the number of cattle of both domestic and priority foreign specialized breeds of beef cattle in the Republic of Kazakhstan is shown in Fig. 1 (Ministry of Agriculture of the Republic of Kazakhstan, 2022).

The analysis of the dynamics of the absolute number of cattle of the meat direction of productivity in recent years (2020-2022) in the Republic of Kazakhstan and their belonging to various breeds showed, according to Fig. 1, the largest proportion of animals is: Kazakh whiteheaded (60%), Aberdeen-Angus (18%), Auliekol breed, Herefordskaya (10%) each and Kalmyk (2%) breed (Chechenikhina *et al*., 2018). Recently, for imported beef cattle breeds, there has been a tendency to increase the absolute and relative number of Aberdeen Angus breeds (Saruar, 2020), which for the years taken into account amounted to 18%, the relative number of animals, which increased from 2020-2021 by 10.4%, from 2021-2022 by 6.1%.

In general, the Aberdeen-Angus breed can be considered the most dynamically developing and in demand (Mazzucco *et al*., 2016; Raidan *et al*., 2016), which surpasses other foreign breeds in the number of imported breeds to the Republic of Kazakhstan, such as Hereford by 8% and Kalmyk by 16%, according to Fig. 1. It should be noted that cattle of the Aberdeen-Angus breed acclimatize well in the conditions of a sharply continental climate, to which the northern part of the Republic of Kazakhstan belongs.

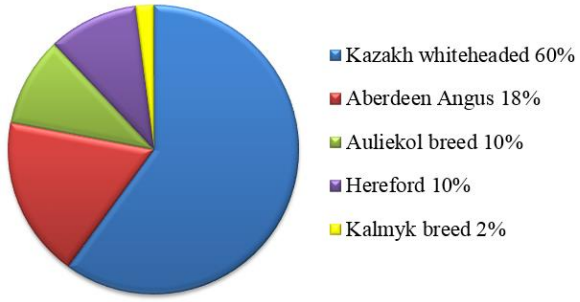

Fig. 1: The number of breeding stock of beef cattle in the Republic of Kazakhstan

Thus, the successful development of beef cattle breeding in Kazakhstan largely depends on the breeding use of imported animals and their adaptation characteristics to new conditions. To be precise, adaptation to a specific climatic zone, since when imported cattle enter new natural and climatic conditions, there is a change in breeding characteristics, which, ultimately, in one way or another the degree is reflected in their biological qualities, up to changes in the physiological functions of the whole organism (Babich *et al.*, 2022).

However, the breeding qualities and biological characteristics of Aberdeen-Angus cattle are insufficiently studied in the conditions of the northern part of the Republic of Kazakhstan. In this connection, there is a need to study the breeding and adaptive qualities of this breed. As well as determining the stability in the transmission of hereditary traits as the main factors in the formation of productivity in future offspring and their breeding use in the conditions of the Northern region of Kazakhstan.

The purpose of the research is to study the breeding and adaptive qualities of Aberdeen-Angus cattle in the conditions of the Kostanay region (Northern region of the Republic of Kazakhstan). To achieve this goal, we studied the breeding qualities of imported breeding stock Aberdeen-Angus cows and their breeding use as factors in the formation of productivity in future offspring.

Materials and Methods

The adaptive qualities of Aberdeen-Angus cows of different genotypes were carried out in scientific and economic experience 2021-2022 in "Kolos-Firma" Limited Liability Partnership (LLP) of Kostanay region.

One of the leading farms in the Kostanay region for breeding cattle of the Aberdeen-Angus breed is "Kolos-Firma" LLP, which herd was updated in 2019 with imported cattle of the Aberdeen-Angus breed in the amount of 100 heads from Estonia, which affected the pedigree of the breeding stock of the farm under study.

Modern breeding stock is represented mainly by full-aged cows and the specific weight of the total livestock in the farm is 43.1%, of which, cows of breeding: Kazakh-74.2%, aged 4 years-77 heads or 26.6%, 5 years and older-211 heads or 73.9% and Estonian-25.5%, aged 3 years-13 heads or 13.3%, 4 years-80 goals or 80% and 5 years-7 goals or 7%.

At the same time, the largest share is occupied by cows of the leading factory lines Abaja Portos 95283-39.8% and less Abaja Elvis 9528-34.9%, Connealy Skipper and Frankie 95259-3%.

Experimental groups were formed by the method of analog pairs (origin, age, live weight) by availability and the entire breeding stock of cows on the farm. An alternative feature was the selection of imported breeding stock from Estonia and local Kazakhstani.

