

**REVIEW**

Report of 1207 pages, 1 figure, 7 tables, 86 references, 12 Appendixeses.

Key words: BEEF AND DAIRY CATTLE BREEDING, SHEEP BREEDING, CAMEL BREEDING, HORSE BREEDING, YIELDING CAPACITY, PASTURES, PREVENTION, flow process charts, pests, Entomophages, phytopathogens, FODDER CROPS, biological products, EPIDEMIC SITUATION, DIAGNOSIS, VACCINE.

Object of research: farm livestock, pasturelands, forage crops, flow process charts, pests, entomophages, phytopathogens, biological products, veterinary products, biomaterial.

Purpose of research is to identify constraints that prevent production process development in livestock industries (dairy and beef cattle, sheep, horses, camel breeding) of Baiserke-Agro LLP, to develop and implement production methods to increase the yield of forage crops, harvesting and preparation of feed; to develop comprehensive system of productivity and improvement of breeding ability of livestock.

Research methods: Generally accepted agricultural and biological methods with original and transfer modifications.

We have calculated the optimal load and demand of pasturelands for all types of livestock with the duration of grazing period. We have researched dairy and cattle breeding, horse breeding, camel breeding and sheep breeding and identified factors that hinder the development of production processes for intensive management of livestock industries of Baiserke-Agro LLP.

We have analyzed survey results and adjusted scientific developments to reduce the cost of final products; prepared and implemented regional flow process charts of forage crop cultivation. As a result, we have received 4 patents of the Republic of Kazakhstan for a utility model; registered 2 research and development deliverables in STI information; prepared recommendations for cultivation and integrated protection system of forage crops; completed production tests and implemented biological agents - Entolek and Fitodok, seeding green manure.

We monitored epidemic situation among epizootic units in Baiserke-Agro LLP and adjacent territories. We have studied and analyzed efficiency of anti-epizootic measures given in comprehensive plan among large and small cattle, horses and camels; offered optimization ways during anti-epizootic measures, taking into account the epizootic situation and the sequence of application of biological products.

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**TERMS AND DEFINITIONS**

In this report:

Trans – humance grazing is cattle breeding with maximum use of seasonal pastures

Body composition – a set of biological and economic properties and characteristics of animals that characterize the body as a whole

Exterior – an external shape of the cattle body considered when determining yielding and breeding qualities

Service period – the period from calving to fruitful insemination

Postnatal development period – the stage of ontogenesis, during which the growing organism begins to adapt to external environment

Body weight – the cattle weight in kilograms, determined in standard conditions before feeding (usually morning)

Meat yield – quantity and quality of meat products obtained from meat-producing animals

Breed – an integral animal group of the same species, created by human in certain social and economic conditions with common history of development and origin

Yield – animal production level

Development – qualitative changes of the body at a particular time

Herd reproduction – maintaining the number of herds at the same level or increasing its number

Absolute gain – the increase in body weight over a certain period of time, expressed in kilograms

Average daily gain – the gain in body weight over a certain period of time, expressed in grams

Relative gain – the increase in body weight over a certain period of time, expressed in percentage

Number of heads – the total number of any animals in a certain area

Herd (herd, flock, group) – a group of animals of the same species, permanently or temporarily living together, put together for economic use or a population living in a certain area

Monitoring – monitoring of epizootic indicators of animal diseases

Livestock complex – an agricultural enterprise (subdivision), which manage breeding, maintenance, reproduction of [livestock](https://ru.wikipedia.org/wiki/%D0%A1%D0%B5%D0%BB%D1%8C%D1%81%D0%BA%D0%BE%D1%85%D0%BE%D0%B7%D1%8F%D0%B9%D1%81%D1%82%D0%B2%D0%B5%D0%BD%D0%BD%D1%8B%D0%B5_%D0%B6%D0%B8%D0%B2%D0%BE%D1%82%D0%BD%D1%8B%D0%B5) and production of livestock products

Abortion – premature termination of pregnancy

Infertility – a violation of reproductive function

Hypo-varianism – weakening of the functional activity of ovaries

Fertilization – a process in which female and male germ cells, ovum and sperm fuses to form a zygote

Estruation – a positive sexual response of female to male

Sexual cycle – a complex, chain, reflex neurohumoral process that occurs in the body of a non-pregnant female from one stage of excitation to another

Bura breeder – male of two-humped camel for breeding

Bactrian – a two-humped domesticated camel. Its wild type still lives in in the Northern somones of Mongolia

Camel breeding – a branch of animal husbandry for breeding and rational use of camels

Foaling time – the end of variability period by the camel birth

Genetic pool – the composition and number of different forms (alleles) of different genes in populations of different organisms

Heterosis – growth acceleration or increase in size, improving the vitality and fertility of hybrids of the first generation compared to the parent forms of animals

Homogeneous – homogeneous in composition

Dromedar – humped domesticated camel, its wild type does not exist now

Camel monitoring – the constant monitoring of a process to determine whether it meets the desired parameters or initial assumptions

Young camels for replacement – are young camels selected for reproduction

Hand mating – mating of individually selected camels under the supervision of specialist

Type – a form and kind of something, possessing certain characteristics, as well as a sample, which corresponds to a known group of objects, phenomena

Commercial camels – are camels used for the production of commodity products

Pure-breeding of camels – breeding of camels of the same breed (Kazakh Bactrian, Turkmen dromedar Arvana, Kazakh dromedar) in order to consolidate and typify the characteristics inherent in this breed with the use of camels of related breeds (Kalmyk Bactrian) in breeding

Camel exterior – the external shape of different camels taking into their yielding ability (dairy, meat-wool, meat-dairy), determined by visual inspection, assessment, measuring, weighing, photographing, etc.

Body composition of horse – a set of its morphological and physiological features

Biological products – plant protection products created from products synthesized by living organisms that have high chemical activity, or consist of living organisms that are active against pathogens

Pest – [an animal](https://ru.wikipedia.org/wiki/%D0%96%D0%B8%D0%B2%D0%BE%D1%82%D0%BD%D0%BE%D0%B5) that causes damage to a human or its farm, reduces the yield and quality of products, and thereby causes economic damage

Insecticides – products for the destruction of harmful insects

Integrated plant protection – plant protection subdiscipline that develops theoretical and methodological foundations for the integrated use of various means and methods of plant protection in order to ensure the phytosanitary safety of the territory

Mycotoxins – toxins, low molecular weight secondary metabolites produced by microscopic fungi

Pollinator – an animal that carries flowers pollen and contributes to the plant pollination (insects, etc.)

Flow process chart – a list of production operations (works), agent types, their quantities, deadlines and key economic indicators per unit area and products

Yield – grass per unit area

Phytopathogen – an environmental factor that causes plant diseases (viruses, bacteria, fungi, nematodes, insects, toxic substances, etc.)

Phytosanitary measures – science-based measures aimed at protecting from risks arising from the penetration, consolidation or spread of pests harmful to plants and products of plant origin, and improving the environment

Phytoexpertise – determination of quantitative and qualitative composition of pathogens transmitted with seed, as well as seed germination, which may vary depending on the infection degree in laboratory conditions

Entomoacarocenosis – a set of all invertebrates, including economically important (harmful and useful), living in the agrocenosis of a certain crop

Entomophages – organisms that affect the natural regulation of the pest population; agents of the biological method and integrated plant protection

Epizootic situation – a set of factors and conditions in a certain area that characterize the availability of disease, its prevalence, the incidence of livestock, risk level of the herd in a certain period of time

Epidemiological research – investigation of epizootic process, which represents the interaction of three basic links of epidemic chain of infection, mechanism of disease transmission and the presence of susceptible animal

Epizootic (epidemiological) unit – a group of animals with a certain, limited geographical range (relatively permanent or temporary), where the risk of penetration of the causative agent and potential disease progression is equally (for each animal) detected

Risk – an existing danger, a failure. In this case, it is penetration of infection and progression of disease

Infectious diseases – diseases caused by pathogenic microorganisms

Parasitic diseases – diseases caused by helminths, protozoa and arthropods

Non-infectious diseases – diseases of agricultural animals arising from metabolic disorders caused by deviations from feeding standards, care rules and economic use of animals

Disease – a body condition when there are deviations from normal functioning and lack of ability to maintain homeostasis.

Monitoring – monitoring of epizootic indicators of animal diseases.

Livestock complex – an agricultural enterprise (subdivision), which manage maintenance, reproduction of livestock and production of livestock products.

**LIST OF ABBREVIATIONS AND DESIGNATIONS**

In this report

heads – animal number;

g / kg – gram per 1 kilogram;

unit – unit;

feed per unit – feed unit;

% – percent;

mon. – month;

mg – milligram;

M±m – arithmetic mean and its statistical error;

N – sample size and number of species in the group;

v. – village;

CMY – coefficient of milk yield;

CWY – coefficient of wool yield;

DF – dairy farm;

BAP – biological active points;

USE – ultrasound examination

R – research;

GOST – state standard;

kg – kilogram;

ha – hectare;

m2 – square meter;

mg % – milligram percentage;

M±m – arithmetic mean and its statistical error;

N - sample size and number of species in the group;

ASC - aqueous suspension concentrate;

year – year;

PGA - potato-glucose agar;

SC - suspension concentrate;

l/t - liter per ton;

ml/t - milliliter per ton;

Ministry of Agriculture – Ministry of Agriculture of the Republic of Kazakhstan;

LLP - limited liability partnership;

Baiserke-Agro LLP - Limited liability partnership “Baiserke-Agro”;

LLP “KazNIIZiKR” - Limited liability partnership “Zhiembayev Kazakh Research Institute of Plant Protection and Quarantine”;

LLP “ERPC Baiserke-Agro” - Limited liability partnership “Educational research and production center “Baiserke-Agro”.

MoA – Ministry of Agriculture;

RK – Republic of Kazakhstan;

Inv. - inventory;

cp. - copy.

EC - emulsion concentrate;

SC - suspension concentrate;

WP - wetting powder;

SCS - sporo-crystal suspension;

WC - water concentration;

LC – large cattle;

SC - small cattle;

EU - epizootic unit;

MIA - meat infusion agar;

MPLB - meat-peptone liver broth;

MPB - meat-peptone broth;

GIT - gastrointestinal tract;

AR - agglutination reaction;

CFT - complement-fixation test;

RBT – rose bengal test;

EIA - enzyme immunoassay;

CFU - colony-forming unit.

**INTRODUCTION**

Relevance. The main aspect of breeding development is widespread intensification with the use of modern scientific achievements and best practices. In this aspect, it is important to accelerate the pace of scientific research by introducing new developments in production. At this stage, improvement of breeding and productive qualities of livestock is one of aspects in intensification of cattle breeding based on modern scientific achievements, new technologies that ensure high productivity of animals, eco-friendliness and competitiveness of production. Implementation of advanced technologies for the production of animal products using case study of «Baiserke-Agro» LLP creates favorable conditions for full manifestation of the genetic potential of animals. In this regard, the relevance of scientific research is widely replication of the scientific research results among agricultural producers of various branches of animal husbandry. The main aspect of breeding development is widespread intensification with the use of modern scientific achievements and best practices. In this aspect, it is important to accelerate the pace of scientific research with the introduction of new developments in production.

One of the most important tasks in the agro-industrial complex development in Kazakhstan is to create a forgae reserve based on its intensification. Often, the composition and quality of the feed produced do not meet the requirements of full-fledged animal feeding. Sometimes their analysis shows a protein deficit of up to 30-35%, and easily digestible carbohydrates - 30-40%. Expensive forage is produced and it significantly increases the cost of farm products and reduces the efficiency of the industry as a whole. The decrease in their gross yield and production costs is often due to the wide spread of pests. Crop seeds have a wide spread of infectious plant diseases, which also causes significant damage to the crop and the feed quality. This complex of pests damages plants, starting from sprouting till the end of the growing season. Therefore, the plant protection from these pests is crucial in the agricultural technology of forage crops. Chemical method of plant protection is often used when growing forage crops. This results significant increase in the cost of growing and storing products and reducing its value in the market. In addition, the chemical method of plant protection does not always guarantee the safety of the crop – insects develop resistance to many chemicals. Using pesticides can cause a mass death of useful and non-target fauna entomophages, pollinators, soil-formers, and pollution of the environment with toxic residues. In this regard, we should investigate the species composition of useful species such as entomophages and pollinators having a significant role in obtaining eco-friendly crops [1-4]. Now the production of organic products is extremely relevant all over the world. It was also mentioned in the Message of President - N. A. Nazarbayev to Kazakhstan people in 2018. One of the most rational ecological and economical ways to fight against diseases and soil pests is proper seed treatment. In this regard, one of the main areas of research was improving the seed grain of forage crops by developing protective and stimulating components [4]. Pathogenic complex of seeds includes dozens of species of fungi and bacteria, so high-quality seed treatment should begin with phytoexpertise, and depending on the species composition of harmful microorganisms, effective fungicides are selected taking into account their spectrum of action, as well as stimulants, biologics and insecticides. At the same time, not only seed infection is suppressed, but also seed sowing qualities, plant growth and progress are stimulated, many infectious diseases and damage by soil and sucking pests are prevented at the early stages of plant development [5, 6]. Thus, it is necessary to take into account all the above factors to improve the existing crops cultivation and integrated protection system.

