**HABILIDADES BIOLÓGICAS E ADAPTATIVAS DE BOVINOS JOVENS DAS RAÇAS
HEREFORD E ABERDEEN-ANGUS E SUAS CRUZAS EM REGIÕES ÁRIDAS DO
CAZAQUISTÃO OCIDENTAL****BIOLOGICAL AND ADAPTIVE ABILITIES OF YOUNG CATTLE OF HEREFORD AND
ABERDEEN-ANGUS BREEDS AND THEIR CROSS-BREEDS IN ARID TERRITORIES OF
WEST KAZAKHSTAN REGION****БИОЛОГИЧЕСКИЕ И АДАПТАЦИОННЫЕ СПОСОБНОСТИ МОЛОДНЯКА
ГЕРЕФОРДСКОЙ, АБЕРДИН-АНГУССКОЙ ПОРОД И ИХ ПОМЕСЕЙ В УСЛОВИЯХ
ЗАСУШЛИВЫХ ТЕРРИТОРИЙ ЗАПАДНО-КАЗАХСТАНСКОЙ ОБЛАСТИ**

AKHMETALIYEVA, Aliya^{1*}, NASSAMBAYEV, Yedige¹, BOZYMOV, Kazybay¹,
NUGMANOVA, Aruzhan¹

¹ Zhangir Khan West Kazakhstan Agrarian Technical University. Kazakhstan.

* Correspondence author

e-mail: aliya.akhmetalieva@mail.ru

Received 20 August 2020; received in revised form 20 October 2020; accepted 09 November 2020

RESUMO

Nos últimos anos, tem ocorrido um desenvolvimento anômalo persistente do clima, como resultado do qual as pastagens foram queimadas, a produção dos campos de feno diminuiu drasticamente e foram observadas quedas de temperatura. Nessas condições, a escolha da raça com embasamento científico e a criação de novos genótipos adaptados às condições locais e às exigências do mercado é um problema urgente. O objeto do estudo foram rebanhos jovens (bezerros-touros, bezerros) e bovinos adultos (vacas) das raças Hereford, Aberdeen-Angus e Cazaque de cabeça branca e bovinos jovens de cruzamentos de touros Hereford e Aberdeen-Angus com gado local. O artigo apresenta os resultados da análise e determinação dos recursos raciais de bovinos de corte para a obtenção de carne bovina ambientalmente segura. O estudo foi conduzido para estabelecer o grau de adaptação das raças de corte não-cazaques às condições naturais e climáticas da região do oeste do Cazaquistão. Animais mestiços apresentaram propriedades adaptativas mais pronunciadas em termos de cobertura e estrutura de pelos do 1º e 2º grupos de controle. Ao mesmo tempo, em termos de parâmetros principais de mudanças na cobertura e estrutura do cabelo, os animais de raça pura das raças Hereford e Aberdeen-Angus dos 1º e 2º grupos experimentais, em geral, foram caracterizados por propriedades adaptativas bastante boas dependendo das mudanças no ambiente externo. Os dados sobre a composição bioquímica do sangue indicaram o estado fisiológico normal dos animais de todos os grupos e mostraram boas capacidades adaptativas ao clima acentuadamente continental das estepes e semi-deserto do Cazaquistão Ocidental em animais de todos os grupos.

Palavras-chave: *bovinos jovens, habilidades biológicas e adaptativas, parâmetros clínicos e fisiológicos, cobertura de pêlo, bioquímica do sangue..*

ABSTRACT

In recent years, there has been a persistent anomalous development of the climate. As a result of which pastures have been scorched, the yield of hayfields has sharply decreased, and temperature drops have been observed. In these conditions, the scientifically grounded choice of the breed and the creation of new genotypes adapted to local conditions and market requirements is an urgent problem. The object of the study were young stock (bulls-calves, heifer calves) and adult cattle (cows) of the Hereford, Aberdeen-Angus, and Kazakh white-headed breeds and young cattle cross-breeds of Hereford and Aberdeen-Angus bulls with scrub cattle. The article presents the analysis and determination of the breed resources of beef cattle for obtaining environmentally-safe beef. The study was conducted to establish the degree of adaptation of non-Kazakhstani beef breeds to the natural and climatic conditions of the West Kazakhstan region. Cross-bred animals had more pronounced adaptive properties in terms of hair cover and hair structure of the 1st and 2nd control groups. Simultaneously, in terms of main parameters of changes in hair cover and hair structure, purebred animals of the Hereford and Aberdeen-Angus breeds of the 1st and 2nd experimental groups, in general, were characterized by rather good

adaptive properties depending on changes in the external environment. The data on the biochemical composition of blood indicated the normal physiological state of animals of all groups. They showed good adaptive capabilities to the sharply continental climate of the steppes and semidesert of West Kazakhstan in animals of all groups.

Keywords: *young cattle, biological and adaptive abilities, clinical and physiological parameters, hair cover, blood biochemistry.*

АННОТАЦИЯ

В последние годы и в настоящее время наблюдается стойкое аномальное проявление климата, результатом которого являются выгорание пастбищ, резкое снижение урожайности сенокосов, температурные перепады. В этих условиях актуальным вопросом является научно-обоснованный выбор породы и создание новых, приспособленных к местным условиям и требованиям рынка генотипов. Объектом исследования являлся молодняк (бычки, телочки) и взрослый скот (коровы) герефордской, абердин-ангусской и казахской белоголовой пород, а также помесный молодняк, полученный от использования в скрещивании герефордских и абердин-ангусских быков с беспородными коровами. В статье проанализированы и установлены породные ресурсы мясного скота для получения экологически чистой говядины, а также проведена исследования по установлению степени адаптации зарубежных мясных пород к природно-климатическим условиям Западно-Казахстанской области. По показателям волосяного покрова и строения волос более выраженными адаптационными свойствами отличались помесные животные. В то же время по основным параметрам изменения волосяного покрова, его структуры чистопородные животные герефордской и абердин-ангусской пород в целом характеризовались довольно хорошими приспособительными свойствами в зависимости от изменения внешней среды. Полученные данные биохимического состава крови свидетельствуют о нормальном физиологическом состоянии организма животных всех групп, а также указывают на хорошую адаптационную способность животных всех групп к резко-континентальному климату сухих степей и полупустыни Западного Казахстана.

Ключевые слова: *молодняк, биологические и адаптационные способности, клинико-физиологические показатели, волосяной покров, биохимия крови.*

1. INTRODUCTION:

Breeding beef cattle is a traditional industry for West Kazakhstan, and it is the leading region in the country in this field. At present, several farms are engaged in breeding the Hereford and Aberdeen-Angus breeds and providing scientific support for the selection process for these breeds. The relevance and scientific novelty of the project were also underlined by the need to select breeds of cattle characterized by high adaptability to changing natural and climatic conditions (Berman, 2011; Zinullin *et al.*, 2016).

In recent years and today, there has been a persistent anomalous development of the climate. As a result of which pastures have been scorched, the yield of hayfields has sharply decreased, and temperature drops have been observed (Dubovskova and Kuzin, 2005; Oraz *et al.*, 2019). In these conditions, the scientifically grounded choice of the breed and the creation of new genotypes adapted to local conditions and market requirements are an urgent problem (Sharafutdinova, Zhukov, and Rostova, 2016; Kosilov *et al.*, 2005; Wyatt *et al.*, 2013; Sahagun, Medina, and Ruiz, 2009; Pilvere, Proskina, and Nipers, 2016).

In developed countries, a special industry of specialized beef cattle breeding was created. Its role and importance as a source of high-quality meat production are steadily increasing (Kosilov *et al.*, 2015; Makaev, 2005; Aitzhanova *et al.*, 2017).

