

## ANNOTATION

**dissertation work on the topic: «Productive qualities and reproductive characteristics of the Aberdeen Angus breed in the conditions of the Northern region of Kazakhstan» Shevchenko Pavel Viktorovich for the degree of Doctor of Philosophy (PhD) in the education program 8D08201- «Technology of livestock production»**

### **Relevance of the research topic.**

The theory and practice of beef cattle breeding testify that one of the reserves for increasing animal productivity at the present stage in the Republic of Kazakhstan is sustainable management of genetic resources, great importance is given to deep study of Aberdeen Angus cattle breed, which will predetermine further improvement and its wide geographical distribution across the zones of the country and adaptability to different breeding and growing technologies. All this causes the necessity to search for more successful combinations of leading lines for productive and climatic conditions. At the same time, breeding by lines and allows to develop new, scientifically-based prerequisites for the directional breeding of animals.

However, the nature of the effect of improving the productive traits of Aberdeen Angus cattle is still not disclosed both from the biological and practical sides, so the use of this method is associated with a long search for the most favourable combinations of initial lines in Kazakhstan breeding.

Consequently, there is a need for in-depth study of productive and reproductive qualities of this breed, 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, which will allow to assess the level of increasing the efficiency of herd growth and identify reserves for increasing high-quality beef in the conditions of the Northern region of Kazakhstan.

The necessity of scientific research on evaluation of Aberdeen Angus cattle on exterior-constitutional features (development, typicality), productivity (meat, reproductive) on industrial basis and on suitability to technologies - housing, feeding, monitoring of genetic characteristics in the breed for the purpose of biodiversity conservation becomes especially urgent.

Thus, complex scientific studies on revealing the realisation of genetic potential of Aberdeen Angus cattle of different genotypes on breeding qualities depending on phenotypic and genetic factors are poorly studied.

In connection with the above-mentioned relevance, the **purpose** of research was: a comprehensive study and evaluation of productive, reproductive qualities of cattle Aberdeen Angus breed taking into account breeding and genetic parameters and determination of genetic reserves to improve the breeding qualities of different lineage and increase the profitability of beef cattle breeding in the conditions of Kostanay region.

### **Objectives of the study:**

- to analyse the breed and class composition, genealogical structure of the Aberdeen Angus breed herd;

- to evaluate exterior-constitutional features of cattle of different sex and age groups of cattle in the context of lines (measurements, body indices, exterior measurements, herd division into body types according to Stepanenko S.Ya.);
- to analyse and test young stock of Aberdeen Angus cattle on their own productivity (growth and development);
- to evaluate the breeding stock by reproductive qualities;
- to evaluate bulls-producers on the quality of offspring with the establishment of index evaluation and identification of the best of them;
- to study productive qualities taking into account calculation of indices of selection-genetic parameters:  $X$ ,  $S_x$ ,  $\sigma$ ,  $C_v$ ,  $r$ ,  $z$ ,  $S_d$ ;
- to carry out experimental studies to investigate the comparative efficiency of 4 schemes of synchronisation of sexual heat for artificial insemination of cows and heifers of service age;
- to carry out a comprehensive assessment of the quality of semen of bulls - producers used in free mating for «mopping up»;
- to conduct experimental studies on effective methods of express diagnostics of pregnancy;
- to carry out microsatellite analysis of DNA of Aberdeen Angus cattle by STR-loci;
- to determine the economic aspects of justification of Aberdeen Angus cattle breeding.

#### **Methods of research.**

Productive qualities in the studied cattle stock were studied by evaluation, growth and development analysis. Linear growth by measurements of exterior (height at the withers and rump, chest girth, chest depth, chest width, width in maclocks, oblique length of trunk, oblique length of butt, girth of heel) and calculation of body build indices (long-leggedness, stretchedness, bunchedness, chest, overgrowth, massiveness and bonyness).

Growth intensity (live weight) of animals selected for analysis was studied according to the results of control weighing.

In young animals, the following indicators were calculated to assess growth intensity: absolute, average daily body weight gain.