Successful development of animal husbandry is not possible without ensuring veterinary safety. Unstable epizootic situation in a number of regions in Kazakhstan is the main threat to the development of animal husbandry and obtaining high-quality products. Methodical support of veterinary and sanitary safety and improvement of livestock productivity requires investigation of the actual epizootic situation, identification of possible risks of carrying pathogens, developing measures to improve herd reproduction and yield of calves. The above indicates the relevance of this area of research and solving the necessary problems.

*Scientific novelty* of this project is that we, within farm case analysis, have performed a complex examination on optimal selection of process parameters in breeding various livestock industries; transfer and adaptation of innovations in protection of forage crop seeds, seeding green manure of tansy phacelia, conducting phytoexpertise of seeds and development of protective-stimulating components, implementation of technology saturation crops by entomophages and pollinators, examining features of entomocenoza of forage crops (soybeans, alfalfa, barley and wheat) and subsequent preparation of recommendations for making regional flow process charts for the cultivation of fodder crops according to the research results. EU is formed; the epizootic situation in areas of certain animal groups and adjacent territories of «Baiserke-Agro» LLP is defined for the first time.

*Practical significance*. Implementation of domestic and foreign scientific systems for intensification of cattle breeding will increase the yielding qualities of livestock. Research information can be used by plant protection specialists, agronomists of farms, entomologists when conducting organic farming for the cultivation of organic agricultural products.

*Research purposes* for 2018-2020: Develop an optimal selection and production parameters for growing various species of breeding animals. Develop and implement production methods to increase the yield of forage crops, harvesting and preparing feed. Ensure epizootic safety from infectious and non-infectious diseases in the context of individual epizootic (epidemiological) units of «Baiserke-Agro» LLP.

*Research objectives for* 2018-2020:

1. Survey pasture territory and develop a scheme for their seasonal use.

2. Comprehensive assessment of camel productivity and development of criteria for selection and establishment of patterns of growth and development of young camels.

3. Develop an effective management system for dairy cattle with a full herd turnover cycle, raising young animals, selecting species and creating breeding groups of cows.

4. Develop an effective management system for beef cattle with a full herd turnover cycle.

5. Comprehensive assessment of horse productivity and development of criteria for selection and establishment of patterns of growth and development of young horses.

6. Develop an effective system for managing sheep breeding, raising young animals, selecting species and creating. Survey pasture territory and develop a scheme for their seasonal use.

7. Comprehensive assessment of camel productivity and development of criteria for selection and establishment of patterns of growth and development of young camels.

6. Develop an effective management system for raising young animals, selecting species and creating.

9. Analyze the results obtained and make adjustments to scientific developments, if necessary, to reduce the cost of final products

10. Identify the features of entomoacarocenosis of forage crops (soy, alfalfa, barley and wheat). Give an economic assessment of its components. Hold phytoexpertise of seeds.

11. Develop science-based measures to improve existing agricultural technologies of cultivation and integrated protection of forage crops (soy, alfalfa, barley, wheat), transfer and implementation of advanced developments that will increase their yielding ability.

12. Analyze the results obtained and make adjustments to scientific developments, if necessary, to reduce the cost of final products

13. Develop regional flow process charts of cultivation and integrated protection of forage crops (soy, alfalfa, barley and wheat)

14. Prepare, publish and distribute practical recommendations on the use of innovative integrated system for the protection and cultivation of forage crops (soy, alfalfa, barley and wheat) in the South-East of Kazakhstan.

15. Form epizootic units in «Baiserke-Agro» and define an epizootic situation in them.

16. Investigate and define the epizootic characteristic of EU of «Baiserke-Agro» LLP and adjacent areas.

17. Develop a sequence of optimal use of antiepizootic products.

18. Prepare Animal desease control plan for livestock of large and small cattle, horses and camels.

19. Replication of research results.

The research location

Research had been completed on the farm of «Baiserke-Agro» LLP, Talgar district, Arkabay village, Kerbulak branch of «Baiserke-Agro» LLP in Almaty region, «Abzel» farm, Kerbulak district in Almaty region, laboratory works in Baiserke-Agro LLP and KazNIIZiKR LLP. Metrological support of research was provided by the Almaty branch of JSC “National Center for Expertise and Certification” by state verification of laboratory devices and measuring instruments in “Baiserke-Agro Educational research and production center” LLP.

Reports from previous years of research:

BR06249249-OT-18 inv. No. 0218РК01286

BR06249249-OT-19 inv. No. 0219РК01179

**BASIC PART OF THE RESEARCH REPORT**

**1 Selection of research line**

Selection and priority of research conducted within the framework of the program are based on: Message of the President of the Republic of Kazakhstan N. A.Nazarbayev to people of Kazakhstan from January 5, 2018; Resolutions of the Government of the Republic of Kazakhstan dated October 12, 2010 No. 1052 “On approval of Program on development of farming sector in the Republic of Kazakhstan for 2010-2014” and dated 31 December 2009 No. 2339 “On the Strategic plan of the Ministry of Agriculture of the Republic of Kazakhstan for 2010-2014”; Transition Concept of Kazakhstan to sustainable development for the period of 2007-2024 dated November 14, 2006 No. 216; the Law of the Republic of Kazakhstan “On science” No. 408-IV dated February 18, 2011; Message of the President of the Republic of Kazakhstan – Leader of Nation N. A. Nazarbayev to the people of Kazakhstan dated January 17, 2014 “Kazakhstan's way in 2050. Common goal, common interests, common future”; Decree No. 733 “On measures to implement the President's Message dated January 17, 2014 “Kazakhstan's way in 2050. Common goal, common interests, common future”; Program of development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 (AGRIBUSINESS-2020). Message of the President of the Republic of Kazakhstan No. 151 dated February 18, 2013; State program of agro-industrial complex development in the Republic of Kazakhstan for 2017-2021. The development of animal husbandry is promoted by measures to prevent the occurrence and elimination of infectious and non-infectious animal diseases in economic entities. In the specialized literature, there is data on anti-epizootic measures for certain infectious, initially non-infectious etiology and non-infectious diseases. However, we have developed comprehensive measures to ensure veterinary and sanitary safety, taking into account the epizootic characteristics of a particular region. Analysis of data from the special literature concerning epizootic situation showed the absence of epizootic characteristics in individual farms of «Baiserke-Agro» LLP containing various types of animals (large and small cattle, camels, horses). The data of this research will be the basis for the development of complex sufficiently effective antiepizootic measures. In this regard, all planned research and practical activities were aimed at developing scientific support for the veterinary welfare of animal husbandry of «Baiserke-Agro» LLP.

**2 Documents and methods of research**

The research work was conducted at the base of «Baiserke-Agro» LLP. The research targets were animals bred in the farm and pasture plots within the farm. The research documents are the documents of primary zootechnical and breeding records, availability of existing livestock for different age and sex groups and in the context of species and breeds, animal yield, service period, productivity, growth and development of young animals, genealogical structure of herds.

Geobotanical survey was carried out according to the Instructions and methods of Botanical and fodder survey of hay and pasture lands [7]. The fodder stock of the surveyed territory was defined by the method [8]. The type of pastures and grazed cattle was defined according to the scientific and methodological manual [9]. Livestock needs for pasture feed were defined in the grazing period according to the method [10]. The possibility of guaranteed watering of animals is defined by the needs of the herd and spring flow by the method [11]. Calculation of possible livestock grazing by the method [12]. Establishment of grazing load standards according to the scientific and methodological manual [13]. Determination of rational use of pastures according to the scientific and practical manual [14].

The body weight of camels was determined by individual weighing of animals on stationary scales or calculation method [15]. Indices of camel body were determined by the calculated method according to S. Brody [16]. Regularities of growth and development of camels of the Kazakh Bactrian of the South Kazakhstan breed born in 2019 were inspected according to the generally accepted method [17]. Morphofunctional features of the udder of camels were inspected by the method of A. Baimukanov from 1972 [18]. The fat content of milk was determined on Milkotester (2017). The influence of fertility index on the actual milk yield in experimental camels of the Kazakh Bactrian of the South Kazakhstan breed was checked according to the generally accepted method [19, 34, 35]. Grading by the coefficient of wool production was carried out in three ranks: up to 0.8; 0.9-1.4; 1.5 and above [20].

During the research period, the influence of microclimatic parameters in livestock bases, monitoring of the general physiological state of cows, body temperature rectally, pulse, respiratory rate and milk productivity of high-yielding groups of cows were determined. The body type of dairy cattle was evaluated in accordance with the method [21]. The body weight of animals is determined by individual weighings. Body weight of calves is corrected and the index of breeding value of beef cattle is defined in accordance with the method [22, 23]. Wool productivity of sheep was determined by individual record of experimental animals cutting during wool cutting. The quality of wool is pre-determined by organoleptic evaluation of the sheep and clarified through laboratory tests. Agricultural animals were evaluated according to the Instructions [24-29].

Biochemical tests of milk were performed in the laboratory of LLP “Kazakh research Institute of animal husbandry and feed production” to determine the quality of milk content: fat %, protein % and urea by using device MilkoScan (FOOS). In order to inspect the features of the mares' body, we calculated the indices of size, chest girth, massiveness and bony [30]. The shape of the mares' udders was determined visually, and the length and thickness of the teats were measured using a measuring tape. Milk productivity of mares was determined by actual milk yields by arranging weekly control milk yields. Commercial milk yield of mares was determined monthly during lactation by the method of control milk yields, twice a month on two adjacent days [31]. Milk productivity was calculated taking into account the milk sucked at night by the foal, according to the formula of Professor I.A. Saigin [32].

The digital material was processed by the methods of variational statistics proposed by Lakin [34]. The research results were processed on PC by “MS Excel” statistical programs.

When conducting research on subproject 2, we used generally accepted methods in entomology and plant protection [6, 36]. In the course of research, we used an eco-friendly soil trap developed by performers [37]. Original modifications of artificial nesting sites were used to attract entomophages and pollinators [38-40]. We used summaries, guidelines, articles, and determinants from the list of references to identify pests, entomophages and ticks, to clarify their biological characteristics, distribution, conservation status, and economic significance [41-68]. To compare the results with another plot for several parameters (the number and species composition of pests, pollinators, and entomophages), the system of biodiversity score assessment described in the source from the literature list was used [53]. Growing bee-moth to develop a culture of entomopathogenic nematodes was carried out using a feed mixture developed by the authors [69]. The culture of entomopathogenic nematodes for pest control was developed using the method developed by the authors [70]. Samples for analysis of toxicological samples were selected according to “Unified rules on sampling of agricultural products, food and environmental objects for identifying micro-quantities of pesticides” No. 2051-79 (No. 6.01.001.97) [71]. Quantitative determination was performed using gas-liquid and high-performance liquid chromatography [72-74] and other methods.

Research methods generally accepted in Phytopathology and Mycology were used to conduct phytoexpertise [5, 6, 75-79]. As a result of phytopathological analyses, fungal and bacterial microflora of seeds were detected in the seeds of forage crops. Untreated seeds of fodder crops were subjected in laboratory conditions to phyto-expertise in a wet chamber and on the nutrient medium potato-glucose agar (PGA). The efficiency of biological drugs and entomopathogenic nematodes was taken into account in accordance with the existing rules [80]. Statistical processing was performed using Dospekhov method [81].

The system of anti-epizootic measures was developed on the basis of formation of epizootic units, which safety is based on a complex of organizational and economic, veterinary and sanitary and special measures. Epizootic characteristics of EU in «Baiserke-Agro» LLP and its adjacent areas were inspected and clarified by analyzing their own research on infectious and non-infectious diseases. Antiepizootic measures are implemented by drawing up plans, which indicate their complexity, timeliness and possibility of implementation. Immunization of animals was carried out with sufficiently effective inactivated or mixed and associated vaccines, provided that the immunogenic properties inherent in each initial monovaccine were preserved, taking into account the technology of animal husbandry, the type, age and physiological state of the animals. The research was conducted on the base of «Baiserke-Agro» LLP. The research targets were animals bred in the farm and pasture plots within the farm. The research documents are the documents of primary zootechnical and breeding records, availability of existing livestock for different age and sex groups and in the context of species and breeds, animal yield, service period, productivity, growth and development of young animals, genealogical structure of herds.

**3 Research results**

**3.1 Pasture management**

We found that the average number of grazing days for cattle is 180 days, for other types of animals (sheep, horses and camels) - 240 or more days as a result of the survey of pasture territories and natural and climatic conditions of that region. The total area of pastures used as of the reporting period was 26,000 ha: 18,000 ha is available under the land use act and 8,000 ha is leased. The Botanical composition of the herbage was determined and examined according to the seasons of the year. Based on geobotanical surveys, 4 independent plots were identified that differ in vegetation cover. Thus, 1st plot is covered by artemisia, ebelek and snow-grass; 2nd - feather-grass, teresken; 3rd - artemisia, cereal grass; 4th - wormwood, ephemeral grass. During the research, the yield of pasture mass was taken into account depending on their type (Appendix D, table D.1). The table shows that the average yield in 2019 was 10.6 centner/ha, in 2020 this indicator was 10.0 centner/ha. Data on pasture yields in 2018 were obtained only for the autumn period. In the course of research on pasture yields, it was found that 2018 and 2020 were different dry years, and therefore the autumn yield of pastures was lower compared to 2019. The cold unstable spring of 2019 was characterized by a small number of ephemera, the pasture yield did not rise above 5.5 centner/ha and amounted to 5.0 centner/ha. At the same time, the spring of 2020 was warm and humid, which primarily affected the pasture yield to 14.8 centner/ha, respectively. The average yield of pastures in 3 years was 10.8 centner/ha. It follows that the total forage stock of available pastures was 280800 centner (10.8 x 260000=280800 centner). It is established that there is a certain surplus of feed in 2019 and 2020 compared to 2018. (Appendix D, table D.2). However, it should be noted that the calculations of the feed stock in 2018 are based on the autumn yield, which affected the shortage of feed in that period. In addition, experiments on creation of seeded pastures were performed to increase the yield of the pasture. In this regard, autumn (150 ha in 2018) and spring (300 ha in 2019) seeding of wheat grass of “Karabalyk 202” type was carried out on “Kerbulak” seeding area.