The search for successful combinations and their repetition during selection accelerates the pace of improvement of the breed as a whole (Nametov *et al.*, 2022).

The research material was Aberdeen-Angus cows of different genotypes. Two experimental groups of cows were formed: Group I (n = 288 heads) Kazakh breeding, and Group II (n = 100 heads) Estonian breeding.

An important indicator characterizing the growth and development of cows of the breeding core is the live weight since changes in the value of this indicator affect in a certain way the processes of formation and meat productivity in the offspring, which determines their rather significant role in improving the herds. Also, a significant indicator characterizing the breeding qualities of the uterine composition is the study of exterior and constitutional features. The assessment of growth and development was determined by comparison with the requirements of breed standards (Ministry of Agriculture of the Republic of Kazakhstan, 2003; 2014).

Based on the obtained results on the study of exterior and constitutional features, the indices of physique were calculated, which characterize the overall development of the animal organism in the context of different genotypes.

The effectiveness of breeding on the normative course of all physiological processes in the animal's body indicates the possibility of characterizing the indicators of the biochemical and morphological composition of blood since blood is a significant indicator of the body's stability and its characteristics of changing environmental factors: Feeding conditions, maintenance.

Morphological parameters were determined from the blood taken from the jugular vein: The amount of hemoglobin, erythrocytes, leukocytes, and platelets on the Exigo 17 veterinary hematology analyzer (Sweden), and biochemical parameters in the blood serum: The content of total protein, glucose, iron, potassium, the activity of aminotransferases Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) in the biochemical automatic analyzer Bio Chem HTFC -120 (USA) with corresponding reagent kits-HTI Technology, USA.

The main digital material obtained during the study was processed by the biometric method, with finding the values: Arithmetic mean (M), mean square deviation (δ), arithmetic mean error (m); Coefficient of variation (Cv) using the Excel program.

Results

In this study, a comparative method was used to assess the breeding qualities of the breeding stock Aberdeen-Angus cows of various genotypes. Table 1 presents data on the live weight of cows of the studied groups of cows of different genotypes.

According to the data in Table 1, it should be noted that live weight is superior at the age of 4 and 5 years and older in group II, cows of Estonian breeding over cows of group I cows of Kazakh breeding at the age of 4 years by 18.3 kg (3.7%) and at the age of 5 years and older by 6.1 kg (1%). However, it should be noted that cows of Kazakh breeding by live weight comply with the current standard of the instructions for evaluation in Kazakhstan, the "Elite" class, which in turn indicates comfortable conditions for their cultivation: Maintenance, feeding on the farm and provided significant facilitation of the process of adaptation of imported cattle to local climatic conditions.

Also, an important indicator characterizing the productive qualities of the uterine composition of the studied breed is the study of exterior and constitutional features, an exterior assessment was carried out in accordance with the breed standard, the results of which are provided in Table 2.

From the data obtained in Table 2, it should be noted that significant measurements of the exterior of cows aged 4 and 5 years increased proportionally in both groups studied. If in the comparative aspect, there is an advantage in the II group of cows of imported Estonian breeding over cows of the I group-domestic Kazakh breeding. According to the main measurements: "Height at the withers" of cows of group II at the age of 4 is higher than that of cows of group I by 0.7 cm (0.5%), at the age of 5, similarly, 0.6 cm (0.4%) higher; according to the "oblique length of the trunk", cows of group II at the age of 4 are 2.6 cm (1.5%) higher and at the age of 5 the same by 5.2 cm (3%), according to the "chest circumference" cows of group II at the age of 4 years are higher than cows of group I by 2 cm (1.0%), at the age of 5, similarly, 6.3 cm (3.2%) higher; according to the "chest width" of cows of group II at the age of 4, higher than that of cows of group I by 0.3 cm (1.5%), at the age of 5, the values are equal; according to the "chest depth" of cows of group II in at the age of 4, it is higher than in cows of group I by 0.2 cm (0.2%), at the age of 5, it is similar by 3.9 cm (4.7%); according to the "width of hook bone", cows of group II at the age of 4 are 0.5 cm (0.9%) higher and at the age of 5 the same by 2.3 cm (4.2%); according to the "girth of the pastern" cows of group I and II at the age of 4 and 5, the values are equal.