It should be noted that the further development of specialized beef cattle breeding in Kazakhstan can be successful if there is a good breeding base, including valuable breeding cattle with a high genetic potential for productivity (Zinullin and Nugmanova, 2016). Unfortunately, the breeding base in Kazakhstan does not provide farms with young breeding stock to achieve the indicators of the outlined program for cattle production development. To develop the breeding base and cattle production in Kazakhstan, it is necessary to expand and strengthen the existing multiplication farms for breeding animals and create new ones by importing limited livestock populations of the most valuable and promising breeds while focusing on traditional beef breeds from the CIS countries, in particular, the Hereford and Aberdeen-Angus breeds. However, the advantage should be given to the use of homegrown breeding resources (Belousov and Godzhiev, 1990; Bozymov, Nasambaev, Akhmetalieva, and Nugmanova, 2019; Kayumov,

2005; Dzhulamanov, 2006; Piccoli *et al.*, 2020; Wyatt *et al.*, 2014).

The social aspect of the need to breed and study animals of the Hereford and Aberdeen-Angus breeds and compare them with the Kazakh white-headed cattle is the need to factor in the specific natural and climatic zones of the Western region of Kazakhstan (Kayumov, Dubovskova, and Kuzin, 2005).

The study of the adaptive abilities of Hereford and Aberdeen-Angus breeds of animals in West Kazakhstan conditions compared with other genotypes is of scientific interest (Salikhov and Kosilov, 2008; Kosilov, Buravov, and Salikhov, 2006; Gabidullin, Belousov, and Tagirov, 2016). The Hereford and Aberdeen-Angus breeds were brought from far abroad to the "Musa" farm in the Zhangalinsky district of the West Kazakhstan region to increase beef production and expand the gene pool of beef cattle breeds.

Since these breeds were brought into this farm for the first time, comprehensive scientific and industrial research was conducted (concerning local natural and climatic conditions) to study their adaptive abilities to the new environment and determine economic and biological characteristics, and to compare the Hereford and Aberdeen-Angus cattle with the Kazakh white-headed breed from the "Khafiz" farm (Shevchenko, Kladova, and Chufeneva, 2008; Zelenkov, Drobot, and Zelenkov, 2009; Zhuzenov, Muskhanov, Umarov, Sadykova, and Seitmuratov, 2013; Meshcheryakov, 2004; Makaev, Kayumov, and Nasambaev, 2005).

The object of the study were young stock (bull-calves, heifer calves) and adult cattle (cows) of the Hereford, Aberdeen-Angus, and Kazakh white-headed breeds and young cattle cross-breeds of Hereford and Aberdeen-Angus bulls with scrub cattle. Biological and economically useful features of the Hereford and Aberdeen-Angus cattle imported from far abroad were studied for the first time in Kazakhstan.

The study aimed to analyze and determine breed resources for obtaining environmentally-safe beef and identifying the individual parameters of the degree of acclimatization of non-Kazakhstani beef breeds to the climatic conditions of the West Kazakhstan region by studying the biological characteristics of different genotypes.

2. MATERIALS AND METHODS:

2.1. Duration of the study and samples

The study was conducted in 2019-2020 in the Zhangalinsky district of the West Kazakhstan region at the "Musa" farm that breeds the Hereford and Aberdeen-Angus breeds and the "Khafiz" farm that breeds the Kazakh white-headed breed.

2.2. Experimental groups

Several groups of animals of various breeds were formed: 1st experimental (Hereford), 2nd experimental (Aberdeen-Angus), and control groups (Kazakh white-headed); 15 heads in each group in the age from birth to 15 months. Feeding and maintenance conditions of animals of all groups were the same and at the same level.

2.3. Ethics

Experimental studies and maintenance of animals were carried out taking into account the instructions and recommendations of Russian Regulations, 1987 (Order No. 755 on August 12, 1977, the USSR Ministry of Health) and "The Guide for Care and Use of Laboratory Animals (National Academy Press Washington, DC 1966)". In the research, everything possible was done to ensure a minimum of animal suffering and reduce the number of experimental prototypes (Aitzhanova *et al.*, 2017; Kazhgaliyev, Shaulyayev, Omarmozhauy, Shaikenova, and Shurkin, 2016).

2.4. Experimental procedures

The rations of experimental animals were made up of a set of feeds available on the farm. The limit of the feed set determined feed costs. Milk production of cows was determined by the live weight of young stock at 6 months of age.

The weighing was carried out to study the growth and development of young stock monthly before feeding. The weighing was carried out on electronic stationary scales "VPE-1000-S" (Farmer). Based on its results, live weight was determined at different ages, and the average daily increase in live weight in different age periods was calculated.

2.5. Blood collection

Blood was taken from three animals from each sex and age group during each season (autumn, winter, spring, summer) in the laboratory of the Zhangir khan West Kazakhstan Agrarian-Technical University.

2.6. Biochemical Paramaters

The study of the biochemical composition of blood was carried out using a ChemWell biochemical analyzer (manufactured by Awareness (USA)). In all groups of animals, the following parameters were determined: glucose (mmol/l), albumin (g/l), alanine aminotransferase (ALT) (units/l), aspartate aminotransferase (AST) (units/l), bilirubin (total, direct; $\mu\text{mol/l}$), cholesterol (mmol/l), triglycerides (mmol/l), urea (mmol/l), creatinine ($\mu\text{mol/l}$), alkaline phosphatase (ALP) (units/l), gamma-glutamyltransferase ($\gamma\text{-GT}$) (units/l), uric acid ($\mu\text{mol/l}$), iron (Fe) ($\mu\text{mol/l}$), pancreatic amylase (units/l), lactate dehydrogenase (LDH) (units/l). Sampling was carried out on a stainless steel sampler with a level sensor. The following biochemical stabilized liquid reagents were also used: calcium; magnesium; phosphorus; albumen; amylase; ALP; AST; ALT; total bilirubin; direct bilirubin; bilirubin direct and total; cholesterol; creatine kinase; creatine kinase MB-fraction; creatinine; glucose; $\gamma\text{-GT}$; high-density lipoproteins (HDL) direct; low-density lipoproteins (LDL) direct; LDH; total protein; triglycerides; uric acid; urea.

The total acid capacity of the blood was determined by Nevodov's titrimetric method. The mixture of 10 ml of 0.01 N HCL and 0.2 ml of blood was shaken and titrated with 0.1 N NaOH solution until turbidity and flakes appeared (protein precipitate), then 10 drops of indicator (1% phenolphthalein alcoholic solution) were added. The amount of alkali spent on titration was subtracted from unity (consumption of alkali in the control experiment); the resulting difference was multiplied by a factor of 20, an alkalinity index of 100 ml of blood was obtained (in mg%).

For each type of farm animals, there were average indicators of the biochemical composition of the blood, and there were also variations within different breeds. So, for cattle, the following average levels of biochemical parameters were determined: glucose: 2.3 - 4.1 $\mu\text{mol/l}$; albumin: 38 - 50%; ALT: 6.9 - 35 units/l; AST: 45 - 100 units/l; bilirubin: 0.7 - 14 $\mu\text{mol/l}$; cholesterol: 2.3 - 6.6 $\mu\text{mol/l}$; triglycerides: 0.0 - 0.2 $\mu\text{mol/l}$; urea: 2.8 - 8.8 $\mu\text{mol/l}$; ALP: 18 - 153 $\mu\text{mol/l}$.

2.7. Physiological indicators

The degree of development of the hair coat was studied on bulls of Kazakh white-headed and Hereford, and Aberdeen-Angus breeds in the arid steppe and semidesert zone of Western Kazakhstan by the seasons of the year according

to the method of E. A. Arzumanyan (1957) in the wool laboratory of the Higher School "Technology of production of animal products" West Kazakhstan Agrarian Technical University named after Zhangir khan.

