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EFFECTS OF BIOCHAR ON THE POLLUTED HEAVY METALS LEACHED CHERNOZEM SOIL

Abstract. In a 40-day laboratory experiment, a study was conducted of the effect of biochar on the properties of leached chernozem soil contaminated with heavy metals. Biochar exhibits a great potential to efficiently tackle soil contaminants considering the wide availability of feedstock, low-cost and favorable physical/chemical surface characteristics. The well-distributed pore network that includes micropores <2 nm, mesopores 2-50 nm and macropores >50 nm. It is established that the introduction of biochar led to an increase in NPK, a decrease in the content of heavy metals Zn and Pb in the soil. It is shown that the introduction of 2% biochar positively affects the growth of vegetation and seed germination in quantity increases 31 to 58 seeds.

Keywords: biochar, leached chernozem, humus, mobile phosphorus, total nitrogen, exchange potassium.

Introduction. The presence of excessive metal contents in soils may have serious consequences for surrounding ecosystems, groundwater, agricultural productivity and human health [1]. The emergence of new concepts and requirements in the sustainable development of the world economy could not but affect such an important sector as agriculture, which directly depends on nature and causes no small environmental damage [2]. The restoration of hazardous soils is thus essential. Conventional remediation techniques (e.g. excavation, landfilling, soil washing) are nowadays recognized as inappropriate because they generate considerable disturbance in the environment and they are economically unfeasible on a large scale. An alternative technique consists in introducing in situ amendments into the contaminated soils in order to reduce the metal mobility while simultaneously creating conditions that promote plant growth. This technique has received a growing interest and is turning out to be a promising green and cost-effective alternative for soil remediation [3-6]. Thus, the natural growth of plants in technogenic landscapes, regardless of the climatic zone, the type of damage and the types of discoveries, is accompanied by slow growth and the plant cannot regenerate naturally [7].

Among the methods, biosorption technique is the most common and costeffective. This is because biosorbents are environmentally friendly and readily available in large quantities, and one of the most popular biosorbents is biochar. Biochar is a carbon-rich, fine-grained, and porous material. It has received increasing attention due to its ability to store large amount of carbon, increase crop yield, reduce soil emission of greenhouse gases, improve soil quality, decrease nutrient leaching, and reduce irrigation and fertilizer requirements [8-10].

As far as the former application is concerned, biochar has demonstrated to be able to improve soil properties [11, 12] as well as to reduce contaminant leaching [13, 14]. As adsorbent, it represents a more
economically and environmentally sustainable alternative to commercial media because its use allows to avoid industrial activities for adsorbent production as well as to reuse a waste that alternatively would need to be disposed of. As adsorbent, biochar can be applied to water and wastewater treatment, for a wide range of pollutants such as lead arsenic, copper, cadmium, chromium, mercury, zinc and nickel [15-17]. Biochar, which can be applied to contaminated soils to reduce metals mobilization. Indeed, heavy metals become bound to carbonates and organic matter after biochar incorporation, which enhances the adsorption process due to metals building bonds with oxygen, carbon and nitrogen containing functional groups [18-20].

Quality and properties of biochar depend on many factors [21]; it is essential to identify characteristics of this adsorbent to predict its effectiveness towards the target contaminant. Many biochars have a high adsorption capacity for metal contaminants because of the high heterogeneous specific surface [22] and the well-distributed pore network that includes micropores (<2 nm), mesopores (2-50 nm) and macropores (> 50 nm) [23].

**Material and methods.** Soil sampling and characterization. The objects of study was leached black soil contaminated with heavy metals from emissions from the zinc plant of the Ridder city, East Kazakhstan region. Soil samples were collected from 0 to 30 cm depth [24]. When dry samples were homogenised and sieved (<2 mm). In soil samples, total nitrogen, mobile phosphorus (P$_2$O$_5$) and exchange potassium (K$_2$O) [25], the pH of the aqueous extract [26], the humus content according to generally accepted methods [27], Zn and Pb by atomic absorption spectroscopy were determined [28].

**Production and characterization of biochar.** Biochar was produced from rice husk which is an abundantly available agri-food residue in Kazakhstan. Then it was placed in a reactor to prevent O$_2$ input. The reactor furnace was heated at a rate of 50 cm$^3$/min up to 650°C. The temperature was held for about one hour and subsequently cooled slowly to room temperature.