Table 1: Results of the dynamics of the live weight of Aberdeen-Angus cows of different genotypes, kg

	Age			
Group	4 years	Cv	5 years and more	Cv
	n = 60		n = 171	
I	485,4±5,28	8,28	527,7±5,18	12,21
	n = 12		n = 85	
II	503,7±3,61	7,32	533,8±4,58	8,48
The breed standard	390-485	420-530		

Table 2: Basic measurements of the physique of cows of" Kolos Firma" LLP, cm

	Group/Age							
	I				II			
	4 years		5 years and more		4 years		5 years and more	
Measurement, cm	M ± m	Cv	M ± m	Cv	M ± m	Cv	M ± m	Cv
Height at the shoulder	132,9±0,37	2,18	133,60±0,25	2,48	133,6±0,39	2,68	134,2±1,29	3,33
Height at hips	133,7±0,44	2,53	133,6±0,76	7,46	134,2±1,39	3,57	134,7±0,39	2,69
Squinting body length	163,2±1,9	9,0	165,0±1,73	8,4	165,8±1,48	8,22	170,2±2,79	5,69
Chest girth	188,4±1,39	5,72	190,2±1,32	9,07	190,4±1,45	7,02	196,5±3,09	5,44
Pastern girth	22,2±1,69	6,61	21,9±0,03	2,03	21,9±1,69	2,3	22,3±0,03	3,2
Chest depth	77,4±1,14	11,43	78,5±0,73	12,08	77,6±1,10	3,08	82,4±2,05	8,63
Width of the chest behind the shoulder blades	39,1±1,07	21,28	39,7±0,45	14,71	39,4±1,20	10,79	39,7±0,69	6,13
Squinting quarter length	40,8±0,46	8,7	44,6±1,36	9,79	42,2±0,34	7,34	45,8±1,02	8,1
Width of hook bone	50,4±0,55	8,40	52,0±0,64	6,5	50,9±0,49	8,85	54,3±0,99	6,29

Table 3: Indices of the physique of cows of "Kolos firma" LLP, %

	Group			
	I		II	
Index	4 years	5 years and more	4 years	5 years and more
Long legs	41,8	41,2	41,9	43,6
Sprawl	122,8	123,5	124,1	126,8
Pelvic chest	77,6	76,3	77,4	73,1
Pectoral fin	112	113,8	113,5	115,5
Blockiness	115,4	115,3	114,8	115,5
Overgrowth	100,6	100	100,4	100,4
Bony	17,5	16,4	16,4	16,6

Table 4: Hematological blood parameters of the studied cows of different genotypes in "Kolos-Firma" LLP, (X ± m)

		Group			
		I		II	
Indicators	Standard	4 years old	5 years old and more	4 years old	5 years old and more
Erythrocyte, 10^{12}/l	5,0-10,0	5,88±0,13	5,81±0,22	5,91±0,16	5,86±0,17
Leukocyte, 10^{9}/l	4,0-12,0	8,15±0,28	8,53±0,31	7,68±0,37	7,83±0,34
Platelets, 10^{9}/l	100-800	260,1±12,22	259,6±12,99	275±19,51	265,75±16,08
Haemoglobin GM/DL	80-150	108,25±2,43	107,88±1,46	108,5±1,57	110,75±1,98
Whole protein, g/l	72-86	75,31±2,87	75,77±2,86	78,1±2,6	80,6±2,52
Glucose, mol/l	2,2-3,3	3,34±0,15	3,2±0,19	2,27±0,06	2,52±0,19
Iron, mcmole/l	12,0-42,0	20,57±1,82	18,74±1,96	25,24±2,37	18,9±1,54
Kalium, mcmole/l	4,0-5,8	4,36±0,22	4,29±0,21	4,2±0,20	3,89±0,12
AST, u/l	46-110	68,76±6,34	69,38±4,90	71,16±4,69	75,06±4,96
ALT, u/l	6,9-35	31,98±2,97	31,93±2,85	32,5±2,99	33,95±4,27
Alkaline phosphatase, u/l	18-153	57,8±14,26	55,08±12,28	58,08±12,19	59,13±12,78

The indices of the physique of cows are presented in Table 3. According to Table 3, it can be seen that, in general, the physique indices of the studied cows of 4 and 5 years of Kazakh and Estonian breeding differed by not large numerical fluctuations, on average up to 1 in superiority over cows of Estonian breeding.

Thus, according to the assessment of growth and development: Live weight, exterior-constitutional features, and physique indices, the studied stock of the breeding stock of "Kolos-Firma" LLP have positive dynamics in terms of external signs of the exterior and the severity of the physique indices: Compactness and massiveness, which is associated with the genetic characteristics of the genotypes taken into account.

The II group of cows of Estonian breeding at the age of 4 and 5 years corresponds to the intrabreed tall type of physique and the I group of cows at the age of 4 and 5 years of Kazakh breeding should be attributed to the average intrabreed type.