In cows, the period from calving to the first heat, fertility, insemination index, duration of the service period, and fruiting was taken into account according to the data of the primary journal "Register of the breeding and calving of beef cows" (Form 3-meat). To determine the age of puberty by constant observation, the timing of the first manifestation of the sexual cycle and the established sexual cycle were recorded. The results of the pregnancy of heifers were clarified by rectal examination 3 months after mating.

Physiological indicators of young stock (body temperature, respiratory rate, pulse rate) were determined at the age of 9 and 15 months in winter (January) and summer (July) in the morning and at noon. According to the generally accepted method, physiological studies were conducted at the age of 9 to 15 months in the winter (January) and summer (July) periods in the morning and at noon in farm conditions. To study the clinical and physiological state of young stock, body temperature, pulse, and respiratory rate were measured, and three heads of young stock were selected for the study. The body temperature of young stock was measured with a special veterinary thermometer in the rectum (through the anus). The pulse rate was determined by placing a finger on the femoral artery, the respiratory rate – by the movement of the chest, by the tremors of exhaled air, felt by the palm of the hand placed near the nostrils.

2.8. Statistical Analysis

Digital materials were processed by biometric methods using the office software package "Microsoft Office" using the program "Excel" ("Microsoft", USA) with the determination of the reliability of the difference at three levels of probability according to Student-Fisher.

3. RESULTS AND DISCUSSION:

3.1 Breeding and production qualities of young stock of the Hereford and Aberdeen-Angus breeds

The object of studies of the breeding and productive qualities were the Kazakh white-headed animals in the "Khafiz" farm, and the Hereford and Aberdeen-Angus breed in the "Musa" farm of the Zhangalinsky region. The farms

are located on the same territory; natural and climatic conditions, soil and vegetation cover, botanical, the composition of the pasture and hayfields were the same.

The genealogical structure of foreign breeding cattle was based on the breeding certificates of servicing bulls.

The genealogical structure of the Aberdeen-Angus breed in the number of 383 heads was established from the records of breeding certificates for belonging to servicing bulls EG FRONTIER 678 OF107 – 28 heads, EG POUND MARKER 612 Of415 – 12 heads, S A V Premier 0096 – 67 heads, S A V Viper 0986 – 42 heads, EG POUND MARKER 612 OF 415 – 20 heads, BUFFALOS FINAL PRODUCT 12 – 22 heads, BUFFALOS MIDLANDER 143 – 9 heads, RANDY'S REACH OUT 112 – 10 heads, BUFFALOS KING EMPIRE 133 – 20 heads, BUFFALOS CC and 7 JR 118 – 20 heads, BUFFALOS SURTITLE 136 – 8 heads, BUFFALOS SIR CC and 7 18 – 13 heads, DF TOTAL 1729 – 8 heads, KAF N61 – 4 heads, SCHELKES K37 ABERDEEN 169 – 12 heads, SCHELKES IRONWOOD 1380A – 6 heads, SCHELKES K37 ABERDEEN 171 – 4 heads, SCHELKES EXPEDITION 1063M – 3 heads, SCHELKES K37 ABERDEEN 164 – 10 heads, Schelskes Expedition 1064M – 7 heads, SCHELKES 15 K37 – 15 heads SCHELKES K37 ABERDEEN 187 – 7 heads, SCHELKES ON TARGET 1067M – 4 heads, SCHELKES 747 LEGEND 134 – 5 heads, Connealy True Answer 892 – 27 heads.

The genealogical structure of the Hereford breed in the number of 120 heads: UPS DOMINO 3027 – 2 heads, E RIBSTONE STANDARD JR ET – 1 head, CJH HARLAND 408 – 1 head, UPS DOMINO 5216 – 2 heads, CHURCHILL NEON 626S – 2 heads, BLL DIAMOND 72S – 5 heads, CHURCHILL YANKEE ET – 1 head, KB L1 DOMINO 655 ET – 1 head, C 5131 DOMINO 7084 – 1 head, C 5131 DOMINO 7084 – 1 head, KT JOHN WAYNE 7167 – 2 head, UPS NAVARRO – 1 head, F REST EASY 847 – 1 head, BLL STANDARD 17U – 5 heads, BLL STANDARD 13U – 2 heads, H5 3027 DOMINO 957 – 2 heads, CD STANDARD C99 – 3 heads, CTY EASY 9904W – 1 head, HH ADVANCE 0184X ET – 4 heads, H W4 GRIZZLY 0146 ET – 1 head, BLL STANDARD TIME 743 7X – 5 heads, BIRD 157K ISSIAH 114 – 2 heads, HH ADVANCE 1173Y ET – 4 heads, CHURCHILL RED EYE 1107Y – 8 heads, BLL TRAVELER 9121W 185Y – 1 head, WSF LCR RCR ONSTAR 23NET – 1 head, THM DURANGO 4037 – 1 head, B REMITALL ANCHOR ET – 1

head, MSU TCF REVOLUTION 4R – 1 head, KCF BENNETT 9126J R294 – 1 head, HB LOADED 7822 – 6 heads, CRR ABOUT TIME 743 – 1 head, KJ HVH 33N REDEEM 485T ET – 1 head, RST P20 PROGRESS 7020 – 6 heads, NJW 98S DURANGO 44U – 2 heads, R LEGEND 2218 – 2 heads, TDP VINTAGE 402U ET – 1 head, LJR 023R WHITMORE 10W – 1 head, MOHICAN WARRENT 50W – 3 heads, H WCC / WB 668 WYARNO 9500 ET – 3 heads, RST R117 RIB EYE 9093 – 2 heads, B NORTHSTAR 951 – 8 heads, AW RIBSTONE 954 – 2 heads, MOHICAN XEROX 404X ET – 1 head, B RIBSTONE BRAXTON 072 – 1 head, BLL WARRIOR 309 26X – 4 heads, OHR BULLSEYE 110N 68X ET – 4 heads, LSW WCC ABOUT TIME X06 – 3 heads, TH 60W 719T VICTOR 43Y – 1 head, DD ANCHOR PRIDE 068 – 1 head, NJW 5M 100W TRUST 81Y ET – 1 head, TRICKY 'SVICTORW37-719T Y04 – 2 heads.

The qualitative composition of animals in the experimental and control groups is presented in Table 1. All animals were of pure breed. Table 1 shows that the servicing bulls of all genotypes belonged to the highest classes, while the breeding stock was of different quality. Animals of the highest classes occupied the highest proportion in the herd of Hereford and Aberdeen-Angus breeds – 79.2% and Aberdeen-Angus – 79.6%, respectively, and in the herd of the Kazakh white-headed breed – 40.0%. A similar trend was observed in the qualitative composition of young stock. Although the young stock of all genotypes corresponded to the complex class of the breed standard, the Hereford breed was noticeably dominated by animals of higher classes in bulls – 84.4% and heifers – 92.2% against peers of the Aberdeen-Angus breed, respectively – 89.9% and 85.1% and Kazakh white-headed breed – 60.9 % and 62.0%, respectively.

Indicators of age dynamics of the live weight of young stock of different genotypes are of particular interest (Table 2). The live weight of young stock of all genotypes met and exceeded the breed standard requirements for all age indicators, and in general, all age periods were marked by a rather high live weight of bulls heifers. The bulls of the 1st experimental group exceeded their peers of the Kazakh white-headed breed at birth by 2.1 kg (at $P > 0.95$), at 6 months of age by 49.0 kg (at $P > 0.999$), at 8 months of age by 53.6 kg (with $P > 0.99$), at 12 months of age by 21.5 kg (with $P > 0.95$), at 15 months of age by 25.5 kg (with $P > 0.95$). The bulls of the 2nd experimental group exceeded their peers of the Kazakh white-headed breed at birth by 0.1 kg (at $P < 0.95$), at 6

months of age by 39.2 kg (at $P > 0.99$), at 8 at the age of 57 kg (at $P > 0.99$), at the age of 12 months by 14.4 kg (at $P > 0.95$), at 15 months of age by 24.2 kg (at $P > 0.95$).