Evaluation (testing) of bulls on their own productivity was carried out according to the rules of the Order of the Ministry of Agriculture of the Republic of Kazakhstan from 25 January 2023, № 27.

Reproductive qualities of the studied cows were studied according to the following traits: duration of dry period, pregnancy, service period, inter-moisture period (IMP), age at first insemination and calving, live weight at first insemination.

MS Excel software was used for biometric, statistical, selection-genetic calculations and calculation of selection-genetic parameters using an online calculator to calculate statistical criteria.

The dynamics of follicle growth was determined by scanning method using ultrasound diagnostic scanner iScan Draminski (Poland). Immunological rapid tests IDEXX Visual Pregnancy Test (USA) and Oxiline ® Blue Eyes (Canada) were used to determine cow pregnancy.

To obtain semen from breeding bulls, we used a Minitube DC 100-240V electroejaculator (Germany), complete with a probe and semen collection kit. Semen

was collected in tightly closed sterile plastic vials with a volume of 15 ml. Microscopy of sperm products was performed according to generally accepted methods, using a Unico G380 microscope (USA).

To study haematological and biochemical blood parameters, blood was taken from the jugular vein of experimental animals three to four hours after morning feeding into sterile syringe tubes and 10 ml tubes with EDTA anticoagulant.

Haemoglobin, erythrocytes, leucocytes and platelets in whole blood were determined on a veterinary haematological analyser Exigo 17 (Sweden). Biochemical parameters in blood serum: content of total protein, glucose, iron, AST and ALT aminotransferase activity were studied on a BioChemHTFC -120 biochemical automatic analyser (USA).

Hair follicles served as material for studying the genetic structure of Aberdeen Angus breed animals by microsatellite DNA markers. Genomic DNA was isolated using DNA-Extran-2 kit (SINTOL LLC, Russia). DNA extraction was performed according to the protocol of the reagent manufacturer.

DNA fragments were identified by PCR analysis using the COrDIS Cattle kit (Gordiz LLC, Russia) designed for parentage detection and genetic passporting of cattle.

#### **The main provisions put forward for defence:**

- Analysis of breed and class composition, genealogical structure of Aberdeen Angus breed herd;
- Evaluation of exterior-constitutional features of cattle of different sex and age groups of cattle in the context of lines;
- Analysis and testing of young stock of Aberdeen Angus cattle on its own productivity (growth and development);
- Evaluation of breeding stock on reproductive qualities;
- Evaluation of bulls-producers on the quality of offspring with the establishment of index evaluation and identification of the best of them;
- Study of productive qualities taking into account calculation of indices of selection-genetic parameters:  $X$ ,  $S_x$ ,  $\sigma$ ,  $C_V$ ,  $r$ ,  $z$ ,  $S_d$ ;
- Study of comparative efficiency of 4 schemes of synchronisation of sexual hunt for artificial insemination of cows and heifers of service age;
- Estimation of quality of semen of bulls - producers used in free mating for «mop-up»;
- Study of effective methods of express diagnostics of pregnancy;
- DNA analysis of Aberdeen Angus cattle by STR-loci;
- Determination of economic aspects of justification of Aberdeen Angus cattle breeding.

#### **Description of the main results of the research.**

- Evaluation and analysis of productive qualities of Aberdeen Angus cattle of different genotypes revealed:

On live weight - in «Kolos-firm» LLP there is a superiority on live weight at the age of 4 and 5 years and older in group II, cows of Estonian selection over cows of group I of cows of Kazakhstan selection 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%).

In LLP «Sever-Agro N» a similar picture is observed. Cows of imported selection at the age of 4 and 5 years and older exceeded cows of domestic selection in

live weight and the following parameters were obtained: at the age of 4 years cows of American origin exceeded cows of domestic selection by 9.7 kg (2%) and at the age of 5 years - by 4 kg (0.8%).

- The analysis of evaluation of growth and development of young animals of LLP «Sever-Agro N» and LLP «Kolos-firma» showed that bulls and heifers, roots from the American selection of LLP «Sever-Agro N» showed excess in live weight over the breed standard and in comparison with analogs of Estonian selection of LLP «Kolos-firma», in the group «steers» at the age of 6 months - 10,8 / 0,8 %, at the age of 8 months - 27,4 / 10 %, at the age of 15 months - 40,4 / 7,9 % ( $P < 0,95$ ).

