ABSTRACT

dissertation work by Kulbayev Rukhan on the topic “Economically useful indicators and biological features of inbreeding types of Kazakh white-headed cattle” submitted for the degree of Doctor of Philosophy (PhD) in the speciality 6D080200 – Technology of livestock production

Relevance of the Research.

Animal husbandry is an important sector of Kazakhstan's economy, as it directly influences the development of agriculture and the standard of living of the population. The development of livestock breeding and the increase in its efficiency are currently considered among the most important tasks. Modern technologies and growing demand for protein products contribute to the development of this sector. In particular, beef protein is vital for the human body, which is why special attention is paid to the intensification of beef cattle breeding and the increase in productivity through the breeding of meat breeds.

One of the key issues in the development of specialized beef cattle breeding is the formation and strengthening of the breeding base, the production of highly productive cattle breeds, and their effective use. Beef breeds of cattle are characterized by high meat productivity, good quality, early maturity, and efficient feed conversion. Upon slaughter, they yield high-quality meat, heavy carcasses, and premium hides and raw materials. Moreover, beef cattle breeding has relatively low costs and offers great potential for effective land use, especially in vast regions.

Currently, several types of beef cattle and 13 improved breeds have been developed in the CIS countries. In Kazakhstan, the Kazakh White-headed breed is widely used in meat production. This breed is highly adapted to extreme natural and climatic conditions, is very hardy, undemanding in terms of feed, and quickly adapts to the environment. It also stands out for its meat quality, rapid maturity, and ease of rearing.

Many scientists have devoted their research to studying the economically useful traits and breeding and productive characteristics of the intra-breed types of the Kazakh White-headed breed. Among them are Sh. A. Makaev (2002), V. Kalashnikov, V. Levakhin (2009), Kh. A. Amerkhanov, F. G. Kayumov (2009), Sh. A. Makaev (2005), K. K. Bozymov (1994), E. Nasambaev (2006), N. Zh. Kazhgaliev (1999), N. M. Gubashev (2009), A. B. Akhmetaliyeva, and others. Their work is aimed at comprehensive study of the productivity, breed characteristics, and economically valuable traits of the Kazakh White-headed breed.

The main source of meat production in the country is beef cattle. For the dynamic development of this sector, the West Kazakhstan region is an ideal location. In the western region, breeding of pedigree cattle is mainly carried out in pedigree livestock farms. High-performance herds are formed here, deeply coordinated selection work is conducted, and new factory lines and intra-breed types are bred. For

example, in LLP “Ankatinsky” and LLP “Chapayevsky,” the most valuable Kazakh White-headed cattle are concentrated, since this region is the origin of the breed. As a result of scientific experience and research conducted over the past 30 years, five factory lines of this breed have been created, and two new intra-breed types have been formed: the Ankatinsky “enlarged” and the Shagatay polled types.

Western Kazakhstan is a region specializing in the insemination and breeding of the Kazakh White-headed breed, therefore, a relevant task today is a comprehensive study of the breeding and productive qualities, the improvement of their genetic traits, and the increase in meat yield.

Objective of the study: To study the economically useful indicators and biological features of inbreeding types of Kazakh White-headed bull calves under the conditions of the West Kazakhstan region.

Tasks of the study:

1. To study the economically useful phenotypic and biological indicators of inbreeding types of the Kazakh White-headed breed;
2. To study the growth and development of bull calves of the Ankatinsky "enlarged", Zavolzhsky, and Shagatay polled types;
3. To study the physiological and hematological parameters of bull calves of various inbreeding types;
4. To analyze the genetic structure of bull calves of various inbreeding types using microsatellite markers;
5. To determine the meat productivity of bull calves of various inbreeding types;
6. To assess the economic efficiency of rearing bull calves of various inbreeding types.

Object of the Study: The research was conducted at the “Sultan” farm in the Akzhaik district of the West Kazakhstan region. The object of the study was bull calves of various inbreeding types of the Kazakh White-headed breed.

Subject of the Study: The productivity of bull calves of various inbreeding types of the Kazakh White-headed breed.

Methodology and Research Methods. During the study, three groups were formed: Group I – bull calves of the Ankatinsky "enlarged" type, Group II – bull calves of the Shagatay type, and Group III – bull calves of the Zavolzhsky type. Each group consisted of 15 bull calves. All groups were created using the method of paired analog selection. During the research, the housing and feeding conditions for all bull calves were kept uniform.

Growth and development Studies were carried out through monthly weighing. To determine the growth rate, the average daily gain, absolute gain, relative gain, and growth rate of live weight were calculated.

