

## ANNOTATION

**dissertation work of Jumatayeva Kumis Kudaibergenkyzy on the topic  
«Increasing the reproductive function of cows using biotechnological methods  
of reproduction» submitted for the degree of  
Doctor of Philosophy (PhD) in the educational program  
8D09101 – «Veterinary medicine»**

**Relevance of the research:** In Kazakhstan, special attention is given to the development of the livestock industry. The country possesses significant potential for exporting livestock products, particularly meat. The availability of vast natural pasturelands provides an excellent opportunity to produce competitive and, importantly, environmentally friendly livestock products.

One of the key methods for intensifying reproduction is the application of biotechnological approaches in animal reproduction. Currently, many biotechnological techniques are already used as auxiliary tools to regulate the reproductive capacity of cattle. These include technologies for adjusting estrous cycles, estrus detection, artificial insemination, as well as control of fertilization processes and pregnancy development, among others.

It is important to note that not all hormonal stimulation and estrus synchronization protocols are equally effective. The direction of this research is determined by the need for scientific justification and practical adaptation of estrus stimulation and synchronization schemes for cows in different natural and climatic zones of Kazakhstan. The goal is to improve fertility, reduce the service period, and increase calf yield. In this context, the study of the physiological and hormonal mechanisms underlying synchronized estrous cycles, as well as factors influencing the effectiveness of reproductive measures, becomes particularly significant.

Therefore, the development and improvement of cow estrus synchronization schemes is highly relevant at present.

As milk and meat productivity increases, cow fertility tends to decrease due to neurohormonal changes in reproductive function. These changes negatively affect the expression of estrus, making it difficult to detect. Hence, accurate and timely estrus diagnosis is of great importance.

Thus, the present study is aimed at addressing a significant scientific and practical challenge — improving the reproductive capacity of cows through the use of modern synchronization methods adapted to regional conditions, with subsequent implementation of the results into production practices and the educational process.

**Purpose of the dissertation research:** Development and scientific justification of effective schemes for stimulation and synchronization of estrus to enhance the reproductive function of cows under the farming conditions of the Republic of Kazakhstan.

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

1. Conduct monitoring of cattle herd reproduction in several farms across the southern, southeastern, eastern, and northern regions of Kazakhstan and develop a comprehensive program to improve the reproductive function of cows.
2. To develop effective estrus synchronization protocols with a fertilization efficiency of over 70%.
3. Study the influence of certain external and internal factors on the effectiveness of estrus synchronization in cows.
4. Determine the economic efficiency of the developed estrus synchronization protocols and implement the most effective ones in production as well as in the educational process of universities and colleges.
5. Develop recommendations on optimal estrus synchronization schemes for cows and integrate them into production and the training process for specialists.

**Research methods:** The object of the study included cows of Kazakh White-headed, Holstein-Friesian, and Simmental breeds kept in the conditions of the Almaty, Zhambyl, Pavlodar, and East Kazakhstan regions (now Abai region). To assess the reproductive function of cows and determine the effectiveness of biotechnological methods, comprehensive research methods were applied, including clinical and laboratory analyses.

During clinical studies, the condition of the genital organs was determined using standard examination methods with ultrasound devices such as iScan Draminski Ultrasound Scanners (Poland), Mindray Z5 (China), and Easi Scan BSF technology (United Kingdom). Insemination was carried out using the Alpha Vision video system and the cervical method with rectal fixation of the cervix.

For estrus synchronization in cows and breeding-age heifers, various treatments were used, including: Tissue-based stimulants: ASD fraction 2; Hormonal preparations: Dinolytic, Estrofan, Magestrofan, Estrofantin, Broestrofan, Estrumate, Prosolvin, Surfagon, Fertagon, Fertagil, Fertibel, Acegon, PRID Delta, CIDR, ECP Synestrol 2%; Neurotropic agents: 0.5% Proserin and 0.1% Carbocholine (2-3 ml); Vitamin supplements: E-Selenium, Selevet, Tetramag, Tetravit, Butofan, Multivitamins + Minerals.