- Evaluation of reproductive features based on the results of production experience has established effective schemes №2, №3 and №4 «SIDR-SINCH» of synchronization of sexual cycle in Aberdeen Angus cows in LLP «Sever-Agro N», which allow inseminating all treated cows with hormones without detecting signs of puberty in a fixed time, which greatly simplifies the work of specialists.

- Microscopic examination of semen of bulls-producers showed that the highest number of spermatozoa with rectilinear progressive movement was in sperm production of bulls from «Sever-Agro N» LLP - 7.7 points, which is 0.4 points more than in bulls from «Kolos-firm» LLP and high ejaculate volume - 4.9 ml. 0.2 ml more than in bulls from «Kolos-firm» LLP, ( $P \geq 0.99$ ).

- The study of polymorphism of 15 STR-loci showed that in the studied groups of Aberdeen Angus bulls the average number of alleles per locus was 5.33 and 6.133. On average, no heterozygote deficiency was found at the studied loci in the studied animals. The fixation index of group I amounted to -0.030 fractions of units and -0.094 of units of group II, i.e. there was an excess of heterozygotes in both groups studied. Thus, in the studied populations of the Aberdeen Angus breed, a high stock of genetic diversity at 15 STR-loci was found.

#### **Degree of reliability of scientific results.**

The reliability of the research results is confirmed by sufficient sampling of animals of the studied animals of the studied breed, with the use of a set of statistical and biometric methods that allow to confirm the correctness of the obtained conclusions. The work was carried out in accredited laboratories according to «GOST ISO/IEC 17025-2019. General requirements for the competence of testing and calibration laboratories». *Обоснование новизны и значимости полученных результатов».*

For the first time in conditions of northern Kazakhstan, covering Kostanay region the complex researches on scientific and economic substantiation of methods of perfection of cattle of Aberdeen Angus breed depending on various linear belonging of domestic and imported selection are carried out.

The complex estimation of productive and reproductive qualities with the account of calculation of selection-genetic parameters of cattle of Aberdeen-Angus breed of different sex and age groups of cattle in the section of lines is carried out, that gives the possibility to get the full productive characteristic both on phenotype and on genotype (on DNA-technologies), which in modern conditions of development of pedigree cattle breeding are included in the organisation of republican centralised pedigree accounting in the program IAS.

According to results of scientific researches new data on productive, reproductive indicators and interrelation of studied features in cattle of Aberdeen Angus breed of different sex and age groups of cattle are received.

The ways of improvement of selection and breeding work on increase of productive qualities of the bred breed are scientifically substantiated and recommended.

#### **Directions of science development or compliance with state programmes.**

The work was carried out within the framework of scientific and technical programme BR06249373 «Increasing the efficiency of breeding methods in cattle breeding» funded by the Ministry of Agriculture of the Republic of Kazakhstan, the project «Study of reproduction problems in the selection of breeding herds and the use of modern methods to increase the yield of calves Kostanay region», and within the framework of grant funding project AP14973046 «Development and implementation of a comprehensive assessment of cattle Aberdeen Angus breed in the Republic of Kazakhstan».

#### **Description of doctoral student's contribution to the preparation of each publication.**

The doctoral student was directly involved in the preparation of scientific publications, design and their submission for publication in domestic and foreign editions.

The results of dissertation research and the main provisions are reflected in 9 publications, including 2 - in journals included in the international database Scopus (82% and 26% percentile), 6 - in the publications recommended by the CCES, 3 articles - in the collections of the international conference, 1 - in journals, peer-reviewed in the system of the Russian Science Citation Index. Published: 3 - practical recommendations.

#### **Scope and structure of the thesis.**

The thesis is set out on 127 pages of typewritten text and includes the following sections: introduction, literature review, own research, research results, conclusions and practical suggestions, list of used sources, appendices. The work contains 11 figures, 28 tables, 10 appendices, 198 sources of literature.