Comparison of bulls of the 1st and 2nd experimental groups showed that the superiority of Herefords over their peers of the Aberdeen-Angus breed was observed at 6 months of age by 9.8 kg (at $P > 0.95$) and 12 months – by 7.1 kg (at $P > 0.95$); at other ages, the differences in live weight were insignificant.

The heifers of the 1st experimental group exceeded their contemporaries in the control group (Kazakh white-headed breed) at birth by 3.1 kg (at $P > 0.99$), at 6 months of age by 20.9 kg (at $P > 0.99$), at 8 months of age by 20.9 kg (with $P > 0.99$), at 12 months of age by 15.7 kg (with $P > 0.95$), at 15 months of age by 19.9 kg (at $P > 0.95$). The heifers of the 2nd experimental group exceeded their peers in the control group (Kazakh white-headed breed) at 6 months of age by 16.36 kg (at $P > 0.95$), at 8 months of age by 17.7 kg (at $P > 0.95$), at 12 months of age by 20.7 kg (with $P > 0.99$), at 15 months of age by 11.9 kg (with $P > 0.95$). When comparing the 1st and 2nd experimental groups (Hereford and Aberdeen Angus heifers), a more noticeable difference in live weight in favor of the 1st experimental group is 8.0 kg (at $P > 0.95$). The main feature in selection and breeding work with beef cattle breeds is the growth rate of young stock in different age periods (Table 3).

The research results showed that a significant advantage in terms of the average daily increase in live weight was in the bulls of the control group (Kazakh white-headed breed) in 8-12 months and for the entire period of 8-15 months compared with the peers of the 1st experimental group by 267.22 g ($P > 0.95$) and 133.97 g ($P > 0.95$), for 2nd experimental group – by 354.44 g ($P > 0.95$) and 155.87 g ($P > 0.95$), respectively. The post-weaning adaptation of young Kazakh white-headed breeds was more successful with lower stress costs than peers of imported breeds. High indicators of average daily growth of young stock in 0-6 months of the 1st and 2nd experimental groups compared with the control group are associated with higher milk production of livestock. Thus, the average difference between bulls was 239.3 g ($P > 0.999$) and between heifers – 93.9 g ($P > 0.999$).

3.2 Reproductive qualities of young stock

The reproductive qualities of young stock were studied according to the following indicators: sexual reflexes, reaction to taking sperm products,

and seed quality (Table 4). It should be noted that the indicators of sexual activity of bulls of different genotypes were at a rather desirable level. Nevertheless, according to the locomotor reflex, more noticeable activity was observed in bulls of the control group, as it was in comparison with the 1st experimental group by 3 sec and the 2nd experimental group by 4 sec higher. The copulation reflex was also the most pronounced in the bulls of the control group. Bulls of the 2nd experimental group showed the most significant activity on the reflex of erections. Thus, the manifestation of sexual reflexes indicates a sufficiently high reproductive capacity of young stock of different genotypes.

Inbreeding work on the study of reproductive qualities of animals, especially on the selection of bulls for reproduction, the quality of sperm production is of particular importance (Table 5). The table shows that the bulls of the control group outperformed the peers of the 1st and 2nd experimental groups in sperm activity by 1 point with the same volume of ejaculate. In general, the quality of sperm production of young stock of different genotypes is quite suitable for artificial insemination in manual and free mating.

3.3 Reproductive qualities of cows

Successful reproduction of the herd is one of the main factors in the efficiency of the production of beef cattle products since the only marketable product in the industry is a calf. Moreover, the reproductive capacity of cows is determined, among other things, by the breed characteristics, as well as the natural and climatic conditions of their breeding place. Such indicators characterize the reproductive qualities of cows as the manifestation of sexual reflexes, the duration of pregnancy, the service period, the inter-body period, fertilization, insemination index, and the yield of calves. When organizing the reproduction of the herd, especially the need to obtain four calving or equalization of calving according to the season of the year, it is important to take into account the manifestation of sexual reflexes of cows.

Indicators of sexual reflexes of cows of different breeds are shown in Table 6. Table 6 shows that the longest duration of sexual excitement was observed in cows of the 1st and 2nd experimental groups, the 1st experimental group in particular – 0.7 hours and the 2nd experimental group – 2.4 hours higher than the control group. The duration of estrus was the lowest in cows of the control group; the duration of the immobility reflex in cows of different genotypes was in the range of 8.6-10.3 seconds. The interbody period is

a generalizing indicator, one of the key indicators among the characteristics of the reproductive abilities of cows. The length of the service period has the greatest impact on the variability of lactation duration. This indicator is determined to assess the state of the reproductive functions of cows. The value of the service period depends on the rate of involution of the uterus (restoration of its normal shape, size, and sexual cyclicity), which takes from 28 to 80 days (Diaz *et al.*, 2018; Kazhgaliyev *et al.*, 2016).

The main indicator that characterizes the reproductive capacity of meat cows is the interbody period, the average values of which are influenced by all cases of violation of the reproductive function (Table 7). It follows from the table that the cows of the control group did not have significant age-related differences in terms of the duration of the interbody period, service period, and pregnancy; they were within the physiological norms. It follows from Table 6 that the cows of the control group had the minimum calving period (344.4 days), the maximum – in cows of the 1st and 2nd experimental groups (348-351 days); the difference in comparison with the cows of the 1st experimental group was close to the reliability of the first level of probability with a large number of observations (1.61), and with the cows of the 2nd experimental group, the differences turned out to be significant ($P > 0.95$).

Due to the lack of artificial insemination of cows on farms, fertilization in cows of the 1st, 2nd experimental and control groups was determined by the number of fertilized cows during the breeding season. The fertilization rate of cows of the 1st and 2nd experimental and control groups averaged 96.56%, which has unjustified economic costs for beef cattle breeding. It should be noted that the indicators of the duration of the service period, as one of the important indicators of the reproductive properties of cows, in all genotypes were within the acceptable and desirable limits for normal reproduction of the herd (62.3-69.1 days).

The calf yield indicator reflects not only the economic value but also, to a certain extent, characterizes the reproductive qualities of cows. The highest rate of calf yield was observed in cows of the 1st experimental group, and the difference was in the range of 7.1-3.8% in comparison with the peers of the 2nd experimental and control groups, respectively. Cows of the Kazakh white-headed breed of 5-year-old age had an advantage in the yield of calves (by 2%), and cows of the Hereford breed had the highest yield of calves (89.1%).

An important practical value in the reproduction of the herd is taking into account the manifestation of sexual reflexes of cows. The results of the research showed that the shortest duration of sexual excitement was observed in cows of the 5-year-old control group compared to cows of 4 years old and was less by 0.6 hours. An insignificant difference in 4 and 5-year-old cows was observed in the duration of the immobility reflex and estrus at $P > 0.95$. Animals of all genotypes were generally characterized by quite good reproductive qualities, while Kazakh white-headed cows had minor advantages.

3.4 Reproductive abilities of animals of different sex and age groups

It was studied the indicators of sexual activity and the quality of sperm production in bull calves at 15 months of age. The results of studying the sexual activity of bulls of different genotypes are shown in Table 8. Table 8 shows that sexual reflexes were most pronounced in the control group of bulls. Simultaneously, the indicators of sexual reflexes of bulls of the 1st and 2nd experimental groups fully met the requirements of a high level of reproductive quality.