As a result of survey, it was found that autumn seeding had too thin sproutings (1-7 PCs. per 1 m2), which were severely depleted due to the rapid development of ephemera and ebelek on the surface-treated area. Spring sowing was more successful (20-35 PCs. sprouts per 1 m2) not only in the number of sprouts, but also in growing of plants (height up to 27cm against 16cm for autumn sowing). The sowing results once again indicate the need of careful preparation and meeting agricultural requirements for the creation of sown hayfields, especially in areas with an annual rainfall of 200-250 mm. This year, the yield of spring sowing was -20.0 centner/ha compared 12.5 centner/ha in autumn sowing. A scheme for 3-season, 4-year pasture turnover for large and small cattle was developed (table 1) based on the actual state of pasture vegetation and forage stock.

Table 1 - Pasture turnover scheme

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Plot | 2019 | 2020 | 2021 | 2022 |
| 1st plot | spring | autumn | rest | summer |
| 2nd plot | summer | spring | autumn | rest |
| 3rd plot | rest | summer | spring | autumn |
| 4th plot | autumn | rest | summer | spring |

Thanks to this alternation of grazing areas and moderate grazing (65%), modified pastures started to restore indigenous vegetation and be used by more effective 3-year system (spring-summer-autumn).

The optimal load and needs of pasturelands for all types of grazed livestock are calculated (Appendix D, table D.3) based on pasture productivity, developed schemes of pasture turnover, creation of cultivated grasslands, as well as the availability of bred livestock. Analysis of data on the needs of pasturelands showed that the total need of pastures for all types of animals kept on "Kerbulak" plot varies from 9.9 to 13.8 thousand hectares, depending on natural conditions. It follows that the pasture load for sheep was from 0.6 to 1.2 ha/head, for cattle from 1.8 to 3.0 ha/head, for horses from 4 to 2.3 ha/head, for camels, respectively, 2.9 to 3.9 ha/head.

**3.2 Camel breeding**

As part of complex assessment of camel’s wool and milk productivity among the main breeding stock, the main indicators of selected traits were examined. According to the data of the reporting period, the number of camels has not changed in 3 years of practice, but the number of camels increased by 38 heads, which is 49.0% in the specific weight compared to 2018, where their specific weight was 32.1%. During evaluating the reproductive capacity, wool and milk productivity of the Kazakh Bactrian, a wide range of alternations of examined characteristics was revealed (Appendixes D, table D.4). The yield of young camels in 2018-2020 varied from 40% to 50%. The safety of young camels was 72.7-87.5%. Female camels of the main livestock produce an average of 5.1 kg to 5.6 kg of wool. The average daily milk yield was 5.7-5.9 kg in the third month of lactation, which corresponds to animals of the 2nd quality class. Based on the data obtained, it is recommended to rotate the Bura breeders used for breeding of females of the main livestock. We offer to purchase the Bura breeders from Turkestan or Kyzylorda regions in the amount of 3 heads. So, the sibling relationship will be minimized. The main parameters of this breeding trait were inspected to perform tasks on selection criteria for camels based on the production parameters of the udder. It was found that camels of purebred Kazakh Bactrians have all 4 types of nipple length. The frequency of individuals with teat lengths up to 2.0 cm was 20% and 2.0-4.0 cm, respectively, 50%. Camels with a teat length of 4.0-6.0 cm made up 20.0%, 6.0 cm and more - 10% of the total number. It was found that in 2018, female camels with a cup-shaped udder (6.4±0.11 kg) produced significantly more milk compared to female camels with rounded (5.6±0.17 kg), flat (4.5±0.28 kg) and lobular (4.7±0.15 kg) udder forms. In 2019, female camels with cup-shaped udders outperformed their peers with flat udders by 18.8% and rounded ones by 11.8% (Appendix D, table D.5).

Regularities of growth and development of camels in the dairy period, depending on the technological parameters of the selected traits of their mothers have been studied as well. Thus, in the course of research, it was found that camels clearly have body composition and exterior characteristic of the original parent shapes (Appendix D, table D.6). In particular, young Kazakh Bactrian camels are characterized by stumpiness and high churn at birth. Young camels of the Kazakh Bactrian dairy breed have live weight of 40.3±1.9 kg at birth, wool and meat producing breed - 34.2 kg and milk and meat producing breed - 36.8 kg. Young camels received from dairy producing female camels outperformed their wool and meat producing peers by live weight by 17.8% (P<0.01), dairy and meat - by 9.5% (P<0.1). In the first 3 months after embryonic development, the live weight of Kazakh Bactrian young camels from dairy producing camels increased 2.8 times, wool-meat 2.76 times, milk-meat 2.95 times. After reaching 6 months age, young camels from milk producing camels weighted more than its wool-and-meat producing heardmates for 25,4 kg, milk and meat producing camels for 13,7 kg. That is, the high milk yield of camels undoubtedly has a positive effect on the intensity of growth and development of camels during the dairy period. One of the main indicators that affect the growth rate in the post-embryonic period is the live weight of camels at birth. This indicator describes the relationship between the size of the growing mass and the growth rate, which uses the relative growth indicator. In young animals of group 4 (from high milk producing camels), the live weight was greater than the live weight of camels from other groups, ranging from 4.31% to 6.34% (Appendix D, table D.7). In other words, in the future it is necessary to strengthen all measures for the formation of herds from the number of high milk producing camels.

During the reporting period, effective methods for evaluating and selecting camels for milk, meat and wool productivity were also developed. As part of the research, the female camels ranked by lactation degree: up to 65-74; 75-84; +85. For the first 60 days of lactation 2019, female camels with full degree of lactation as 75-84% produce milk by 23.3% more in comparison with herd mates with full degree of lactation as 65-74% and 11.7% more than camels with full degree of lactation +85% (Appendixes D, table D.8,9). When monitoring milk yield in 150 days of lactation, it was found that camels with full degree of lactation 75-84% outperform their herd mates with full degree of lactation 65-74% - by 178.4 kg, +85% by 98.3 kg. Based on the above, it is necessary to complete the dairy herd with camels of the Kazakh Bactrian breed from among individuals with a degree of lactation of 75-84%. They were ranked by coefficient of milk production: up to 1.4; 1.5-1.9; +2.0 (Appendix D, table D.10). During 120 days of lactation, camels with milk productivity up to 1.4 had 143.7 kg less compared to herd mates with a rank of 1.5-1.9 and 237.4 kg less with a rank of +2.0. Evaluation of Kazakh Bactrian camels by coefficient of milk production allowed to establish that the optimal indicator for selection is the rank of 1.5-1.9, rather than up to 1.4 and +2.0. This is due to the optimal fat content in the milk 5.5%.

The coefficient of wool cutting is the main production parameter of selection for meat productivity of young meat and wool producing camels. Camels were ranked by the coefficient of wool production: up to 0.8; 0.9-1.4; +1.5. It is established that the one-year-old age young camels of the Kazakh Bactrian breed have different live weight and fatness depending on the indicators of the wool cutting coefficient (Appendix D, table D.11). For breeding it is necessary to select young Kazakh Bactrian camels of the South Kazakhstan type estimated on the coefficient of wool cut of 0,9-1,4 due to superiority on body weight of herd mates with the coefficient of a wool cut up to 0,8 by 28,1%, +1,5 by 3,3%. Based on the results obtained, zootechnical parameters of female camels and breeding camels were developed for growing them in the conditions of “Kerbula” area (Appendix D, tables D. 12, 13). It is recommended in the future to improve the breeding qualities of camels, at the 1st stage to create herds of purebred camels of the Kazakh Bactrian breed by color (sand, brown, white), inbred animals. At the 2nd stage, to practice targeted selection and selection of parent pairs in order to consolidate the desired traits for the selected traits, determine the direction of further selection for meat-dairy and meat-wool productivity. We developed the criteria for reliable evaluation of breeders by the quality of offspring based on the coefficient of wool production. When evaluating the breeders, their daughters were in identical conditions. This made it possible to obtain reliable data (Appendix D, table D 14). It was found that with a homogeneous selection of Bura breeder and Kazakh Bactrian camels of the South Kazakhstan type according to the wool producing coefficient, the best indicators for the precocity of daughters were recorded in the wool producing coefficient of 0.9 - 1.4. Female Kazakh Bactrian camels obtained from Bura breeders with a wool producing coefficient of 0.9-1.4 outperformed their peers from fathers with a wool producing coefficient of up to 0.8 by 28.7%, +1.5 by 6.9%. At weaning, one-year-old female camels from fathers with wool producing coefficient of 0.9-1.4 outperformed their peers with a wool producing coefficient of up to 0.8 by 9.5%, +1.5 by 12.6%. One-year-old camels received from fathers and mothers with a high wool producing coefficient (+1.5) significantly outperform their herd mates by 29.2% (wool producing coefficient is up to 0.8) and 14.8% (wool producing coefficient 0.9 - 1.4). In the current year, it was predicted that the wool of females will be cut at the age of 2 years based on the instructions for class determination of camels. However, the actual wool production was lower in 2-year-old females received from parents with wool producing coefficient up to 0.8 and +1.5. In 2-year-old females received from parent pairs with wool producing coefficient of 0.9-1.4, the actual wool production coefficient was 9.1% higher than predicted. Based on this, we believe that the wool producing coefficient is a reliable criterion for evaluating Kazakh Bactrian camels in terms of wool production. In the future, when selecting, give preference to individuals with wool producing coefficient of 0.9-1.4.

**3.3 Dairy farming**

Analysis of data obtained on the herd structure over the past 3 years allowed us to establish some dynamics of improving the efficiency of herd turnover, associated with an increase in specific weight of the main breeding stock (Appendix D, table D.15). The percentage of cows in the herd structure decreased by 12.1%. However, the specific weight of heifers increased and this ensures replacement of the herd by 19.0%, which is 12.9% higher than in 2018. The specific weight of heifers increased during the full cycle of the herd turnover. So, if the main composition of heifers of the past and current year of birth was at the level of 59.8% in 2018, then in 2020 this figure reached 82.1%, which indicates the effectiveness of management by regulating the number of the main herd. In addition, due to the adjustment of their diet, in recent years, the cow’s milk productivity increased. So, in the feeding diet, the total dry feed consumption increased by 0.6 kg on average. As a result of partial replacement (soy meal with rape plant) and changes in the ratio of some components, the total cost of the diet of dairy cows reduced by 12%, but the overall nutritional value increased. Analysis of the household diet showed that the average consumption of dry feed per head is 21.2 kg with a digestible protein content of 2,985 g and an exchange energy of 224 MJ. The ratio of dry components in structural to concentrated feeds is 39 to 61% and raw fiber in dry component is 14%. Balancing the diet made it possible to ensure the content of digestible protein in the diet up to 3,565 g, metabolic energy up to 269 MJ and crude fiber up to 16%. As a result of optimizing the diet and grouping cows by productivity, the average milk yield per head increased by 7.42 kg and averaged 36.8 kg (lim. 28-86 kg).

Table 2 - Comparative productivity indicators of cows in the robotic dairy complex of Baiserke-Agro LLP

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Average daily productivity, kg | Fat content, % | Protein content, % |
| 2018 | 29,38±1,6 | 3,73 | 3,24 |
| 2019 | 36,8±1,54 | 3.71 | 3.32 |

For the period of 2018, the average productivity of cows in the robotic groups was 29.38 kg with a fat content of 3.63% and protein content of 3.24%. During the favorable climatic period from March to June and from September to November, the average milk yield reached 40-42 kg per head. Based on the data obtained and feed consumption, the cost of milk was calculated (Appendix D, table D.16). Taking into account the sale of 3,832.5 tons of milk for a total amount of 613,200.0 thousand KZT, the cost of 1 kg of milk is 116.89 KZT when marketable cost is 160 KZT per 1 kg with an average fat content of 3.71%. The net profit from milk sales in one year is 165.2 million KZT, with a production margin of 36.8%. In addition, there is an annual sale of 10-12 months of bull calves in the amount of 200-210 heads with a live weight of at least 340 kg. With the cost of 850 KZT per 1 kg of live weight, the sales amount is at least 289 thousand KZT per 1 head. As for expenses, the highest share has feed and the most expensive component is high-protein rape plant and soy meal. Average feed consumption per 1 head per day during the year is 991.12 KZT on average, while the lowest cost of the diet is observed in the summer since corn silage replaced by freshly mown green feed partially.