As a natural stimulator of sexual function, teaser bulls with aprons were used, with an S-shaped bend of the lower knee of the penis surgically altered.

The collected data were statistically processed using a personal computer with Microsoft Office Excel software. The reliability of mean values was determined using Student's t-test.

**Principal theses submitted for defense (substantiated scientific hypotheses and other findings representing original contributions to knowledge):**

- Analysis of the reproductive status of cattle herds in the studied farms across the southern, southeastern, eastern, and northern regions of Kazakhstan for the period 2018-2019, and the development of a program to enhance the reproductive function of cows.

- Development of estrus synchronization protocols for cows with a fertilization efficiency of 70-90%. Results of the conducted studies in various regions of the country.
- The impact of different methods of stimulation of the reproductive system in cows on the effectiveness of estrus synchronization protocols and the dynamics of estradiol 17 $\beta$  hormone levels in the blood.
- Results of using teaser bulls, hormonal drugs, biologically active substances, and genital electrostimulation in estrus synchronization and their effects on the reproductive function of cows.
- The influence of certain climatic factors on the effectiveness of estrous cycle synchronization protocols.

**Justification of the novelty and significance of the obtained results:** For the first time, work was carried out to improve stimulation and estrus synchronization protocols for cows under farm conditions in the Almaty, Zhambyl, East Kazakhstan, and Pavlodar regions. Existing estrus synchronization schemes were refined, and new ones were developed, addressing issues related to determining the optimal time for insemination and the site of semen deposition. The research results were presented at international conferences, published in scientific journals, and integrated into the educational process of KazNAIU, Toraighyrov University, Shakarim University, Zhangir Khan WKATU, WKITU, and A. Baitursynov KRU.

It should be noted that the improved and newly developed estrus synchronization protocols enhance the reproductive function of cows. Each component used in the synchronization protocols was theoretically justified, and the effectiveness of their application in practice was determined.

The use of teaser bulls for the correction of cows' reproductive function during synchronization and estrus stimulation was also substantiated. Additionally, methods of genital electrostimulation during the synchronization period were proposed and scientifically validated.

The influence of various climatic factors on the effectiveness of estrus synchronization in cows was studied. The dynamics of estradiol 17 $\beta$  hormone levels in the blood were established under different synchronization protocols and climatic conditions.

The developed and recommended protocols are practically feasible, easy to implement in production, and have proven to be effective for both dairy and beef cattle.

**Compliance with scientific development priorities or government programs:** Within the framework of the scientific project on applied research in the agro-industrial complex for 2018–2020 (O.0879), under the scientific and technical program "Improving the efficiency of selection methods in cattle breeding," within the project "Development of effective selection methods in the pedigree beef cattle industry," under the activity "Study of reproduction problems in the selection of pedigree herds and the use of modern methods to increase calf yield in the southern and southeastern regions."

**Research Project Location** The experimental part of the study was conducted at PF "Akhay" in the Talas district of the Zhambyl region, LLP "Aqsut LLC" in the Ili district of the Almaty region, APC "Azamat 2" in the Beskaragay district of the East Kazakhstan region, and LLP "Ushterek and K" in the Aksu district of the Pavlodar region. Laboratory studies were carried out at the veterinary diagnostic center "EQUI LAB," at Saints Cyril and Methodius University in Skopje, and in the "Veterinary Reproductive Biology and Surgical Pathology" laboratory of the "Clinical Disciplines" department at the Kazakh National Agrarian Research University.

### **Implementation of Research Results**

The research results have been integrated into the educational process through lectures and laboratory-practical sessions for veterinary students and professional development trainees at the Kazakh National Agrarian Research University, at Saints Cyril and Methodius University in Skopje, Zhangir Khan West Kazakhstan Agrarian-Technical University (Uralsk), West Kazakhstan Innovative-Technological University (Uralsk), Toraighyrov University (Pavlodar), Shakarim University (Semey), and A. Baitursynov Kostanay Regional University (Kostanay).