Exterior evaluation was conducted by measuring the main body parameters (height at withers, height at the sacrum, chest depth, oblique body length, chest girth behind the shoulder blade, chest width, width at hips, and cannon bone girth). Based on the measurement results, body conformation indices were calculated.

Reproductive traits of breeding bulls, cows, and bull calves were studied using standard methodologies.

Microsatellite analysis involved the selection of 15 highly polymorphic microsatellite loci (BM1818, ETH3, CSSM66, INRA23, ILSTS6, TGLA227, TGLA126, TGLA122, SPS115, ETH225, TGLA53, CSRM110, and one additional locus recommended by ISAG), and a multiplex PCR was performed. Each batch included negative controls without DNA, and contamination prevention was ensured. Amplification was carried out using the Applied Biosystems kit (Beverly, Massachusetts, USA).

For the analysis of PCR products, fragment length was determined using an AB 3500 genetic analyzer, and the results were processed with the GeneMapper 6.0 software. Allele sizes were aligned with the standards of the ISAG International Bovine STR Typing Comparison Test (2018–2019).

Physiological parameters: Body temperature was measured using a rectal thermometer. Pulse was counted with a stethoscope over 15 seconds and multiplied by four. The hair cover was studied from a 1 cm^2 area.

Blood sampling was conducted to study hematological parameters in the morning from all experimental groups. Blood was collected in special tubes in compliance with aseptic and antiseptic requirements. Vacutainer tubes were used for blood collection.

Meat productivity was determined by weighing the animals using electronic scales.

The initial data obtained through the application of modern methodologies for data collection and processing were analyzed using Microsoft Excel (Office 2019, Microsoft Corp.), and the mean value (M), standard deviation (σ), and coefficient of variation (CV) were calculated for each indicator.

Scientific novelty of the research. For the first time under the conditions of the West Kazakhstan region, a comparative study was conducted on the breeding and productive traits as well as some physiological and biochemical indicators of bull calves of different intra-breed types of the Kazakh White-headed breed. The obtained results were presented to the farm and implemented into practice.

Practical Significance of the Project. This dissertation research has provided new scientific data on the biological characteristics and productivity indicators of various intra-breed types of the Kazakh White-headed breed. Based on this, the theoretical foundation was expanded, and the mechanisms and pathways of intra-breed diversity influence were detailed. The results have allowed large beef farms in the Republic of Kazakhstan to develop practical recommendations for improving the efficiency of breeding Kazakh White-headed cattle and to apply them on a broad scale.

Provisions Submitted for the Defense of the Dissertation

1. Study of economically useful phenotypic and biological traits of inbreeding types of the Kazakh White-headed breed;

2. Study of the growth and development of bull calves of different inbreeding types of the Kazakh White-headed breed;
3. Study of physiological and hematological parameters of bull calves of different inbreeding types;
4. Analysis of the genetic structure of bull calves of different inbreeding types using microsatellite markers;
5. Determination of meat productivity of bull calves of different inbreeding types;
6. Economic efficiency of rearing bull calves of different inbreeding types.

Approbation of the work. The main results of the dissertation research were presented in the materials of the international scientific and technical conference (2015) at the Dulatov Engineering and Economic University in Kostanay.

Implementation of research results. The research results have been implemented in the breeding of Kazakh White-headed cattle at the "Sultan" farm in the Akzhaik district of the West Kazakhstan region and are used in both theoretical and practical activities of specialists.

Degree of reliability of the results. The reliability of the research results is confirmed by a sufficiently large sample of animals of the studied breed types, the application of a comprehensive set of statistical methods, which ensured the validity of the conclusions obtained. The research was conducted in accredited laboratories in accordance with "GOST ISO/IEC 17025-2009. General requirements for the competence of testing and calibration laboratories."

Publications. The results of the dissertation are published in 15 scientific papers, including 4 (four) articles in journals recommended by the Committee for Quality Assurance in the Sphere of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, 5 articles in peer-reviewed international scientific journals indexed in the Scopus database, 1 article in the materials of international conferences. One methodological recommendation has been published. The research was presented at an extended meeting of the Institute of Veterinary Medicine and Agrotechnology of Zhangir Khan West Kazakhstan Agrarian and Technical University and received a positive evaluation.

Structure and volume of the work. The dissertation consists of the following sections: introduction, scientific rationale, methodology and materials of the research, research results, economic efficiency of the study, conclusion and recommendations for production, list of references, and appendices. The text was typed using a computer and contains 113 pages, including 34 tables, 7 figures, and 1 scheme. The list of references includes 136 sources: 37 in the state languages, 39 in foreign languages, and 60 in the languages of CIS countries.