A more objective description of the reproductive properties of young stock can be obtained by indicators of the quality of sperm production (Table 9). Table 9 shows that the activity of sperms in comparison with the 1st and 2nd experimental groups was 1 point higher in the bulls of the control group.

3.5 Biological and adaptive abilities of young Hereford and Aberdeen-Angus breeds and their cross-breeds in the conditions of arid steppes of the West Kazakhstan region

For the use of classic imported beef breeds of cattle for industrial breeding or cross-breeding, it is important to study individual physiological and clinical indicators of both purebred and cross-bred animals (Table 10), where: 1st experimental (Hereford breed), 1st control (crosses from Herefords and outbred cattle), 2nd experimental (Aberdeen-Angus breed), 2nd control (Aberdeen-Angus and outbred cattle cross-breed).

Table 10 shows that body temperature indicators (38.1-38.6 °C) were practically at the same level in animals of different genotypes both during winter and during summer. Pulse and respiration rates were higher in winter in all animals of different genotypes. At the same time, fluctuations in pulse rate and respiration rate during the day over the seasons of the year were more adequate in crosses of animals of the 1st and 2nd control groups, which is associated with the

better adaptive ability of scrub cattle used in crossing.

It is important to determine the features of the structure of the hair cover during different seasons of the year to study the adaptive abilities of cattle of foreign selection and their cross-breeds with scrub animals (Table 11). Table 11 shows that the indicators of the amount of hair per 1 cm², hair length, and hair mass in summer are lower than in winter in animals of all genotypes, which naturally reflects their adaptive response to changes in environmental conditions. Simultaneously, animals of 1st and 2nd control groups (scrub cattle with the Hereford and Aberdeen-Angus breeds) adapted better in terms of the amount of hair per 1 cm², hair length, and hair mass both in winter and summer.

In winter, indicators of the amount of hair per 1 cm² animal of the 1st control group from animals of the 1st experimental group were 62.6 pcs higher than in the 2nd control group and 136.2 pcs higher than from animals of the 2nd experimental group of the same age. In the summer, on the contrary, the amount of hair per 1 cm² in animals of the 1st control group was 24.1 pcs lower than in the 1st experimental group, and animals of the 2nd control group had 23.4 pcs lower amount of hair than animals of the 2nd experimental group of the same age. No significant differences between animals of different genotypes for the rest of the hair cover parameters were observed in winter and summer, which, to a certain extent, characterized animals of all genotypes as sufficiently adapted to environmental conditions.

The structure of the hair characterizes biological characteristics and, to a certain extent, the adaptive abilities of the animal body (Table 12). Table 12 shows that fluff content was prevalent in the hair structure (63.8-71.8%) in animals of all genotypes in winter. In comparison, the content of awn was prevalent (42.1-46.1%) in summer, which naturally reflects the adaptive abilities of animals to changing environmental conditions. A comparison of the genotypic characteristics of the animals showed that animals of the 1st control group had 2.7% higher fluff content than animals of 1st experimental group, and animals of the 2nd control group had 2.5% lower fluff content than animals of the 2nd experimental group in winter. The fluff content was 1.3% lower in cross-bred Hereford animals and 0.9% lower in cross-bred Aberdeen-Angus animals compared to purebred animals, which also, to a certain extent, indicates higher adaptive abilities of cross-breed animals with scrub cattle

genetic material.

It can be concluded that more pronounced adaptive abilities characterized the cross-bred animals in terms of the hair cover and hair structure. Simultaneously, in terms of the main parameters of the change in the hair coat and its structure, purebred animals of the Hereford and Aberdeen-Angus breeds were generally characterized by good adaptive abilities, depending on changes in the external environment.

The biochemical composition of the blood of different genotypes was analyzed to reveal the adaptive qualities of the animal organism to the natural and climatic conditions of West Kazakhstan. (Table 13). The results showed that the indicators of the biochemical composition of the blood of animals of all genotypes were within the physiological norm. Simultaneously, in comparison with cross-bred animals, there was an increased level of activity of AST and ALT in the blood of young cattle of the 1st experimental group and an increased level of AST in animals of the 2nd experimental groups. It is possible to predict fattening and meat qualities by the level of enzyme activity. According to recent studies, the maximum activity of blood serum aminotransferases coincides with the maximum growth of muscle tissue in bulls. A significant positive correlation was established between the activity of serum aminotransferases and the live weight and growth energy of bulls at the age of four and twelve months. At the same time, Marutyan believed that the age of four months is optimal for prediction.

The alkaline phosphatase activity was the highest in the 1st experimental group, and the lowest activity was in the 2nd control group. The bulls of the 2nd control group were distinguished by higher blood creatinine and iron (Fe) levels, which makes it possible to expect higher live weight gains when rearing and fattening young cattle with this genotype. The level of albumin and GGT in the blood serum was slightly higher in bulls of the 1st control group. It can be taken into account when organizing the selection of individual genotypes for fattening.

The data on the biochemical parameters of blood indicated the normal physiological state of the organism of animals of all genotypes and good adaptive abilities to the sharply continental climate of West Kazakhstan in animals of all groups.

4. CONCLUSION:

The Hereford breed's genealogical structure is represented by the descendants of 6 servicing bulls and the Aberdeen-Angus – by the descendants of 15 servicing bulls. The live weight of young stock of all genotypes met and exceeded the breed standard requirements for all age indicators by an average of 41.8 kg, and in general, all age periods were marked by a rather high live weight of bull calves and heifers. High indicators of the average daily gain of young stock in 0-6 months of the 1st and 2nd experimental groups compared with animals of the 1st control group were associated with a higher milk yield of cattle. Indicators of the quality of sperm production of young stock of different genotypes were suitable for artificial insemination, manual, and free mating. Cows of all genotypes were characterized by good reproductive qualities, while cows of the control group had insignificant advantages. Indicators of the duration of the service period, as one of the important indicators of the reproductive properties of cows, in all genotypes were within the acceptable and desirable limits for normal reproduction of the herd (62.3-69.1 days).

Analysis of the research results showed that in terms of the hair coat and hair structure, animals of the 1st and 2nd control groups had more pronounced adaptive properties. Since the hair-covering is one of the signs of the adaptability of a living organism to environmental conditions, it serves as a heat insulator. In terms of the main parameters of the change in the hair coat and its structure, animals of the 1st and 2nd experimental groups were generally characterized by good adaptive abilities, depending on changes in the external environment, which are due to the same reaction of the organism of imported and local animals to changing environmental conditions. The data on the biochemical composition of blood showed the normal physiological state of the organism of animals of all groups. Also, they indicated good adaptive abilities to the sharply continental climate of the steppes and semidesert of West Kazakhstan in animals of all groups.

5. ACKNOWLEDGMENTS:

The study was performed in the Grant Funding framework of the Ministry of Education and Science of the Republic of Kazakhstan, project AP05134009 "Efficiency of the use of genetic resources of beef cattle for the production of environmentally-safe beef" of the Zhangir Khan West Kazakhstan Agrarian Technical University.