In the course of research, we developed the effective ways of raising calves and replacing the heifers to create a high-yield herd (Appendix D, table D.17). It has been established that their productivity decrease leads to cost increase on their service. If we calculate the cost of process parameter without excluding the cost of by-products, growing 1 head up to 14 months of age costs 538.8 thousand KZT. Feed costs 45% (242.46 thousand KZT), using equipment and buildings 8.6% (46.3 thousand KZT), fuel 6.8% (36.6 thousand KZT), electricity 3.6% (19.39 thousand KZT), veterinary drugs 9.2% (49.56 thousand KZT), general economic expenses 10.5% (56.57 thousand KZT), salary 5% (26.94 thousand KZT) current repairs of buildings and equipment 4.8% (25.86 thousand KZT), water 0.6% (3.23 thousand KZT), other 5.9% (31.78 thousand KZT). The highest expenditure rates for growing young animals are noted in the first 4 months since they drink milk, the most expensive component of the diet. Total expenditure of milk per 1 head over the entire period, they make up 564 kg or an average of 4.7 kg per head. In 2018, we have defined exterior of dairy cattle for 18 signs. So, it was found that there are some flaws on width of loins (6.7 points with optimal 8), fixing foreudder (6.9 points with optimal 8), furrow udder (5.6 points with optimal 8), the height and width of udder back and the placing of the feet (figure 1).

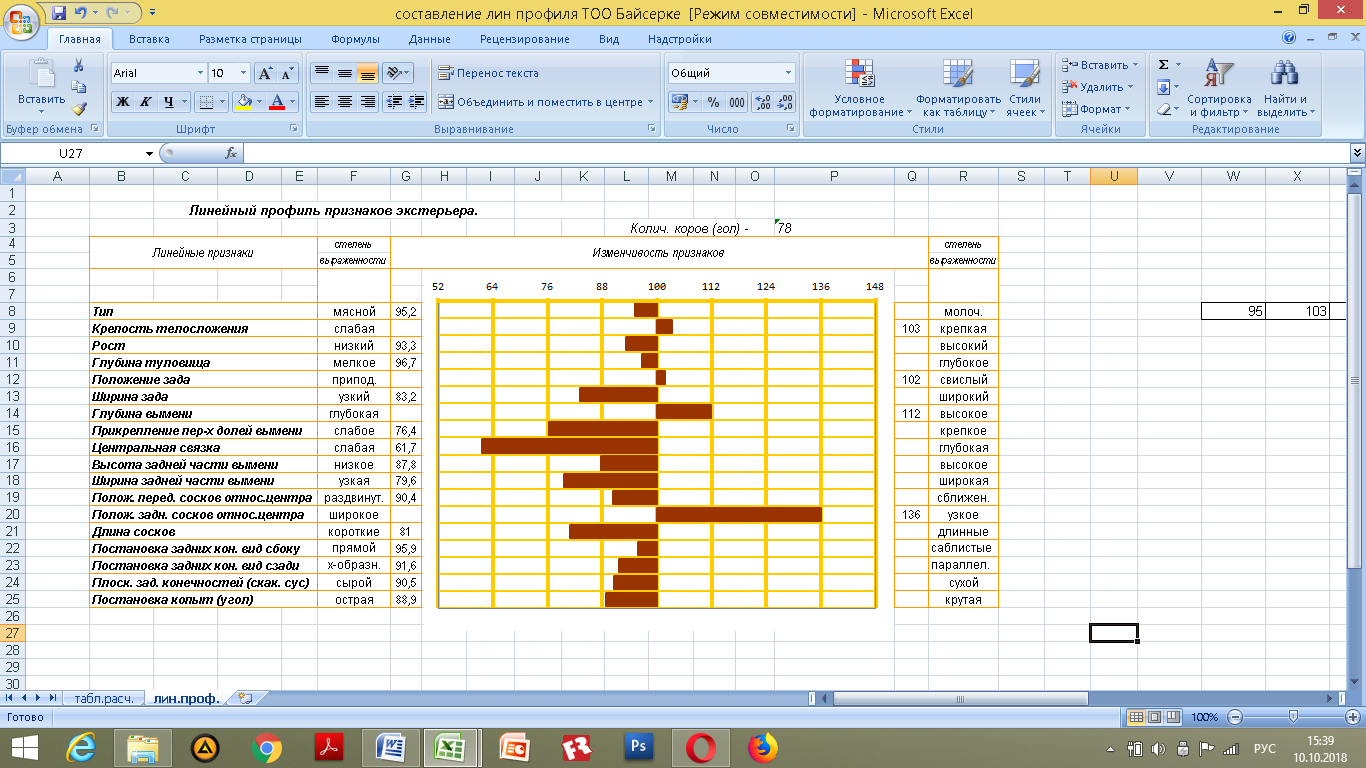


Figure 1 - Linear exterior of first-calf cows

Based on exterior information, we found that the majority of cows in the herd (56%) are characterized by the category of body type as “excellent” and “very good”. 15% of the total number of cows also had a category as “good” (Appendixes D, table D.18.). Inspection of their genealogic structure showed that the animals belong to 4 lines: Montvic Rag Apple Gladiator, Wis Ideal 933122, Pawnee Farm Reflection Admiral 1383926, Wisconsin Admiral Burke 661323. It was revealed that the fathers of 828 heads are 174 breeding bulls, which, in turn, belong to 4 genealogical lines. It follows that the main part of the breeding stock (56.2%) belongs to the genealogical line Pawnee Farm Reflection Admiral 1383926. The smallest number is Montvic Rag Apple Gladiator line. As a result of research, in order to eliminate the above shortcomings and avoid closely related mating in 2019 and 2020, the seed of breeding bulls HONDO 551HO03246 and MARVEL 551HO03444 were used in reproduction. The results will be obtained based on information of the first completed lactation in 2021 and 2020.

**3.4 Beef cattle breeding**

During the 3-year reporting period, scientific research showed that the total number of beef cattle has not changed much (Appendix D, table D.18). However, the number of Angus and Hereford breeds decreased by 154 and 38 heads respectively. At the same time, the indicators of 2020 exceed indicators of 2018 by 59 and 120 heads respectively in herds with Kazakh white-headed and Auliekol breeds. The obtained results made it possible to increase the percentage of cows in the herd structure to zootechnical standards in almost all herds. Thus, the percentage of Angus breed increased from 38.5 to 61.9%, Hereford breed from 42.4 to 45.2%, Kazakh white-headed breed from 36.0 to 57.4% and Auliekol breed from 35.9 to 53.1%. In general, the percentage of cows in the herd increased by 18.8% for all breeds. Actions taken to stabilize the reproductive capacity of cows showed that within 3 years the average yield of calves per 100 cows increased from 55.5 to 79.4%. Thus, rotation and strict culling of animals made it possible to organize an effective system of herd turnover with a full cycle of reproduction. Based on the data obtained, various herds with the most optimal load of bulls were formed (Appendix D, table D.19). Thus, 3 herds were formed for the Angus breed, 2 for the Hereford breed, and 4 and 2 herds for the Kazakh white - headed and Auliekol breed, respectively. Bulls were assigned according to zootechnical standards, where 30 cows and heifers come to 1 bull. It should be noted that all assigned bulls were evaluated for their own productivity and quality of offspring. In general, in 2019, 24 Angus bulls, 11 Hereford bulls, 48 Kazakh white - headed bulls and 38 Auliekol bulls were evaluated for their own productivity (Appendix D, table D.20). It showed that 49 bulls were improvers for all breeding characteristics, including 7 bulls or 29.1% for the Angus breed, 4 bulls or 36.3% for the Hereford breed, 20 bulls or 41.1% for the Kazakh white-headed bulls, and 18 or 47.3% for the Auliekol breed. In parallel, their fathers were tested for the quality of their offspring. In general, 7 bulls estimated for their own productivity and 7 bulls estimated for the quality of offspring are assigned for the Angus breed herds. 4 and 5 bulls for Hereford cows, 18 young bulls and 3 adult bulls for the Kazakh white-headed one, and 7 bulls estimated for their own productivity and 5 bulls estimated for the quality of their offspring for the Auliekol herds. There is a genetic superiority of descendants obtained from different bulls-breeders. It should be noted that before testing the calves, some difficulties were identified in selecting calves of a certain age, since the calving of cows took place from January to March, and the calves were weaned almost in one month. With this in mind, the live weight of calves was adjusted for a certain age. During the analysis, it was found that this formula simplifies the work of breeders and allows calculating the breeding value of animals. Therefore, at the first stage, there was an absolute deviation of the adjusted live weight at 240 days of age within the group. The results of the adjusted live weight of calves at 240 days and the indices of breeding value are shown in Appendix D, table D.21. Analysis of the presented data showed that the actual average age of Angus breed cattle at weaning was 200 days or 6 and 20 days with an average live weight of 185.9 kg, which does not give grounds for testing them, since according to the instructions it is necessary to select animals at 8 months of age. Thus, the developed formulas for the index assessment of animals allow us to assume that if the animals were weaned from their mother cows at 8 months, their live weight would be 221.8 kg. As part of the task for developing an effective model for growing young animals from birth to culling from mother cows, a production experiment was conducted to provide additional feeding for bulls during pasture burnout. Compound feed compositions are shown in Appendix D, table D. 22. As a result, comparative characteristics of the live weight of calves born in 2018 were analyzed (without top dressing) and 2020 (with top dressing), the results of which are reflected in Appendix D, table D.23. Analysis of the presented data showed that the average live weight of Angus bulls in 2018 was 26.7 kg lower than the bulls born in the current year. The difference was 19.3 kg for herefords, 16.2 kg for Kazakh white - headed bulls, and 11.7 kg for Auliekol steers. The live weight indicators of bulls born in 2020 exceeded their peers born in 2018 by 18.7 kg on average for all breeds. This difference in live weight is justified by the presence of feeding calves during pasture burnout. Calculations have shown that additional revenues from the introduction of feeding for calves into production amounted to 22.4 thousand KZT per 1 head taking into account that the total number of bred bulls of all breeds at the end of September 2020 was 427 heads, then additional revenues from the breeding sale of bulls will amount to 9.5 million KZT.

Valuation of meat producing cattle allowed to allocate selection groups of cows for further reproduction. So these data are reflected in Appendix D, table D.24. In the result of valuation, 1629 heads of beef cattle, including 747 heads of cows are selected for groups of elite animals. In the context of breeds, 52.9% of Kazakh white-headed cows, 63.8% of Auliekol, 44.0% of Hereford and 60.4% of Angus breeds are classified as elite animals. In general, 56.3 % of highly productive cows were allocated to breeding groups for all breeds.

As part of determining the optimal technologies for feeding and keeping young animals and adult livestock in the stable period, production solutions were made to compile a diet for young animals of different ages and for adult livestock. Thus, cows in the stable period are provided daily with 5 kg of hay, 10 kg of straw, 3.5 kg of concentrates and 20 kg of haylage, which in total makes an average of 12.1 units per 1 head in a day. For young animals, diet consists of 4 types of feed: mixed grass hay, alfalfa hay, corn hay, grain mix and premixes (Appendix D, table D. 25). According to the data obtained, it is clear that this diet for feeding bulls for 294 days allowed to get 1,065 g of average daily growth with a removable live weight of 526 kg in 18 months and fluctuation of 504-541 kg. Thus, this diet for periods of intensive fattening of bulls allowed to increase production efficiency by 25.3% in comparison with the initial indicators of 2018, where the average daily increase in fattening was 850 g at a cost of 441 KZT per head (Appendix D, table D.26). In general, the analysis showed that the use of mineral, vitamin and other additives in the diet of animals had a positive effect on increasing their live weight, and therefore on their profitability. Thus, the economic effect per 1 kg of live weight gain, depending on the breeding area of the farm and the composition of feed in the diet, varied from 8 to 93.9 KZT (Appendix D, table D.27).

**3.5 Horse breeding**

A comprehensive selection and genetic assessment of Kazakh horses of Zhabe and Kushum breed by production parameters were carried out based on variability of selected traits in stallions and mares, correlation coefficients between measurements and live weight in mares (Appendix D, table D.28). The highest variability is characterized by live weight, which is equal to 1.42 and 1.61 in stallions, 5.75 and 4.64 in mares. The variability of the pastern girth is 1.37 and 1.29 in stallions, 4.92 and 4.18 in mares. By measuring the body length and chest girt, the stable indicators of variability are inherent in stallions - 0,57-0,54, 0,77-0,81, 0,62-0,62 and mares respectively 1,82-1,26, 2,16-2,42, 1,87-2,43. From the data presented, it can be seen that in Kushum and Kazakh horses of Zhabe breed, selection based on live weight, bone structure, body length and chest circumference gives positive results in breeding work to improve these characteristics. At selection of horses of both breeds on live weight, they were selected by a breast girth and a pastern girth. Correlations of the main economic useful signs in mares show that the degree of development of the leading related signs was unequal (Appendix D, table D29). The correlation coefficient (r) between measurements and live weight in Kushum horses is slightly higher than in Zhabe mares. A higher correlation in both breeds of horses is observed between the live weight and the pastern girth of 0.485-0.458, then between the chest girth and the live weight of 0.462-0.458. Finally, the relationship between height at the withers and live weight was 0.223-0.216. Thus, in breeding for the improvement of meat and dairy breeds along with the assessment of horses at the height at withers, oblique body length, it is necessary to carefully select the chest girth and the girth of the metacarpus.