Additionally, the research findings have been implemented in agricultural enterprises, including "Azamat 2" in the Beskaragay district of the East Kazakhstan region (now Abai region), "Aqsut LLC" in the Ili district of the Almaty region, "Ushterek and K" in the Aksu district of the Pavlodar region, and "Akhay" in the Talas district of the Zhambyl region (Appendix A). The implementation of these developments in the mentioned farms has led to an improvement in the reproductive function of the experimental animals.

### **Research Publications**

According to the dissertation materials, 12 scientific papers have been published:

1 article published in the journal Journal of Advanced Veterinary and Animal (ISSN 2311-7710), 2024, Vol. 11, No. 1, pp. 100-106, with a Q2 percentile of 74.

3 articles published in journals from the Committee for Quality Assurance in the Field of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

a) In the scientific-practical journal Science and Education (No. 3-1 (72), 2023, ISSN 2305-9397, pp. 170-179);

b) In the scientific-practical journal Science and Education (No. 3-1 (72), 2023, ISSN 2305-9397, pp. 188-197);

c) In the multidisciplinary scientific journal 3i: intellect, idea, innovation (No. 1, 2024, ISSN 2226-6070, pp. 13-19).

8 articles published in international scientific conference proceedings:

10th Anniversary International Scientific Conference for Students, Postgraduates, and Young Scientists "Knowledge of Youth for the Development of Veterinary Medicine and the Agro-Industrial Complex of the Country" –

Presentation and publication of a scientific article (Saint Petersburg, 2021, pp. 101-102);

All-Russian Scientific-Practical Conference with International Participation Dedicated to the 150th Anniversary of Academician M.F. Ivanov "Selective and Technological Aspects of Intensification of Livestock Production" – Presentation and publication of a scientific article (Moscow, 2022, pp. 93-98);

Reproduction in Domestic Animals at an international conference indexed in the Web of Science database (Thessaloniki, Greece) with an impact factor – Poster presentation and publication (vol. 57, Supplement 4, September 2022, p. 82, ESDAR conference, September 28, 2022, Thessaloniki, Greece);

International Scientific-Practical Conference "State and Prospects of Industrial and Innovative Development of the Agro-Industrial Complex of the Republic of Kazakhstan", dedicated to the 70th anniversary of the Semipalatinsk Zootechnical-Veterinary Institute and the 80th anniversary of Doctor of Veterinary Sciences, Professor Zeinolla Kalymbekovich Tokayev – Presentation and publication of a scientific article (Semey, 2022, pp. 18-20);

International Scientific-Practical Conference "Seifullin Readings – 18: Youth and Science – A Look into the Future" – Presentation and publication of a scientific article (Nur-Sultan, 2022, pp. 113-116);

International Scientific-Practical Conference "State and Prospects for the Development of Veterinary Medicine and Animal Husbandry in the Republic of Kazakhstan", dedicated to the 80th anniversary of Academician of the National Academy of Sciences of the Republic of Kazakhstan, Doctor of Veterinary Sciences, Professor T. Saiduldin – Presentation and publication of a scientific article (Almaty, 2023, pp. 254-258);

International Scientific-Practical Conference "The Path to Science – 2023!" – Presentation and publication of a scientific article (Uralsk, 2023, pp. 86-90);

International Scientific-Practical Conference of Young Scientists and Students, dedicated to the 90th anniversary of the Honored Worker of Agriculture of the Kazakh SSR, Doctor of Agricultural Sciences, Academician Kaldybek Sabdenovich Sabdenov "Continuity in Science – The Basis for Sustainable Development of Agricultural Science and Production" – April 20-21, 2023, Almaty, pp. 235-239.

**The dissertation consists** of 152 pages and includes an introduction, a literature review, research direction selection, research conditions, research results, and conclusions. It contains 38 tables, 4 figures, and 4 appendices. The list of references includes 236 sources.