6. REFERENCES:

1. Aitzhanova, I., Naimanov, D. K., Miciński, B., Dzik, S., and Miciński, J. (2017). Fattening performance of bulls of three breeds fattened semi-intensively in the Kostanay Region. *OnLine Journal of Biological Sciences*, 17(3), 157-165.
2. Belousov, A. M., and Godzhiev, S. (1990). Otechestvennaya populyatsiya aberdin-angusskogo skota [Domestic population of Aberdeen Angus cattle]. *Molochnoe i myasnoe skotovodstvo [Dairy and beef cattle breeding]*, 6, 13-16.
3. Berman, A. (2011). Invited review: Are adaptations present to support dairy cattle productivity in warm climates? *Journal of Dairy Science*, 94(5), 2147-2158.
4. Bozymov, K. K., Nasambaev, E. G., Akhmetalieva, A. B., and Nugmanova, A. E. (2019). Exterior Features and Productive Qualities of Young Beef Cattle of Various Genotypes. *International Journal of Engineering and Advanced Technology*, 9(2), 745-750.
5. Diaz, D., Vander, P. M., Xiao, Y., Renquist, B., Wright, A., Collier, R., and Compart, D. (2018). Environmental chamber heat stress responses and adaptations in cross-bred Hereford steers. *Translational Animal Science*, 2, S185-S188.
6. Dubovskova, M. P., and Kuzin, A. V. (2005). Myasnaya produktivnost bychkov mestnoi populyatsii kazakhskoi belogolovoi porody i potomkov bykov Ankatsinskogo i "Zavolzhskego" zavodskikh tipov [Meat productivity of bulls of the local population of the Kazakh white-headed breed and descendants of bulls "Ankatsinsky" and "Zavolzhske" factory types]. *Beef cattle bulletin: Proceedings of international scientific and practical conference dedicated to the 75th anniversary of Mendeleev All-Russian Institute for Metrology*, 2(58), 195-196.
7. Dzhulamanov, K. M. (2006). Volosyanoi pokrov zhivotnykh kazakhskoi belogolovoi porody [Hair cover of animals of the Kazakh white-headed breed]. *Beef cattle bulletin: Proceedings of international scientific and practical conference dedicated to the 75th anniversary of*

Mendelev All-Russian Institute for Metrology, 2(59), 40-42.

8. Gabidullin, V. M., Belousov, A. A., and Tagirov, Kh. Kh. (2016). Opredelenie plemennoi tsennosti bykov-proizvoditelei v zavisimosti ot metoda otsenki determination of the breeding value of servicing bulls depending on the assessment method]. *Vestnik myasnogo skotovodstva*, 2(94), 22-26.
9. Kayumov, F. G. (2005). Znachenie myasnykh porod v intensivatsii proizvodstva govyadiny [The importance of beef breeds in the intensification of beef production]. *Beef cattle bulletin: Proceedings of international scientific and practical conference dedicated to the 75th anniversary of Mendelev All-Russian Institute for Metrology*, 1(58), 73-79.
10. Kayumov, F. G., Dubovskova, M. P., and Kuzin, A. V. (2005). Uluchshenie produktivnosti skota kazakhskoi belogolovoi porody metodom krossirovaniya v usloviyakh Yuzhnogo Urala [Improvement of the productivity of cattle of the Kazakh White-headed breed by the method of crossing in the conditions of the Southern Urals]. *Beef cattle bulletin: Proceedings of international scientific and practical conference dedicated to the 75th anniversary of Mendelev All-Russian Institute for Metrology*, 1(58), 165-168.
11. Kazhgaliyev, N. Z., Shauyenov, S. K., Omarkozhauy, N., Shaikenova, K. H., and Shurkin, A. I. (2016). Adaptability and productive qualities of imported beef cattle under the conditions of the northern region of Kazakhstan. *Biosciences Biotechnology Research Asia*, 13(1), 531-538.
12. Kosilov, V. I., Buravov, A. F., and Salikhov, A. A. (2006). Osobennosti formirovaniya myasnoi produktivnosti molodnyaka simmental'skoi i chernopestroi porod [Features of the formation of meat productivity of young simmental and black-spotted breeds]. Orenburg, Russia: Izdat. tsentr OGAU, 268 p.
13. Kosilov, V. I., Irgashev, T. A., Shabunova, B. K., and Akhmedov, D. (2015). Klinicheskie i gematologicheskie pokazateli cherno-pestrogo skota raznykh genotipov i yakov v gornykh usloviyakh Tadzhikistana [Clinical and hematological parameters of black-and-white cattle of different genotypes and yaks in the mountainous conditions of Tajikistan]. *Bulletin of Orenburg State Agrarian University*, 1(51), 112-115.
14. Kosilov, V. I., Kuvshinov, A. I., Mufazalov, E. F., Nurzhanova, S. S., and Mironenko, S. I. (2005). *Effektivnost ispolzovaniya simmental'skogo i limuzinskogo skota dlya proizvodstva govyadiny pri chistoporodnom razvedenii i skreshchivanii* [Efficiency of using simmental and limousine cattle for beef production in pure-bred breeding and crossbreeding]. Orenburg, Russia: Orenburg State Agrarian University, p. 246.
15. Makaev, Sh. A. (2005). Seleksionno-geneticheskaya otsenka i metody sovershenstvovaniya kazakhskoi belogolovoi porody selection and genetic assessment and methods of improving the Kazakh white-headed breed]. *Beef cattle bulletin: Proceedings of international scientific and practical conference dedicated to the 75th anniversary of Mendelev All-Russian Institute for Metrology*, 2(58), 65-71.
16. Makaev, Sh. A., Kayumov, F. G., and Nasambaev, E. G. (2005). Kazakhskii belogolovyi skot i ego sovershenstvovaniye. Nauchnoe izdanie [Kazakh White-headed cattle and their improvement. Scientific publication]. Moscow, Russia: All-Russian Scientific Research Institute of Beef Cattle Breeding, 336 p.
17. Meshcheryakov, V. S. (2004). *Myasnaya produktivnost krupnogo rogatogo skota yuga Zapadnoi Sibiri i metody ee povysheniya* [Meat productivity of cattle in the south of Western Siberia and methods of its increase]: abstract of a thesis of a Doctor of Agricultural Science. Siberian Research and Design Technological Institute of Livestock, Novosibirsk, Russia, 58 p.
18. Oraz, G. T., Ospanov, A. B., Chomanov, U. C., Kenenbay, G. S., and Tursunov, A. A. (2019). Study of beef nutritional value of meat breed cattle of Kazakhstan. *Journal of Hygienic Engineering and Design*, 29, 99-105.