Thus, in general, the adult herd of the breeding stock, both of the Estonian and Kazakh breeding of the studied enterprise "Kolos-Firma" LLP, is characterized by pronounced characteristics corresponding to the breed in terms of exterior and constitutional features, rounded and broad physique, which is significant to transmit these valuable qualities to their offspring.

The analysis of the morphological composition of blood according to Table 4 revealed that the content of the shaped blood elements: Hemoglobin, erythrocytes, leukocytes, and platelets in cows of group II of the Estonian selection and cows of group I of the Kazakh selection corresponded to the norm in the aisles.

The intensity of protein metabolism to a certain extent can be judged by the biological composition of the blood. The analysis obtained data indicates that this indicator was higher in animals of Estonian breeding. So, the advantage of group II cows over group I peers at the age of 5 was 4.83 mmoL/l, at the age of 4 years-2.79 mmoL/l.

To assess the state of carbohydrate metabolism in the animal's body and as the significant source of energy in the body, the parameter "glucose" is used. The glucose content in the Angus blood was inferior to the animals of the local population. At the age of 4 years, cows of the I experimental group have superiority over animals of the II group by 1.07 mmoL/l, and cows of the I group at the age of 5 years have a predominance over animals of the II group by 0.68 mmoL/l. The concentration of iron in serum is determined by its absorption in the intestine, the degree of decay or loss of hemoglobin, and the volume of hemoglobin biosynthesis. According to biochemical analysis, according to Table 4, iron is observed normally, in cows of the II experimental group it exceeds cows of the

I group by 4.67 mmoL/l at the age of 4 years and at the age of 5 years, there is an advantage of 0.16 mmoL/l in cows of the II experimental group over cows of the I experimental group. Differences in the element of kalium were not found and were in the same proportions within 4 mmoL/l.

The main components of protein metabolism in the animal body are the processes of transamination performed by Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), by reverse transfer of the amine group of amino acids to ketoacids. The advantage in the activity of AST and ALT was on the side of the claws of Estonian breeding. Thus, the advantage of group II cows over the group I peers in terms of AST activity at the age of 5 years was 5.68 mmoL/h *l and at the age of 4 years-2.4 mmoL/h*l. According to ALT activity, respectively, by 0.02 and 0.52 mmoL/h • l.

Discussion

Numerous adaptive reactions of various systems and organs that the animal's body uses, adapting to various influences (methods of maintenance, feeding) are characterized by the activity of alkaline phosphatase, which regulates the active transport of phosphorus and calcium and, in general, the "bone tissue-blood" system (Pestis *et al*., 2009). The biochemical indicator "concentration of alkaline phosphatase" in our studied groups of cows of different genotypes was detect within the physiological norm, which indicates increased control over the balanced feeding of animals on the farm.

Thus, during the experiment, the level of the studied parameters in the blood reached the standard values according to the results of morphological and biochemical blood analysis of the tested indicators in the experimental herd of cows of both groups and the considered age of 4 and 5 years (Table 4).

A comparative analysis of the breeding qualities of experienced cows of different genotypes in "Kolos-Firma" LLP showed a small, but superiority in the II group of cows of Estonian breeding over cows of the I group of domestic breeding, raised in the same feeding and maintenance conditions.

Limitations of the Study

1. The high heterogeneity in sampling is not appropriate for genetic-based studies; however, it is impossible to avoid that due to objective factors
2. An important link in carrying out these studies to determine the breeding value of Aberdeen-Angus cows of various genotypes was the use of simultaneous assessment on all cattle. Similar studies have been conducted by Dushayeva *et al*. (2021)
3. During the experiment, the authors obtained data that even small differences between animals of different genotypes and the current requirements of standards can influence the formation of economically useful traits. The animals of the Estonian breeding meet the requirements for the modern type of beef cattle in their economically useful qualities. This determines the prospect of its use in improving breeding traits for Kazakh breeding while maintaining adaptability to climatic and forage conditions, which is of great practical importance, is of scientific interest, which determines the relevance of the research topic
4. In general, the results obtained provide accurate information on the assessment of the breeding value of the herds of the breeding stock-Aberdeen-Angus cows in the farm under study (Sermyagin and Zinoviev, 2019)

Conclusion

Thus, according to the obtained research results, it was determined that the breeding qualities of the Aberdeen-Angus cows of Estonian breeding (group II) were superior to their peers-cows of domestic breeding (group I). Further breeding and rearing of Aberdeen-Angus cattle in the conditions of Kolos-Firm LLP in the Kostanay region will increase the number of breeding cores and will have a positive impact on the overall dynamics of the development of beef cattle breeding in the Republic of Kazakhstan.

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Author's Contributions

All authors equally contributed to this study.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues are involved.

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