Features of formation of milk productivity of mares depending on production parameters, body measurements and indexes of body composition are established. Mares of both groups, depending on the shape of the udder, had unequal milkiness. Mares with a cup-shaped udder of 13.75 and 12.07l had a higher milk yield, while mares with a rounded udder had a milk yield of 13.39 and 11.66 l (Appendixes D, table D.30). For complete zoo technical characteristics of development and body type, Kazakh and Kushum mares were measured and weighed (Appendixes D, table D.31). So by size and live weight mares of both groups correspond to the elite and 1st classes. Reproductive qualities of Kazakh horses of Zhabe and Kushum breed depending on the class (elite + 1st, 2nd, extra-class) and productivity course (meat and dairy) have been assessed. It is established that meat producing mares predominate in foal crop after mating their dairy producing peers. Using elite class mares + 1st class increases the absolute rate of fertilization from 60-70% to 80-100% and foal rate from 50-60% to 80-90%, in comparison with individuals of 2nd class and extra-class.

Optimal parameters of milk yield of Zhabe and Kushum breed mares depending on technological parameters of udder are determined. It was found that Zhabe mares with a cup-shaped udder, teat length of at least 2.5 cm, milk yield at 3 months of lactation of at least 7.1 kg are preferred for targeted selection and selection for milk productivity. Mares of Kushum breed with cup-shaped udder, dug of flat forms, directed vertically down, dug length is not less than 3.0 centimeters and not more 6.0 centimeters, milk yield at the 3rd month of lactation of at least 9.5 kg is desirable for targeted selection and selection for milk producing. Comparative analysis of milk yield of Zhabe and Kushum breed mares selected by the proposed method (according to the minimum production parameters) with mares selected by the basic method, showed superiority in milk yield. In mares of Kushum breed, milk yield in 105 days of lactation with the proposed method is 1751.4 kg, with the base method is 1031.8 kg (Appendix D, table D.33). In Zhabe breed mares, the milk yield for 105 days of lactation with the proposed method is 2006.9 kg, with the base method - 1302.6 kg. In dairy horse breeding, the udder shape is one of the leading breeding characteristics. Based on this, we studied the inheritance of the udder shape in different variants of selection of parent pairs.

Regularities of growth and development of growing horses in the dairy period are determined depending on the production parameters of the selected traits of their mothers. As a result, we have prepared a control scale for the development of young animals. In this case, the main evaluation criteria were age and seasonal changes in live weight and body measurements of horses (Appendix D, table D.34). It was found that the measurement parameters of foals of both groups undergo certain changes with age. The largest increase in live weight in foals of both groups was observed from 3 days of age to 1 month and was 40.8 kg in Kazakh Zhabe unaltered male horse, 40.4 kg in mares, 43.1 and 41.7 kg in Kushum young horse, respectively. From 1 month to 6 months of age, the live weight gain in Zhabe breed was 84.8 and 83.0 kg, and in Kushum horses, respectively, 89.5 and 90.4 kg. From 6 months of age to 1 year, live weight gains were, respectively, 36.6-34.0 and 81.6-81.1 kg, and from 1 year to 1.5 years of age, these indicators were: Kazakh horses 79.4 - 75.8 kg, Kushum breed - 99.7-61.6 kg. Analysis of growth and development of young horses of both breeds from 3 days of age to 1.5 years of age made it possible to establish patterns of growth and development of foals. Based on these materials, a scale of development of young animals of both breeds was developed (Appendix D, table D.35).

Traditional methods of selection of breeding stock of Zhabe and Kushum breed on production and selection parameters of yield for further selection are improved (Appendix D, table D.36, 37). The proposed method allows you to complete the shoals of milking mares, uniform in shape udder and flat dugs. The presence of flat dugs facilitates the maximum production of commercial milk. Mares selected by the basic method are significantly inferior in milk yield to herd mates selected by the proposed method. So, the milk yield in 105 days of lactation with the proposed method is 983.2 kg, with the basic method - 682.9 kg, i.e., an additional 44% of commercial milk was obtained.

**3.6 Sheep breeding**

According to lambing data, the yield of lambs per 100 female sheep in 2018 was 87%, and in 2019 and 2020, respectively, 87% and 93%. 2308 lambs were received in 2018, 2668 in 2019 and 2466 in 2020. Livability of lambs for weaning ranged from 88-89%. We have also examined the growth and development of lambs in the suckling period obtained from the selection of rams and ewes of Edilbay breed (Appendixes D, table D.38). The average live weight of Edilbay rams of Baiserke-Agro LLP was equal to 5.0 - 5.3 kg at birth, 38.4-39.8 kg at weaning, and these indicators were 4.8-5.0 and 35.5-37.3 kg in gimmer hogs. This data belongs to well-bred lambs of Edilbay breed. Lambs are rather fast-growing – the average daily gain of body weight makes 283-287 g in rams and 264 g in gimmers. This data belongs to mutton sheep bred in the country. Slaughtering of 4-4, 5 and 16-month-old rams was carried out in order to study the slaughter and meat qualities (Appendix D, table D.39). The average weight of carcass and fat-tail was 19.7 kg at slaughter in 4 - 4.5 months (killing-out percentage - 51.9%), the slaughter weight - 19.9 kg and killing-out percentage - 52.6%. The yield of the meat part of the carcass was 81.3%. The weight of carcass and fat-tail was 38.1 kg at slaughter in 16 (killing-out percentage - 52.6%), the slaughter weight - 38.5 kg, killing-out percentage - 53.1%. The yield of the meat part in the carcass was 81.8%.

According to the research objectives, we continued the work to improve the productive and breeding qualities of Edilbay sheep. The live weight of animals in experimental herds was determined. Wool production was determined when they were cut in May (Appendix D, table D.40). According to the research objectives, we continued the work to create herd of Edilbay sheep with a live weight of lambs - 37-39 lambs and ewe - 53-57 kg at 1.5 years of age. We selected the best animals in the created herds. In addition, 1052 heads of gimmers born in 2018 with an average live weight of 36 kg and 250 rams with an average live weight of 39 kg were left for breed. 673 gimmers with an average live weight of 37.1 kg were selected from among lambs born in 2019 for Edilbay herd replacement. 735 gimmers with an average live weight of 37.9 kg were selected from among lambs born in 2020 for Edilbay herd replacement. In 2019, as a result of valuation, we selected and add 715 gimmers born in 2018 in the herd. Their average live weight is 55.4 kg in 18 months. In 2020, 1004 gimmers born in 2019 were selected and add in the herd. Their average live weight in 18 months was 55.8 kg or at the level of Edilbay sheep of 1st class. The average live weight of breeder rams decreased in 2019 and 2020. It is due to the culling of older rams and adding younger producers in the herd.

During the reporting period, the Kazakh fine-wool sheep were valuated (Appendix D, table D.41). The results of the class composition valuation clearly show that 45% of adult ewes and 45,2% of 1-year gimmers belong to a particularly valuable group of animals. The presented data indicate a high potential of animals. According to the results of valuation, a flock with Kazakh fine-wool ewes was formed in the amount of 1000 heads.

Meat and wool productivity of the breeding flock of ewes exceeded the minimum requirements of the main selected characteristics of fine-wooled sheep with an average cut of unwashed wool - 5.6 kg, wool length (staple length) - 10.4 cm, which is higher by 9.5% (Appendixes D, table D.42). Merino wool was characterized as soft, white, a dirty zone within 1-1. 5 cm, crimp -clearly expressed from the base to the tips of the fiber, the wool was equalized, both in the length of the staple and in tint. Laboratory examination of the wool producing sheep showed that the main wool is 64-70 quality. The true wool length in ewes was 11.0 cm, natural - 10.3 cm, the ratio - 112.6% (Appendix D, table D.43). Based on the results of laboratory analysis of the wool physical and mechanical properties, it can be concluded that the quality of wool meets the requirements of industrial processing for the main physical, technical and technological parameters.

**3.7 Identifying the features of entomoacarocenosis of forage crops (soy, alfalfa, barley and wheat). Economic assessment of its components. Phytoexpertise of seeds**

During the regular phytosanitary monitoring for 2018-2020, lists of pests, entomophages, pollinators, and soil-forming agents that live on the sown areas of Baiserke-Agro LLP were made for the fields of forage crops in the Almaty region. Currently, the list of entomoacarocenosis includes 364 species of pests, 381 species of entomophages, 140 species of pollinators, 32 species of soil-forming agents, 5 species of blood-sucking mites (tables 3-6, Appendix E, tables E.1-E.5).

Table 3 - Total number of pest taxons in the fields of forage crops of Baiserke-Agro LLP 2018-2020

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Class | Number of units | Number of families | Number of species |
| Mollusca | Gastropod | 1 | 7 | 14 |
| Arthropoda |  | 14 | 61 | 303 |
|  | Crustacea | 1 | 1 | 2 |
|  | Arachnida | 1 | 1 | 1 |
|  | Bipedal millipedes | 2 | 2 | 6 |
|  | Insects | 10 | 57 | 294 |
| Vertebral | Birds | 4 | 7 | 20 |
|  | Mammals | 2 | 9 | 27 |
| Total | 7 | 21 | 91 | 364 |

Table 4 - Total number of entomophages in the fields of forage crops of Baiserke-Agro LLP 2018-2020

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Class | Number of units | Number of families | Number of species |
| Arthropoda | 3 | 14 | 77 | 283 |
|  | Arachnida | 1 | 21 | 49 |
|  | Lip-legged millipedes | 4 | 4 | 4 |
|  | Insects | 9 | 52 | 230 |
| Vertebral | Birds | 8 | 24 | 79 |
|  | Mammals | 3 | 6 | 19 |
| Total | 5 | 25 | 107 | 381 |

Table 5 - Total number of pollinator taxons of forage crops in the fields of Baiserke-Agro LLP 2018-2020

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Class | Number of units | Number of families | Number of species |
| Arthropoda | 1 | 3 | 26 | 140 |
|  | Insects | Lepidoptera | 8 | 39 |
|  |  | Hymenoptera | 10 | 72 |
|  |  | Dipterous | 8 | 29 |

Table 6 - Total number of soil-forming taxons in the fields of forage crops of Baiserke-Agro LLP in 2018-2020.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Class | Number of units | Number of families | Number of species |
| Annelida | Clitellates | 1 | 1 | 3 |
| Arthropoda | Crustacea | 1 | 1 | 1 |
|  | Insects | 2 | 4 | 28 |
|  |  | Coleoptera | 3 | 16 |
|  |  | Hymenoptera | 1 | 12 |
| Total | 3 | 4 | 6 | 32 |

As a result of 3-year research, it was revealed that the seeds of forage crops (wheat, soy, barley, alfalfa) are strongly infected with fungal and bacterial microflora, the percentage of infection reached 100%. The dominant microflora in all cultures were fungi of *Alternaria, Fusarium, Mucor*, *Penicillium*, and bacteria of *Pseudomonas, Xanthomonos*, and *Erwinia.*

The energy of germination of seeds of forage crops (wheat, barley, alfalfa) averaged from 68.2 to 96.5% over the years, and the laboratory germination rate was in the range of 78.5-94.7%. The infection rate of seeds with fungal microflora was 67.5% for wheat, 87.5% for barley and 65.0% for alfalfa, and the percentage of bacterial infection was 70% for wheat, 58.0% for barley and 65.0% for alfalfa, respectively. In this regard, over a 3-year period, a number of protective and stimulating compounds were tested in the laboratory to improve the health of the seed material. The components included fungicides, insecticides and growth regulators. Given that all analyzed samples of the seed badly infected with a bacterial infection, all the compositions included a fungicide having antibacterial properties, observed the best efficacy in combination with a Yunta protectant (insectofungicides), stimulants Humistat Potassium Extrasol, Bisolbisan, 350 were selected as growth regulators.

It was noted that bacterial and fungal infection was suppressed from 75.0% to 96.4% after treatment of seeds of forage crops with protective and stimulating compounds. Practical experiments were conducted by using the best compositions based on the results of laboratory studies. They are soy, wheat and barley on an area of 30 hectares of each crop.

As a result of production experiments, we found the positive effect of the developed compositions on the biometric indicators and the structure of the soybean crop. When processing soy seeds, protective and stimulating compounds increase the vegetative growth of soy, the number of beans and seeds per 1 plant, productivity and weight of 1000 seeds. After treatment of soybean seeds, the stored yield varied in the range of 9.9-13.0 centner/ha, sample version - 5.3 centner/ha, final yield - 63.8 centner/ha in 2019 due to the protective and stimulating actions of the developed compounds. In 2020, it was 10-13. 3 centner/ha, sample version - 5.6 centner/ha, final yield – 59.5 centner/ha, respectively.

Similar data in the field were obtained on winter wheat and barley. As a result, after pre-sowing seed treatments, the saved crop options on winter wheat ranged 7,0-8,4 centner/ha and final yield - 9.4 centner/ha, winter barley - 4,1 - 3,2 centner/ha and final yield - 8.7 centner/ha due to the protective-stimulating action formulations.

As a result of the production experience, the positive effect of Extrasol on the biometric parameters of alfalfa was established. On the 5th day after treatment with this drug, the height of the alfalfa stem was higher by 6,4 cm than in the untreated. The bushiness of plants and the number of flowers per 1 m2 when treated with the drug increased by 15.4% and 22.7%, respectively, compared to the final. Also, the height of alfalfa stem on the 10th day after treatment with extrasol increased by 22.2 cm (99.7 cm), final - 77.5 cm. Bushiness of plants during treatment with the drug increased compared to the control by 27.9 %. As a result, the yield increase in the version with extrasol was higher by 29.1% compared to the control.