19. Piccoli, M. L., Brito, L. F., Braccini, J., Oliveira, H. R., Cardoso, F. F., Roso, V. M., Schenkel, F. S. (2020). Comparison of genomic prediction methods for evaluation of adaptation and productive efficiency traits in Braford and Hereford cattle. *Livestock Science*, 231, 103864.
20. Pilvere, I., Proskina, L., and Nipers, A. (2016). Technological and economic aspects of meat cattle farming in Latvia. In *Engineering for Rural Development*. Paper presented at the 15th International Scientific Conference, held at Jelgava, Latvia, May 25-27, 2016 (pp. 473-480). Jelgava, Latvia: Latvia University of Agriculture, Faculty of Engineering.
21. Sahagun, R., Medina, J. H. V., and Ruiz, I. J. (2009). Estimates of genetic and environmental parameters in tropical areas that influence the growth beef bovine F₁. *Journal of Animal and Veterinary Advances*, 8(12), 2503-2507.
22. Salikhov, A. A., and Kosilov, V. I. (2008). Produktivnye kachestva molodnyaka cherno-pestroi porody [Productive qualities of young black-and-white breed]. *Izvestiya Orenburgskogo gosudarstvennogo agrarnogo universiteta*, 1(17), 64–65.
23. Sharafutdinova, E. B., Zhukov, A. P., and Rostova, N. Yu. (2016). Adaptinaya reaktsiya importnogo skota golshtinskoi porody na temperaturnye usloviya sredy [Adaptive response of imported Holstein cattle to ambient temperature conditions]. *Bulletin of Orenburg State Agrarian University*, 2(58), 156-159.
24. Shevchenko, N. I., Kladova, L. A., and Chufeneva, S. V. (2008). Vliyanie sezona rozhdeniya na intensivnost rosta molodnyaka gereforskoi porody [Influence of the season of birth on the growth rate of young Hereford breed]. *Vestnik Altaiskogo gosudarstvennogo agrarnogo universiteta*, 7(45), 56-58.
25. Wyatt, W. E., Collier, R. J., Blouin, D. C., Scaglia, G., and Collier, J. L. (2014). Growth and reproductive performances in F₁ cross-bred heifers from Hereford, Braford, and Bonsmara sires and Angus and Brangus dams. *Professional Animal Scientist*, 30(3), 342-353.
26. Wyatt, W. E., Lawrence, T. E., Collier, R. J., Blouin, D. C., Scaglia, G., Bidner, T. D., and Collier, J. L. (2013). Feedlot performance, carcass merit, and meat tenderness in cross-bred cattle from Hereford, Braford, and Bonsmara sires and Angus and Brangus dams. *Professional Animal Scientist*, 29(6), 632-644.
27. Zelenkov, P. I., Drobot, I. A., and Zelenkov, A.P. (2009). Otsenka bykov po vosproizvoditelnym kachestvam [Assessment of bulls by reproductive qualities]. In *Aktualnye problemy razvitiya zootekhnicheskoi nauki [Actual problems of the development of zooengineering science]*. Paper presented at the International scientific and practical conference, March 20-22, 2009 (pp. 66-69). Persianovsky village, Russia: DonGAU.
28. Zhuzenov, Sh. A., Muskhanov, Zh. V., Umarov, K. T., Sadykova, L. U., and Seitmuratov, A. E. (2013). *Selektsionnye i tekhnologicheskie osnovy povysheniya potentsiala produktivnosti myasnogo skota [Breeding and technological bases for increasing the productivity potential of beef cattle]*. Almaty, Kazakhstan: TOO "Izdatelstvo Bastau", 172 p.
29. Zinullin, A. Z., and Nugmanova, A. E. (2016). Selecting beef cows according to the selection index concerning their natural resistance in the conditions of the sands of the Naryn semidesert. *International Journal of Pharma and BioSciences*, 7(2), 68-75.
30. Zinullin, A. Z., Sadykov, R. S., Alimbekov, S. A., Akhmetalieva, A. B., and Nugmanova, A. E. (2016). The economic traits and adaptive capacity of bull-calves of the Kazakh white-headed breed to the conditions of the semidesert zone of the Naryn sands. *Biosciences Biotechnology Research Asia*, 13(1), 539-546.

Table 1. Breed and class composition of the cattle herd of the "Musa" and the "Khafiz" farms

Class	Youngstock											
	By herd		Cows		Servicing bulls		Heifers at the age of 18 months		Bulls at the age of 6-12 months		Heifers in the age of 6-12 months	
	Heads	%	Heads	%	Heads	%	Heads	%	Heads	%	Heads	%
	1	2	3	4	5	6	7	8	9	10	11	12
Groups												
1 st experimental												
Elite-record	141	64.1	86	71.7	-	-	-	-	24	53.3	31	60.8
Elite	43	19.5	9	7.5	6	100	-	-	14	31.1	16	31.4
1 st class	11	5	-	-	-	-	-	-	7	15.6	4	7.8
2 nd class	25	11.4	25	20.8	-	-	-	-	-	-	-	-
2 nd experimental												
Elite-record	228	32.9	86	22.4	4	26.6	-	-	83	49.4	55	39.0
Elite	363	52.4	219	57.2	11	73.4	-	-	68	40.5	65	46.1
1 st class	42	6.1	4	1.0	-	-	-	-	17	10.1	21	14.9
2 nd class	-	-	-	-	-	-	-	-	-	-	-	-
Control												
Elite-record	48	10.4	27	9.8	-	-	-	-	10	8.1	11	11.0
Elite	199	43.4	83	30.2	-	-	-	-	65	52.8	51	51.0
1 st class	200	43.6	154	56.0	-	-	-	-	48	39.1	38	38.0
2 nd class	11	2.4	11	4	-	-	-	-	-	-	-	-

Table 2. Age dynamics of live weight of young stock of different genotypes, kg

No.	Sex of animals	n	Groups					
			Experimental				Control	
			1 st		2 nd			
			x±Sx	C _v , %	x±Sx	C _v , %	x±Sx	C _v , %
At birth								
1	Bulls	15	27.2±0.59	8.24	25.2±0.64	9.50	25.1±0.66	9.96
2	Heifers		25.8±0.58	8.44	22.1±0.69	11.69	22.7±0.70	11.81
6 months								
1	Bulls	15	231.4±2.13	3.44	221.6±3.85	6.51	182.4±1.96	4.03
2	Heifers		195.2±3.38	6.48	190.66±3.58	7.03	174.3±2.02	4.33
8 months								
1	Bulls	15	271.4±1.93	2.67	274.8±3.21	4.37	217.8±2.87	4.93
2	Heifers		232.3±2.70	4.35	229.1 ±3.84	6.27	211.4±1.40	2.48
12 months								
1	Bulls	15	347.7±2.76	2.97	340.6±2.70	2.96	326.2±3.17	3.64
2	Heifers		292.1±2.82	3.62	297.1±4.20	5.29	276.4±2.76	3.74
15 months								
1	Bulls	15	403.8±3.28	3.04	402.5±3.45	3.21	378.3±4.72	4.67
2	Heifers		337.1±3.53	3.91	329.1±3.80	4.32	317.2±2.48	2.93

Table 3. Dynamics of average daily growth by age period (y)

Groups	Sex	Growth period, months				
		0-6	6-8	8-12	12-15	8-15
		x±Sx	x±Sx	x±Sx	x±Sx	x±Sx
1 st experimental	Bulls	1,134.4±12.4 5	667.77±52.4 4	635.55±19.14	622.96±26.6 1	630.15±13. 19
	Heifers	941.1±20.70	618.88±20.6 7	498.33±17.86	499.25±17.4 7	498.73±10. 68
2 nd experimental	Bulls	1,091.48±23. 25	885.55±37.2 6	548.33±22.27	688.14±32.3 4	608.25±13. 12
	Heifers	936.29±19.3 7	641.11±25.1 3	566.11±16.95	355.56±19.8 5	475.87±11. 56
Control	Bulls	873.70±10.9 1	591.11±48.2 3	902.77±37.96	579.25±61.7 7	764.12±21. 96
	Heifers	844.81±9.66	618.88±34.2 5	541.66±26.33	453.33±15.1 5	503.80±12. 89

Table 4. Indicators of sexual activity of bulls (13 months)

Groups	Reflexes, sec			
	locomotor	erections	hugging	copulatory
1 st experimental	17.0±0.7	15.0±2.5	11.2±1.2	11.0±1.8
2 nd experimental	18.0±2.5	12.0±1.8	13.0±3.7	14.0±2.1
Control	14.0±0.7	14.0±2.1	11.0±0.7	10.0±1.4

Table 5. Qualitative indicators of sperm production in bulls of different genotypes

Groups	Ejaculate volume	Activity of undiluted sperm, point	Density
1 st experimental	5.3±0.98	8.0±0.81	average
2 nd experimental	5.0±1.24	8.0±0.47	average
Control	5.0±0.74	9.0±0.47	average

Table 6. Manifestation of sexual reflexes in cows of different breeds

No.	Indicators	Groups		
		Experimental		Control
		1 st	2 nd	
		$\bar{x} \pm Sx$	$\bar{x} \pm Sx$	$\bar{x} \pm Sx$
1	Number of cows	120	383	275
2	Duration of the hunting period, hour	16.3±0.70	18.0±0.94	15.6±1.16
3	Duration of estrus, hours	37.3±1.62	35.2±1.03	34.7±1.44
4	Immobility reflex, sec	9.4±0.89	8.6±0.57	10.0±0.56