During phytoexpertise of soybean seeds, their sowing qualities were evaluated (germination energy on days 3 and 5, laboratory germination on days 7) before and after pre-sowing treatment with protectants and growth stimulants. In laboratory conditions, the effectiveness of 26 developed protective and stimulating compounds was evaluated on soy seeds. Based on the conducted research, the most effective protective and stimulating compounds were selected that positively affect the seed quality and the growth rate of seedlings and the root system, effectively suppressing the fungal and bacterial microflora of seeds and the number of diseased soybean seeds and seedlings (Appendix F, tables F.1-F.5, figures F.1-F.3). Based on laboratory studies, the following drugs were selected - fungicides TMTD w.s.c., insectofungicides - Yunta, s.c., stimulants: Potassium Humophosphate, Phytolavin, w.e.c., Bisolbisan, 350. All drugs were tested at the recommended doses.

As a result of the analysis, protective and stimulating compounds had a positive effect on the sowing qualities of crops. The highest density of seedlings on winter wheat was in TMTD, V. S. K. – 3.0 l/t + Celest-top, 312.5 K.S. - 1.0 l/t + Bisolbisan 1.0 l/t – 250 PCs/m2, final – 222.5 PCs/m2. On winter barley, both variants showed high field germination in TMTD, V.S.K. - 3.0 l/t + tabu, K.S.- 0.5 l/t + Extrasol - 1.0 l/t-289.5 PCs/m2, and TMTD, V.S.K. - 3.0 l/t + Celest-top, 312.5 K.S. - 1.0 l/t + GSN - 0.5 l/t – 290.0 PCs/m2, final – 246.5 PCs / m2. In addition, the selected variants showed high biological effectiveness against seed mold, both variants showed 100% biological effectiveness for winter wheat, and 97.9% and 100% for winter barley (Appendixes F, table F.6). The biological effectiveness of protective and stimulating compounds against root rot of winter grain crops was also determined. In winter wheat, the biological effectiveness in the tillering phase of the crop was 70.5%; 61.7%, in the phase of full grain ripeness – 64.9%; 59.6%. On winter barley, these indicators reached 70.8%; 89.5% during the tillering phase, and 68.9%; 85.0% before harvesting, respectively (Appendix F, table F.7). During the harvest period, crop data on experience options and biometric indicators were established. All versions of experiments showed a positive effect of treatment with protective and stimulating compounds on biometric indicators of winter cereals, such as bushiness, stem length, ear water content and weight of 1000 grains. The length of plants in the variants treated with protective and stimulating compounds on winter wheat was in the range of 86.6-89.7 cm, while in the final variant this indicator did not exceed 71.5 cm. In experiments on winter barley, a positive effect on all biometric indicators was also noted (Appendix F, table F.8, figure F.4). The analysis of biometric measurements and crop structure revealed that when treating grain seeds with protective and stimulating compounds, vegetative growth, bushiness, stem length, ear lake content and the mass of 1000 grains increase. As a result, after pre-sowing seed treatments, the saved crop options on winter wheat ranged 7,0-8,4 centner/ha and final yield - 9.4 centner/ha, winter barley - 4,1 - 3,2 centner/ha and final yield - 8.7 centner/ha due to the protective-stimulating action formulations.

Thus, analyzing data on results of laboratory and practical research on the development of protective and stimulating compounds for seed treatment, it is established that presowing treatment of seeds of agricultural crops must begin with a detailed phytoexpertise of seeds, selection of high-quality pesticides in compliance with all regulations for their use. It is proved that the addition of growth regulators to the composition with fungicides, insectofungicides gives certain advantages: they stimulate plant growth, positively affect the physiological processes of development, help plants overcome critical situations with the least losses, increase productivity and product quality.

**3.8 Developing science-based measures to improve existing agricultural technologies of cultivation and integrated protection of forage crops (soy, alfalfa, barley, wheat), transfer and implementation of advanced developments that will increase their yielding ability**

Breeding of *Galleria melonella* wax moth and subsequent cultivation of the entomopathogenic nematodes *Steinernema carpocapsae, S. feltiae, and Heterorhabditis bacteriophora* was organized. In 2019-2020, the number of *Aeoloderma crucifer* (Rossi, 1790), a nutcracker pest, increased sharply on soybean crops of Baiserke-Agro LLP - up to 35 specimen per m2. The areas of soybean field inhabited by it were treated with a suspension of nematode larvae and the biological product - Entolek Planteco®. The pest population count carried out after 3 days showed a sharp decrease in its number (up to 1-2 species per m2) to an economically non-hazardous level. Larvae of the Semirechensk marble crunch *Polyphulla irrorata* were also found by taking a soil sample under withering barley plants. The place of barley crops damaged by crunch larvae was treated with an aqueous suspension of nematodes. After repeated monitoring, no damage was found there. Thus, the nematode *H. bacteriophora* is effective against the larvae of crustaceans and nutcrackers, and it can be recommended for use in production. During the mass breeding of soybean pest caterpillars – *Vanessa cardui* in the fields of LLP "Baiserke-Agro" with a total area of 30 hectares, treatment with with a biological drug Entolek was carried out. When breeding in the fields of Kerbulak branch of Baiserke-Agro LLP with a total area of 10 hectares, the caterpillars of the exclamation scoop *Agrotis exclamationis* (Linnaeus, 1758) were also treated with the biological product Entolek. This drug was also used against locusts, grasshoppers, Sawfly larvae, scoop and moth caterpillars, spun beetles and sucking pests-bedbugs, aphids and *Tetranychus turkestani* on a total area of 40 hectares. The efficiency was 88-100 % depending on the type of pest. This product can be recommended for production as an effective and environmentally safe to reduce the number of pests at an economically imperceptible level. The treatment against mollusks of several species, which are the most massive in the economy and have the greatest economic value suspension based on the nematode - *Phasmarhabditis hermaphrodita* (A. Schneider, 1859), which is now widely used by farmers and gardeners in European countries. Now there is no product against slugs and snails, neither chemical, nor biological in the Reference of pesticides of the Ministry of Agriculture of the Republic of Kazakhstan [82]. The occurence and application of environmentally safe product in Kazakhstan is a very important step in the improvement of the integrated system of plant protection and feed production of the country. The efficiency reached 80%.

To saturate the forage crops with useful organisms, artificial bait nests were installed for breeding entomophages and pollinators. According to the results of the calculations, as before, within a radius of 4-5 m from each nest, inhabited by entomophage wasps by 45-50%, the number of harmful organisms – aphids, thrips, caterpillars, flies, beetles, weevils, etc. The phacelia siderate was sown to attract them [85, 86] (Appendix F, figures F.5 - F.12).

Ecotoxicological assessment of soil samples, forage crops, insects and water in their growing areas was made for the general characteristics of agrocenoses.

**3.9 Analyzing survey results and making adjustments to scientific developments, if necessary, to reduce the cost of final products**

In the reporting year, Baiserke-Agro LLP worked to reduce the cost of final products. For this purpose, plant protection products, in particular seed protectants, were selected according to the rate of consumption and the price of drugs. To accomplish this task, we have completed phytosanitary monitoring of crops and identification of organisms to implement and correct our developments.

Phytoexpertise of seeds and the development of protective-stimulating compositions continued to be performed. According to the project objectives, this year the products were selected at a lower market price in order to reduce the cost of protective and stimulating compounds. During phytoexpertise of soybean seeds from Baiserke-Agro LLP, their sowing qualities were evaluated (germination energy on days 3 and 5, laboratory germination on days 7) before and after pre-sowing treatment with protectants and growth stimulants. In laboratory conditions, the effectiveness of 26 developed protective and stimulating compounds was evaluated on soy seeds. Based on the conducted research, the most effective compounds were selected that positively affect the seed quality and the growth rate of seedlings and the root system, effectively suppressing the fungal and bacterial microflora of seeds and the number of diseased soybean seeds and seedlings (Appendix F, tables F.1-F.5, figures F.1-F.3).

Based on laboratory studies, the following drugs were selected - fungicides TMTD V.S.K., insectofungicides - Yunta, K.S., stimulants: Potassium Humophosphate, Phytolavin, V.R.K., Bisolbisan, 350. All drugs were tested at the recommended doses.

The analysis of the sowing qualities of different seeds shows that they all have good indicators and correspond to 1st class according to GOST, the germination energy on 3rd day varied depending on the characteristics of varieties 47.8 to 86.7%; laboratory germination - 92.5-100%. The final percentage of diseased seeds and seedlings reached from 97.5% to 100%, and in most variants treated with the protective and stimulating compounds developed by us, diseases were not observed. In the white and Victoria soybean varieties, the percentage of infection did not exceed 1.7%.

In production conditions, the effectiveness of treatment of winter cereals (wheat, barley) with protective and stimulating compounds selected on the basis of laboratory experiments was evaluated. The crops of Baiserke-Agro LLP were tested: winter wheat Canada, 2 options on 30 ha each, the seeding rate is 180 kg/ha, winter barley grade, French, 2 options on 30 ha each option, the seeding rate is 180 kg/ha. All drugs were used at the recommended doses.

As a result of the analysis, protective and stimulating compounds had a positive effect on the sowing qualities of crops. The highest density of seedlings on winter wheat was in TMTD, V. S. K. – 3.0 l/t + Celest-top, 312.5 K.S. - 1.0 l/t + Bisolbisan 1.0 l/t – 250 PCs/m2, final – 222.5 PCs/m2. On winter barley, both variants showed high field germination in TMTD, V.S.K. - 3.0 l/t + tabu, K.S.- 0.5 l/t + Extrasol - 1.0 l/t-289.5 PCs/m2, and TMTD, V.S.K. - 3.0 l/t + Celest-top, 312.5 K.S. - 1.0 l/t + GSN - 0.5 l/t – 290.0 PCs/m2, final – 246.5 PCs / m2. In addition, the selected variants showed high biological effectiveness against seed mold, both variants showed 100% biological effectiveness for winter wheat, and 97.9% and 100% for winter barley (Appendixes F, table F.6). The biological effectiveness of protective and stimulating compounds against root rot of winter grain crops was also determined. In winter wheat, the biological effectiveness in the tillering phase of the crop was 70.5%; 61.7%, in the phase of full grain ripeness – 64.9%; 59.6%. On winter barley, these indicators reached 70.8%; 89.5% during the tillering phase, and 68.9%; 85.0% before harvesting, respectively (Appendix E, table E.7). During the harvest period, crop data on experience options and biometric indicators were established. All versions of experiments showed a positive effect of treatment with protective and stimulating compounds on biometric indicators of winter cereals, such as bushiness, stem length, ear water content and weight of 1000 grains. The length of plants in the variants treated with protective and stimulating compounds on winter wheat was in the range of 86.6-89.7 cm, while in the final variant this indicator did not exceed 71.5 cm. In experiments on winter barley, a positive effect on all biometric indicators was also noted (Appendix F, table F.8, figure F.4).

The analysis of biometric measurements and crop structure revealed that when treating grain seeds with protective and stimulating compounds, vegetative growth, bushiness, stem length, ear lake content and the mass of 1000 grains increase. As a result, after pre-sowing seed treatments, the saved crop options on winter wheat ranged 7,0-8,4 centner/ha and final yield - 9.4 centner/ha, winter barley - 4,1 - 3,2 centner/ha and final yield - 8.7 centner/ha due to the protective-stimulating action formulations.

Thus, analyzing data on results of laboratory and practical research on the development of protective and stimulating compounds for seed treatment, it is established that presowing treatment of seeds of agricultural crops must begin with a detailed phytoexpertise of seeds, selection of high-quality pesticides in compliance with all regulations for their use. It is proved that the addition of growth regulators to the composition with fungicides, insectofungicides gives certain advantages: they stimulate plant growth, positively affect the physiological processes of development, help plants overcome critical situations with the least losses, increase productivity and product quality.

In 2020, the following measures were taken to reduce the cost of applied plant protection products: due to the high cost of Celest-top, 312.5 K.S. was replaced with Yunta of insecticide-fungicidal action, but which is much cheaper (2 times). We would like to note that in "Handbook of pesticides allowed for use on the territory of the Republic of Kazakhstan" [50], there are very few protectants for soy against pests of seedlings and seed infection. In this regard, taking the experience of scientists from the CIS countries, as well as after laboratory tests, we were convinced of the effectiveness of many protectants, using unrecorded products in the developed compositions. Extrasol was used as a growth stimulator [51, 52]. TMTD was used as the only anti-bacterial drug. As a result of the use of Yunta, expenses will be significantly reduced (by 11,000 KZT/t of seeds). We also want to note that timely and high-quality seed treatment with the above composition, which includes, in addition to fungicide, insecticide, and growth stimulator, makes it possible to prevent the spread and development of diseases and pests during the growing season.

An analysis of the economic efficiency of soybean seed treatment with protective and stimulating compounds showed that the costs paid off by 6.9 times with a preserved yield of 13.3 centner/ha, which is significant.