Table 7. Comparative indicators of the reproductive capacity of cows of different breeds

No.	Indicators	Groups		
		Experimental		Control
		1 st	2 nd	
		5 years	5 years	
1	Number of cows	120	383	187
2	Pregnancy	278.9±0.06	284.4±0.78	282.1±1.20
3	Service period	69.1±0.10	68.6±0.54	62.3±0.43
4	Calving interval	348.0±0.53	351±0.34	344.4±0.46
5	Breeding efficiency, %	96.1	95.4	98.2
6	The period of sexual excitement	16.3±0.70	18.0±0.94	15.6±1.16
7	Estrus	37.3±1.62	35.2±1.03	34.7±1.44
8	Immobility reflex	9.4±0.89	8.6±0.57	10.0±0.56
9	Output of calves per 100 heads, %	89.1	84.4	83.0

Table 8. Indicators of sexual activity of bulls of different genotypes (15 months)

Groups	Reflexes, sec			
	locomotor	erections	hugging	copulatory
1 st experimental	16.0±0.71	14.0±2.50	12.2±1.22	12.0±1.83
2 nd experimental	15.0±2.52	124.0±1.82	13.0±3.71	14.0±2.12
Control	14.0±0.71	15.0±2.11	11.0±0.72	11.0±1.41

Table 9. Indicators of the quality of sperm production of bulls of different genotypes (15 months)

Groups	Volume of ejaculate, ml	Activity of undiluted sperm score	Density
1 st experimental	5.3±0.98	8.0±0.81	average
2 nd experimental	5.0±1.24	8.0±0.47	average
Control	5.0±0.74	9.0±0.47	average

Table 10. Clinical and physiological parameters of young stock of different genotypes

Groups	Time of day, hour	Air temperature , °C	Clinical parameters		
			Body temperature	Respiratory rate	Pulse rate
Winter					
1 st experimental	8:00	-27.21	57.2±1.54	14.3±0.74	38.5±0.81
	12:00	-24.33	61.6±0.85	16.2±1.51	38.6±1.66
	18:00	-26.11	60.3±1.16	17.1±2.71	38.3±0.78
2 nd experimental	8:00	-27.21	59.3±2.74	15.4±0.58	38.2±1.04
	12:00	-24.33	61.3±2.55	17.9±1.34	38.4±1.54
	18:00	-26.11	61.7±0.47	17.5±2.08	38.2±0.55
1 st control	8:00	-27.21	56.3±2.35	13.2±0.71	38.1±0.53
	12:00	-24.33	57.2±0.06	14.2±1.34	38.3±0.65
	18:00	-26.11	55.4±1.19	12.3±0.07	38.3±0.27
2 nd control	8:00	-27.21	56.2±1.65	15.0±0.91	38.1±0.08
	12:00	-24.33	60.8±1.24	16.5±0.48	38.3±0.44
	18:00	-26.11	59.3±0.38	15.9±1.12	38.2±0.27
Summer					
1 st experimental	8:00	+23.2	68.1±1.77	29.6±1.41	38.1±0.52
	12:00	+28.1	72.2±0.69	39.1±1.65	38.4±2.34
	18:00	+25.4	69.3±3.56	37.7±2.56	38.3±1.09
2 nd experimental	8:00	+23.2	69.6±1.24	31.2±2.23	38.3±1.36
	12:00	+28.1	71.2±2.52	40.4±2.62	38.3±0.54
	18:00	+25.4	71.1±3.14	37.6±0.96	38.6±1.47
1 st control	8:00	+23.2	64.6±1.63	26.9±0.86	38.1±0.48
	12:00	+28.1	67.5±1.69	37.2±1.42	38.3±1.22
	18:00	+25.4	66.2±2.37	33.4±2.81	38.3±1.33
2 nd control	8:00	+23.2	68.5±0.44	31.0±1.05	38.2±1.06
	12:00	+28.1	70.6±1.22	38.2±0.67	38.2±0.13
	18:00	+25.4	68.2±0.14	36.3±0.04	38.1±1.02

Table 11. Hair cover indicators of bulls of different breeds

No.	Groups	Amount of hair per 1 cm ² , pcs	Hair length per 1 cm ² , mm	Hair mass, mg
Winter (n=5)				
1	1 st experimental	1,281.3 ±28.65	39.7±1.35	49.3±1.47
2	1 st control	1,344.1 ±21.24	40.7±2.21	50.2±2.55
3	2 nd experimental	1,155.8 ±29.41	40.3±0.81	46.1±2.43
4	2 nd control	1,292.0±18.26	39.2±1.56	46.8±1.72
Summer (n=5)				
1	1 st experimental	575.3 ±19.14	21.3±1.62	14.1±1.25
2	1 st control	551.2 ±17.14	21.1±0.95	13.5±0.47
3	2 nd experimental	512.6±18.77	23.1±1.39	13.3±1.65
4	2 nd control	489.2 ±12.71	22.7±1.44	13.0±0.32

Table 12. Indicators of the hair structure of animals of different genotypes

Hair fraction	Season	Groups			
		1st experimental	1st control	2nd experimental	2nd control
Awn, %	Winter	19.3± 0.54	18.7±0.66	20.5±1.15	19.2±1.15
	Summer	43.1± 1.08	42.1±0.17	43.2±1.65	46.1±1.25
Fluff, %	Winter	69.1±1.32	71.8±1.02	66.3±1.24	63.8±1.64
	Summer	17.7±0.71	16.4±0.65	15.5±0.39	14.6±0.39
Intermediate, %	Winter	11.6± 0.22	9.5±0.02	13.2±0.85	17.0±0.25
	Summer	39.2±0.58	41.5±1.22	41.3±1.80	39.3±0.56

Table 13. Biochemical parameters of the blood of animals of different genotypes

Breed	Glucose mmol/l	Albumin g/l	ALT units/l	AST units/l	Total bilirubin µmol/l	Direct bilirubin µmol/l	Cholest erol mmol/l	Triglyce rides mmol/l
1 st experimental	2.3±0.32	35.8±1.4 3	31.2±2.0 4	165.7±17 .28.	3.4±0.16	1.2±0.31	2.0±0.20	0.07±0.0 2
2 nd experimental	2.7±0.24	38.2±1.3 4	30.1±1.2 5	165.6±16 .32	4.4±0.70	1.5±0.30	1.7±0.21	0.09±0.0 2
1 st control	3.1±0.38	41.6±0.6 7	26.0±1.1 6	114.2±11 .35	4.5±0.47	1.3±0.24	2.3±0.21	00.9±0.0 2
2 nd control	2.6±0.30	38.1±1.4 2	26.6±1.2 7	150.1±18 .61	3.9±0.26	1.5±0.12	1.9±0.12	0.1±0.01
	AP units/l	GGT units/l	Uric acid µmol/l	Fe µmol/l	Pancrea tic amylase units/l	LDH units/l	Creatini ne µmol/l	BUN mmol/l
1 st experimental	193.2±27 .01	13.8±2.0 4	54.6±3.9 1	52.9±5.9 8	88.3±3.8 2	3600.2± 278.16	82.4±11. 94	8.4±0.45
2 nd experimental	161.8±3. 99	11.4±2.7 0	60.3±3.1 2	32.7±5.7 0	98.9±7.7 7	3588.8±1 37.02	80.6±13. 40	7.9±0.87
1 st control	181.4±50 .77	16.6±4.1 4	50.3±6.2 6	31.3±5.1 6	95.8±3.9 8	3230.0±2 98.45	65.2±5.5 5	6.8±0.90
2 nd control	152.8±12 .92	13.8±2.1 1	59.5±3.1 5	30.0±4.2 3	95.5±4.3 8	3239.1±3 09.54	79.7±5.0 6	7.4±0.69