The cost of products for seed treatment was calculated per 1 ha. The market value of TMTD, V. S. K. is 4000 tenge, Yunta-12672 tenge, growth regulator Extrasol - 5000 tenge. The cost of seed treatment (fuel costs, the tariff rate) - 1500 tenge / t. Consequently, the total cost of seed treatment per 1 ha of soybean crops, depending on the rate of consumption of the drug, is 6661 tenge. When the purchase price for soy is 347.5 tenge per 1 kg (table 7).

Table 7 - Economic efficiency of soybean seed treatment with protective and stimulating compounds (Almaty region, Talgar district, Baiserke-Agro LLP, 2020)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Protective and stimulating compounds | Harmful organism | | Cost of pesticide, l/Tg, kg/Tg | Consumption rate per 1 ha | Cost of pesticides, Tg/ha | Other costs\* Tg/ha | Total cost, KZT/ha | Retained yield, centner/ha | Cost of retained grain, KZT | Payback, number of times |
| diseases | pests |
| TMTD, w.s.c. | the complex of seed infection, growth regulator | - | 4000 | 0.6 | 2400 | 1500 | 6661 | 13,3 | 46217,5 | 6,9 |
| Yunta, | complex of sprouting pests | 12 672 | 0.15 | 1901 |
| Extrasol | - | 5000 | 0.10 | 500 |
| Total: | | | | | | |  |  |  |  |
| Note - \* fuel costs, tariff norms and fund of tractor drivers | | | | | | | | | | |

Thus, it is determined that the use of protective and stimulating compounds for pre-sowing treatment of soybean seeds fully justifies the costs (Appendixes G).

Since there is no drug for soy black stem in the Republic of Kazakhstan, the biological drug Phytodoc Planteco® was selected by analyzing the existing information to combat this disease. They carried out 2 treatments of soybean crops during the growing season as an introduction. Experimental site has no lesion with black stem. Test area affected by black steam for 35 % (Appendixes G).

Breeding of *Galleria melonella* wax moth and subsequent cultivation of the entomopathogenic nematodes *Steinernema carpocapsae, S. feltiae, and Heterorhabditis bacteriophora* were continued. In mid-May, the number of *Aeoloderma crucifer* (Rossi, 1790), a nutcracker pest, increased sharply on soybean crops of Baiserke-Agro LLP - up to 35 species per m2. The areas of soybean field inhabited by it were treated with a suspension of nematode larvae and the biological product - Entolek Planteco®. The pest population count carried out after 3 days showed a sharp decrease in its number (up to 1-2 species per m2) to an economically non-hazardous level. When mass breeding in the fields of Kerbulak branch of Baiserke-Agro LLP with a total area of 10 hectares, the caterpillars of the exclamation scoop *Agrotis exclamationis* (Linnaeus, 1758) were also treated with the biological product Entolek. This drug was also used against locusts, grasshoppers, scoop and moth caterpillars, spun beetles and sucking pests-bedbugs, aphids and *Tetranychus turkestani* on a total area of 40 hectares. The efficiency was 88-100 % depending on the type of pest. This product can be recommended for production as an effective and environmentally safe to reduce the number of pests at an economically imperceptible level. To saturate the forage crops with useful organisms, artificial bait nests were installed for breeding entomophages and pollinators. According to the results of the calculations, as before, within a radius of 4-5 m from each nest, inhabited by entomophage wasps by 45-50%, the number of harmful organisms – aphids, thrips, caterpillars, flies, beetles, weevils, etc. (Appendix F, figures F.5-F.12).

As a result, we have received 4 patents of the Republic of Kazakhstan for a utility model (Appendixes C).

**3.10 Preparing regional flow process charts on cultivation and integrated protection of forage crops (soy, alfalfa, barley and wheat)**

Based on the research, regional flow process charts were developed (Appendix H, tables H.1 - H.4). 2 research and development deliverables are submitted to RSTA information.

**3.11 Preparing, publishing and distributing practical recommendations on the use of innovative integrated system for the protection and cultivation of forage crops (soy, alfalfa, barley and wheat) in the South-East of Kazakhstan**

In accordance with the calendar plan and work program for 2020, the team of performers prepared, published and distributed "Recommendations for the cultivation and integrated system of protection of forage crops (alfalfa, soy, barley, wheat) in the South-East of Kazakhstan" (Appendix B).

**3.12 Forming epizootic units in Baiserke-Agro LLP and defining an epidemic situation in them**

Analysis of the risk criteria for appearance and spread of infectious animal diseases in epizootic units (EU) allowed us to establish that the main reasons for maintaining a complex epizootic situation for infectious animal diseases are the lack of EU formation, inadequate identification of animals, insufficient equipment of livestock facilities with necessary facilities, and unsatisfactory implementation of veterinary and sanitary and special veterinary measures. Therefore, in these EU, there is a risk of maintaining or even increasing the main source of infection, which is sick animals. "Baiserke-Agro" LLP is an organized farm, whose livestock farms are located both outside and within the locality, in the amount from tens to hundreds heads, where: in the cold season, all animals are on a livestock farm; in the warm season, at night – within the farm, during the day on pastures reserved for them; zero grazing within the farm. Animals of such farms are kept separately in winter and summer and do not have contact with other groups and species of animals. Therefore, mutual contact between animals occurs only within this farm. In this connection, we took these economic groups of animals as an epizootic unit. All the specified epizootic characteristics of bacterial infections and production methods of keeping animals in Baiserke-Agro LLP were taken into account when calculating the epizootic units and the sample size in them for subsequent studies.

Taking into account the above, during the reporting period, we examined 4 livestock plots in Baiserke-Agro LLP, where large and small cattle, horses, and camels are located (Appendix K, table K.1). As a result of our research, we have formed epizootic units, in particular:

1. Robotic dairy farm where cows of Holstein-Friese dairy production line are located.

2. Commercial farm (CF) for management of meat producing cattle.

3. "Central branch" farm for breeding and sport horses.

4. "Kyrgauyldy" horse farm for producing horse population.

5. Kumtobe pasture area for fine-wool sheep.

6. Kerbulak pasture area for meat producing cattle. Flocks of sheep, as well as camels and horses are located on this plot.

Thus, all animals in Baiserke-Agro LLP are located on 4 sites and form 6 epizootic units, i.e. separate groups with a certain, limited range (relatively permanent or temporary), where the risk of ingestion of the causative agent with possible subsequent disease development is equally (for each animal) detected.

**3.13 Investigating and defining epizootic characteristics of epizootic units in Baiserke-Agro LLP and adjacent territories**

We have been studying epizootological characteristics of livestock farms of LLP “Baiserke-Agro” and adjacent territory with livestock for 3 years. To diagnose infectious diseases, we have carried out bacteriological research of biological material from fallen and clinically ill animals (calves, cattle, horses). Based on biological properties of the isolated microorganisms, we completed their identification and established sensitivity to certain antimicrobial drugs. Brucellosis test among 14,401 heads in 2018 showed that 10 heads have positive result. Small cattle (0.16 %), 2 patients from the examined 1937 samples reacted positively to chlamydia. Small cattle, the percentage of infection for leukemia was 0.28% out of 408 patients. Cattle, 12 samples (3.37%) responded positively for epididymitis of rams from the tested 354 samples, positively reacted 1 (0.28 %). All positively reacting animals were withdrawn and handed over for slaughter.

In the course of work the epizootic situation on trypanosomiasis and epizootic lymphangitis of the horses kept in Kerbulak was specified. At the same time, positive results of CFT/PCFT for trypanosomiasis and epizootic lymphangitis were obtained. The obtained data were the basis for the development of appropriate antiepizootic measures. *Salmonella abortus-ovis* culture was found in one newborn lamb (2019). Salmonella is identified to the species when making AR with polyvalent and monoreceptor O - and H - Anti-salmonella serum (Appendix K, figures K.1). Mold and Aspergillus fungi (pathogens of aspergillosis and mycotoxicosis of animals) were sown from hay samples. The presence of Proteus group bacteria in the hay indicates that putrefaction processes are taking place (2019) (Appendix K, figure K.2). As a result of bacteriological research of pathological and biological material for the reporting period, the following crops were isolated from farm animals: *Listeria monocytogenes, Pasteurella multocida, Diplococcus*. *L. monocytogenes* was isolated from pathological material from lambs, calves, cows and calves (Appendix K, figures K. 4, 5). It was found that they showed high sensitivity to fluoroquinolone antibiotics (1-norfloxacin, 2-ofloxacin, 5-amoxicillin), weakly sensitive to gentamicin (3), ceftriaxone (4), amoxicillin, cefotaxime (6), amikacin (7) (Appendix K, figures K. 6, 7). *Diplococcus* cultures (14 pieces) were isolated from calves (6 from biological and 8 from pathological material). High sensitivity of diplococci to fluoroquinolones (more than 34 mm) and to amoxicillin (semi-synthetic penicillin) (up to 30 mm) gentamicin (25 mm) was established (Appendix K, figures K. 8, 9). *P. multocida* was sown from individual organs of abortus, forcedly beaten bull and cow's milk. Moderate sensitivity of pasteurels to strepptomycin (15 mm), norfloxacin (15 mm) and ofloxacin (12 mm) was noted (Appendix K, figures K.10, 11). The list and characteristics of the isolated microorganisms are presented in tables K.2 - K.4 of Appendix K. Further, the results obtained are used for health-improving activities. Local veterinary specialists were given recommendations and provided scientific, methodological and practical assistance on disinfection issues. Thus, the rehabilitation of pens and open loafing area for animals was carried out using a combined deodorant - formalin with 10% NaOH solution.

**3.14 Developing consequence of efficient use of anti-epizootic products**

In the course of research numerous diagnostic studies were carried out; cultures of microorganisms were isolated and their biological properties were examined. To optimize therapeutic measures, we perfromed research to determine antibiotic sensitivity and give recommendations for the selection and use of optimally effective medicines. Efficiency of the applied means and methods of prevention and therapy for infectious diseases of farm animals has been examined, and on this basis, the sequence of optimal use of antiepizootic drugs has been developed. The analysis of the epizootic situation, taking into account the significant number of imported livestock, showed the need for additional use of a number of drugs for specific prevention. So, in the course of work, we developed and proposed: "Dry live vaccine against Salmonella abortion of mares from the *Salmonella abortus* - *equi* E-841 strain", "Vaccine against animal necrobacteriosis", "Inactivated vaccine against foot rot of small cattle" and "Vaccine against bovine moraxellosis" (Appendix K, figures K.12 - J.14). These products were developed individually only for this livestock complex. As a result of the preventive and therapeutic measures carried out during the year, the sick animals were promptly identified, isolated and treated. Immunization of animals, according to the anti-epizootic plan, allowed to preserve the epizootic well-being of all available livestock. Implementation of the developed and proposed measures allows maintaining epizootic safety in each EU and significantly reducing the risks of occurrence and spread of infectious and parasitic diseases, as well as pathologies of non-infectious etiology.

**3.15 Preparing Animal disease control plan for large and small cattle, horses and camels, and developing consequence for efficient use of antiepizootic products**

Antiepizootic measures, as is known, should include a set of organizational and economic, veterinary and sanitary and special veterinary measures. Organization of epizootological units, functioning of veterinary and sanitary facilities, in particular, sanitary inspection centers, fencing territories of DF, points of artificial insemination, cremation places, compliance with the identification of animals, working out technological techniques that contribute to the rupture of the epizootic chain require control among organizational and economic measures. The relevant proposals are included in the plan of antiepizootic measures. Proposals for veterinary and sanitary measures are given. Special veterinary measures against infectious and non-infectious diseases are aimed at all links of the epizootic chain, in particular: isolation with subsequent slaughter of all infected livestock, timely diagnostic studies with indication and identification of pathogens. A comprehensive plan of anti-epizootic measures to ensure the veterinary and sanitary safety of Baiserke-Agro LLP's EU presented in Appendix K. Efficiency of the applied means and methods of prevention and therapy for infectious diseases of farm animals has been examined, and on this basis, the sequence of optimal use of antiepizootic drugs has been developed. The vaccination and deworming plan of all species of animals from their birth to the end of economic use is presented in Appendix K.

**3.16 Replication of research results**

Taking into account the difficult epidemiological situation, replication of the results of scientific activities was carried out during the international summer veterinary school held in the period of 2020. At lectures, seminars and trainings, listeners (veterinary specialists) from different countries were introduced to the organization of veterinary services "Baiserke-Agro". In addition, a video was prepared about the organization of the veterinary service in "Baiserke-Agro", which was also demonstrated during the international summer veterinary school. In the course of research work, Methodological recommendations "On sampling for diagnostic tests for infectious diseases of farm animals and birds" were prepared and submitted to the press. They describe methods of sampling for in vivo and post-mortem diagnostics of infectious diseases of farm animals and birds, as well as methods of sampling feed, water, soil and air, as well as methods of their preservation and delivery.

**CONCLUSION**

In accordance with the technical specification, schedule and program, we have completed an extensive amount of work in 2018-2020 to achieve the main goal of the project. In the course of pasture survey, the botanical composition of the herbage was determined and inspected according to the seasons of the year. Based on geobotanical surveys, 4 independent plots were identified that differ from each other by vegetation cover. During the research, the yield of pasture mass was taken into account depending on their type. The average yield of pastures for 3 years was 10.8 centner/ha. It follows that the total forage stock of available pastures was 280800 centner. The pasture load for sheep was from 0.6 to 1.2 ha/head, for cattle from 1.8 to 3.0 ha/head, for horses from 4 to 2.3 ha/head, for camels, respectively, 2.9 to 3.9 ha/head. There is a surplus of pastureland – 12196 ha. According to information of the reporting period, the total number of camels has not changed in 3 years of practice, but the number of female camels increased by 38 heads, which is 49.0% in the specific weight; the specific weight increased by 16.0% compared to 2018. The yield of young camels for 2018-2020 varied from 40% to 50%. The safety of young camels was 72.7-87.5%. Female camels of the main livestock produce an average of 5.1 kg to 5.6 kg of wool. The average daily milk yield was 5.7-5.9 kg in the third month of lactation, which corresponds to animals of the 2nd quality class. In 2018, female camels with a cup-shaped udder (6.4±0.11 kg) produced significantly more milk compared to female camels with rounded (5.6±0.17 kg), flat (4.5±0.28 kg) and lobular (4.7±0.15 kg) udder forms. In 2019, camels with a cup-shaped udder outperform their herdmates with a flat udder shape by 18.8 %, rounded shape by 11.8 % in milk yielding. Young Kazakh Bactrian camels are characterized by stumpiness and high churn at birth. They have live weight of 40.3±1.9 kg at birth, wool and meat producing camels - 34.2 kg and milk and meat producing camels - 36.8 kg. Young camels received from dairy producing female camels outperform their wool and meat producing peers by live weight by 17.8% (P<0.01), dairy and meat producing - by 9.5% (P<0.1). For the first 60 days of lactation in 2019, female camels with full degree of lactation 75-84% produce milk by 23.3% more in comparison with their herd mates with full degree of lactation 65-74% and 11.7% more than camels with full degree of lactation +85%. When monitoring milk yield for 150 days of lactation, it was found that camels with full degree of lactation 75-84% outperform their herd mates with full degree of lactation 65-74% - by 178.4 kg, +85% by 98.3 kg. During 120 days of lactation, camels with milk productivity up to 1.4 had 143.7 kg less compared to herd mates with a rank of 1.5-1.9 and 237.4 kg less with a rank of +2.0. It is established that the young one-year-old camels of the Kazakh Bactrian breed have different live weight and fatness depending on the indicators of the wool cutting coefficient. Based on the results obtained, we made work zootechnical parameters of female camels and breeding camels for growing them in the conditions of the “Kerbulak” area. It was found that with a homogeneous selection of Bura breeder and Kazakh Bactrian camels of the South Kazakhstan type according to the wool producing coefficient, the best indicators for the precocity of daughters were recorded in the wool producing coefficient of 0.9 - 1.4. One-year-old camels received from fathers and mothers with a high wool producing coefficient (1.5 and above) significantly outperform their herd mates by 29.2% (wool producing coefficient is up to 0.8) and 14.8% (wool producing coefficient 0.9 - 1.4).

In dairy cattle breeding, the analysis of data obtained on the herd structure over the past 3 years allowed us to establish some dynamics of improving the efficiency of herd turnover, associated with an increase in specific weight of the main breeding stock. The specific weight of heifers increased and this ensures replacement of the herd by 19.0%, which is 12.9% higher than in 2018. The specific weight of heifers increased during the full cycle of the herd turnover. In addition, due to the adjustment of the diet, in recent years In addition, due to the adjustment of their diet, in recent years, the cow’s milk productivity increased by 7.42 kg, which on average amounted to 36.8 kg (lim. 28-86 kg). Based on the data obtained and feed consumption, the cost of milk was calculated, which amounted to 116.89 KZT when marketable cost is 160 KZT per 1 kg with an average fat content of 3.71%. In the course of research, we developed the effective ways of raising calves and replacing the heifers to create a high-yield herd. If we calculate the cost of process parameter without excluding the cost of by-products, growing 1 head up to 14 months of age costs 538.8 thousand KZT. The highest expenditure rates for growing young animals are noted in the first 4 months since they drink milk, the most expensive component of the diet.

The number of Angus and Hereford breeds decreased by 154 and 38 heads respectively. At the same time, the indicators of 2020 exceed indicators of 2018 by 59 and 120 heads respectively in herds with Kazakh white-headed and Auliekol breeds. The obtained results made it possible to increase the specific weight of cows in the herd structure to zootechnical standards in almost all herds. Based on the data obtained, various herds with the most optimal load of bulls were formed. Thus, 3 herds were formed for the Angus breed, 2 for the Hereford breed, and 4 and 2 herds for the Kazakh white - headed and Auliekol breed, respectively. Bulls were assigned according to zootechnical standards, where 30 cows and heifers come to 1 bull. It should be noted that all assigned bulls were evaluated for their own productivity and quality of offspring. In general, in 2019, 24 Angus bulls, 11 Hereford bulls, 48 Kazakh white - headed bulls and 38 Auliekol bulls were evaluated for their own productivity. There is a genetic superiority of descendants obtained from different bulls-breeders. We have prepared formulas for the index evaluation of animals. During the analysis, it was found that this formula simplifies the work of breeders and allows calculating the breeding value of animals. In the result of valuation, 1629 heads of beef cattle, including 747 heads of cows are selected for groups of elite animals. In general, 56.3% of highly productive cows were allocated to breeding groups for all breeds. As part of determining the optimal technologies for feeding and keeping young animals and adult livestock in the stable period, production solutions were made to compile a diet for young animals of different ages and for adult livestock. Thus, cows in the stable period are provided daily with 5 kg of hay, 10 kg of straw, 3.5 kg of concentrates and 20 kg of haylage, which in total makes an average of 12.1 units per 1 head per day. For young animals, the rations are prepared to allow to get 1,065 g of average daily growth in 294 days, with a movable live weight of 526 kg at 18 months.

In horse breeding, the highest variability is characterized by live weight, which is equal to 1.42 and 1.61 in stallions, 5.75 and 4.64 in mares. By measuring the body lenght and chest girt, the stable indicators of variability are inherent in stallions - 0,57-0,54, 0,77-0,81, 0,62-0,62 and mares respectively 1,82-1,26, 2,16-2,42, 1,87-2,43. A higher correlation in both breeds of horses is observed between the live weight and the pastern girth of 0.485-0.458, then between the chest girth and the live weight of 0.462-0.458. Mares with a cup-shaped udder of 13.75 and 12.07 l had a higher milk yield, while mares with a rounded udder had a milk yield of 13.39 and 11.66 l. Mares of both groups correspond to the elite and 1st classes by size and live weight. It is established that meat producing mares predominate in foal crop after mating their dairy producing peers. Using elite class mares + 1st class increases the absolute rate of fertilization from 60-70% to 80-100% and foal rate from 50-60% to 80-90%, in comparison with individuals of 2nd class and extra-class. It was found that Zhabe mares with a cup-shaped udder, teat length of at least 2.5 cm, milk yield at 3 months of lactation of at least 7.1 kg are preferred for targeted selection and selection for milk producing. Mares of Kushum breed with cup-shaped udder, dug of flat forms, directed vertically down, dug length is not less than 3.0 centimeters and not more 6.0 centimeters, milk yield at the 3rd month of lactation of at least 9.5 kg is desirable for targeted selection and selection for milk producing. Regularities of growth and development of growing horses in the dairy period are determined depending on the production parameters of the selected traits of their mothers. As a result, we have prepared a control scale for the development of young animals. In this case, the main evaluation criteria were age and seasonal changes in live weight and body measurements of horses.

In sheep breeding, the yield of lambs per 100 female sheeps in 2018 was 87%, and in 2019 and 2020, respectively, 87% and 93%. 2308 lambs were received in 2018, 2668 in 2019 and 2466 in 2020. Livability of lambs for weaning ranged from 88-89%. The average live weight of Edilbay rams was equal to 5.0 - 5.3 kg at birth, 38.4-39.8 kg at weaning, and these indicators were 4.8-5.0 and 35.5-37.3 kg in gimmer hogs. The average weight of carcass and fat-tail was 19.7 kg at slaughter in 4 - 4.5 months (killing-out percentage - 51.9%), the slaughter weight - 19.9 kg and killing-out percentage - 52.6%. The yield of the meat part of the carcass was 81.3%. The weight of carcass and fat-tail was 38.1 kg at slaughter in 16 (killing-out percentage - 52.6%), the slaughter weight - 38.5 kg, killing-out percentage - 53.1%. The yield of the meat part in the carcass was 81.8%. The average live weight of breeder rams decreased in 2019 and 2020. It is due to the culling of older rams and adding younger breeders in the herd.

Valuation results of Kazakh fine-wool sheep by class composition showed that 45% of adult ewes and 45.2% of 1-year gimmers were assigned to the particularly valuable group. Meat and wool productivity of the breeding flock of ewes exceeded the minimum requirements of the main selected characteristics of fine-wooled sheep with an average cut of unwashed wool - 5.6 kg, wool length (staple length) - 10.4 cm, which is higher by 9.5%. Merino wool was characterized as soft, white, a dirty zone within 1-1.5 cm, crimp - clearly expressed from the base to the tips of the fiber, the wool is smooth, both in the length of the staple and in tint.

Throughout the growing season and during harvest, according to existing methods adopted in plant protection and entomology, and original modifications, phytosanitary monitoring of forage crops allowed to take into account harmful and useful animals. Based on the results of the research, the lists of pests and entomophages of forage crops of Baiserke-Agro LLP were supplemented. The species composition of pests is supplemented by 12 species belonging to 8 families. The list of entomophages is expanded to 7 species belonging to 3 families. The list of harmful mammals includes 17 species of rodents and 1 species of hares. The list of birds that harm crops includes 18 species. The list of useful amphibians includes 2 species, birds - 80 species, mammals - 19 species. Currently, the list of entomoacarocenosis includes 364 species of pests, 381 species of entomophages, 140 species of pollinators, 32 species of soil formers, and 5 species of blood-sucking mites. During the reporting period, the team of performers carried out production tests and implementation of developments in production against pests. The efficiency reached 88-100 %. The work is confirmed by the relevant implementation acts. Artificial nests for breeding of entomophages and pollinators of old and new modifications have been established. The seeding of the siderate plant of phacelia to attract pollinators and entomophages was carried out. Phytosanitary of feed crop seeds (soybean, wheat, barley, alfalfa) has been conducted. Efficiency of a number of systemic fungicides was evaluated; a protective and stimulating composition for pre-sowing treatment of wheat seeds and barley was developed. According to the results of laboratory and practical research on the development of protective and stimulating compounds for seed treatment, it is established that presowing treatment of seeds of agricultural crops must begin with a detailed phytoexpertise of seeds, selection of high-quality pesticides in compliance with all regulations for their use. It is proved that in the composition with fungicides, insectofungicides, the addition of growth regulators gives certain advantages: they stimulate plant growth, positively affect the physiological processes of plants, help them overcome critical situations with the least losses, increase productivity and product quality. Process flow charts of forage crops cultivation for a particular farm have been developed and implemented from the data obtained. To reduce the cost of applied plant protection products due to the high cost of Celest-top, 312.5 K.S. was replaced by a cheaper (2 times) one - Yunta of insectofungicidal action. An analysis of the economic efficiency of soybean seed treatment with protective and stimulating compounds showed that the costs paid off by 6.9 times with a preserved yield of 13.3 centner/ha. As a result, we have received 4 patents of the Republic of Kazakhstan for a utility model (Appendixes C). 2 research and development deliverables are registered (Appendixes M). The research results were published: 1 article in Web of Science, Scopus and Web of Science, 4 articles in rating Kazakh journals, 9 articles in the materials of International scientific and practical conferences. “Recommendations on cultivation and integrated system of protection of forage crops (alfalfa, soy, barley, wheat) in the South-East of Kazakhstan” were prepared, published and distributed.

Epizootic units were formed in Baiserke-Agro LLP, in particular, a robotic dairy farm, a commodity farm (CF), Central horse farm, Kyrgauyldy horse farm, Kumtobe, Kerbulak pasturing areas. Epizootic characteristics of farms (epizootic units) in Baiserke-Agro LLP and the territory adjacent to it have certain features that are characterized by the presence of pathogens of certain infectious diseases, diseases of the musculoskeletal system of animals and obstetric and gynecological pathologies. Animal desease control plan (preventive and improving) contains a complex of organizational and economic, veterinary and sanitary and special veterinary actions. Plan includes organization and construction of veterinary and sanitary facilities, identification of all livestock animals, techniques that contribute to the gap epizootic chain during times of contagious animal diseases. Proposals for veterinary and sanitary measures are given. Special veterinary measures are also set out in Animal desease control plan with diagnosis, specific prevention and treatment. The use of the developed therapeutic and prophylactic, diagnostic drugs and methods of their application allows to increase the safety of livestock, to obtain high-quality and food-safe products, to ensure the growth of production. The use of the developed therapeutic and prophylactic, diagnostic drugs and methods of their application allows to increase the safety of livestock, to obtain high-quality and food-safe products, to ensure the growth of production. In total, 25 scientific articles were published in various publications in the reporting year. In order to replicate the results of scientific activities, as well as promote scientific knowledge and best practices, 5 seminars were held, and lectures, seminars and training sessions on various issues of veterinary medicine were held within the framework of summer and winter schools for undergraduates.

In 2020, 35 scientific papers on the research topic were published for all 3 research subprojects, including articles in Scopus and Web of Science databases, rating Kazakh journals and materials of International scientific and practical conferences, books and scientific and practical recommendations. Thus, all the tasks set for all 3 research subprojects have been completed.

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