**Results and discussion.** The results of polluted soil sample analyses: pH-7.85; humus content 5.31%; total nitrogen 0.120%; mobile phosphorus (P$_2$O$_5$) 35 mg/kg; exchange (K$_2$O) 433.8 mg/kg; zinc 8804.84 mg/kg; lead 429.2 mg/kg. Our data shows that heavy metals Pb and Zn exceed the MPC. To obtain biochar, rice husk was used (Bakanas, Almaty region), which is a renewable waste of plant origin. In order to extract the powdered remains of rice, the husk was washed with water and dried in a drying cabinet at a temperature of 120°C. Next, the husk was carbonized in a laboratory reactor [28] at a temperature of 650°C for one hour in an inert atmosphere of Ar flow. Quality and properties of biochar depend on many factors [15] it is essential to identify characteristics of this adsorbent to predict its effectiveness towards the target contaminant. We studied biochar with a particle size of not more than 1 cm, obtained from rice husk. The resulting biochar had the following properties: humidity - 1.7%, carbon - 39.98%, oxygen - 34.53%, silicon - 25.49%. In the experiment used the original soil and soil, which made biochar. Biochar properties vary considerably with feedstock material and pyrolysis temperature, with high temperature producing biochars with higher surface area, porosity, mineral contents, but less functional groups. To determine the effectiveness of the biochar obtained by us, 0.5%, 1%, and 2% of biochar were added to the soil; also a control sample of soil without biochar was prepared. There were 3 replicates for each group. Samples were kept under static conditions at room temperature (21±10°C). After a 40-day incubation period in the soil of biochar, the chemical and physical properties of the soil changed: humus 5.31% decreased to 4.20%. With the introduction of 2% biochar after a 40-day incubation period in soil pH 7.85 to 6.56, the content of exchangeable potassium (K$_2$O) increases significantly - 433.8 mg/kg to 589.8 mg/kg, mobile phosphorus (P$_2$O$_5$) - 35 mg/kg to 48.40 mg/kg, nitrogen 0.120% to 0.130% increased by comparison in the control variants of the experiment. These changes are due to the adsorption capacity of biochar, as well as a decrease in the alkalinity of the studied soil, which has led to an increase in the availability of substances for plants. This indicates a long-term positive effect of the use of biochar. And the content of zinc heavy metals is from 8804.84 mg/kg to 6000,5 mg/kg and lead from 429.2 mg/kg to 129.3 mg/kg.

Additionally, biomass and growth were determined, the time of death of «Aray» plant wheat plants on leached chernozem soil contaminated with heavy metals. Seeds were planted vessels, each of which contained 300 g of soil with different content of biochar - 0.5%, 1%, 2%. Soil without biochar was used as a control. Wheat seeds before sowing were calibrated, and defective ones were removed. Sowing was carried out in a moist soil at the rate of 80 seeds per vessel. None mineral or organic fertilizer was applied.
In controlled conditions: the temperature is 23-25 °C, the light period is 14:10 h (day:night) and the soil humidity is 50% of the total moisture capacity of the soil. 14 days after sowing, wheat shoots are observed.

After 25 days on the studied vessels, the grown wheat differed in the amount of each other. As can be seen in Figure 1, out of 80 wheat seeds in the control soil, 31 wheat seeds grew, and 58% of wheat seeds grew in 2% of biochar. This suggests that biochar affects vegetation growth (figure 1).

![Graph showing the effect of biochar for wheat seedlings](image)

**Figure 1 – The effect of biochar for wheat seedlings**

The average length of the roots of wheat on the 25th day of the experiment was 1.5 cm for the control variant. The introduction of biochar into the soil led to a significant (p<0.05) increase in the length of wheat roots by an average of 2.6 times as compared with the control variant (figure 2).

![Graph showing the average length of the roots of wheat](image)

**Figure 2 – The average length of the roots of wheat**

**Conclusion.** The results of the study showed that the introduction of biochar led to an increase in the mobile phosphorus (P<sub>2</sub>O<sub>5</sub>) - 35 mg/kg to 48.40%, in soil pH 7.85 to 6.56, the content of exchangeable potassium (K<sub>2</sub>O) increases significantly - 433.8 mg/kg to 589.8 mg/kg, nitrogen 0.120% to 0.130% increased by comparison in the control variants of the experiment. The content of heavy metals in the soil
after the introduction of biochar of zinc reduces from 8804.84 mg/kg to 6000.5 mg/kg, and lead - from 429.2 mg/kg to 129.3 mg/kg. Adding 2% biochar to the soil shows that it improves wheat growth. In the study of the germination of wheat seeds with 2% biochar increased the number from 31 to 58 seeds. Adding 2% biochar to the soil shows that it improves wheat growth. In the laboratory of carbon nanomaterials and nanobiotechnology, Almaty, Kazakhstan; biomak111@mail.ru; https://orcid.org/0000-0002-5951-9160

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АУЫР МЕТАЛДАРМЕН ЛАСТАНГАН СИЛТИСІЗДЕНГЕН
ҚАРА ТОПЫРАҚҚА БИОКОМІРДІҢ ЭСЕРІ

Аннотация. 40 күнідегі лабораториялық экспериментте ауыр металдармен ластанған сілтісізденген кара топырақтың қасиетіне биокөмірдің эсері. Биокөмір шығындың кол жетімділігін ескеріп, шығыны томен, беттік аудандың физика-химиялық қасиетінің колайлы болуы себебінен топырақты ластануы заттармен эффективті курсуде ұлжан мүмкіндікке не. Кеуекти топырақтың жақсы жетілгендігі, микрокеуек <2 нм, мезокеуек 2-50 нм және макрокеуекі >50 нм. Биокөмірдің топыраққа қосқандық НРК жоғарылып, ауыр металдар Zn және Pb төмendezе анықталды. 2% биокөмірдің топыраққа қосқандық іс өзінен эффективті және құрылығы түсінікті сапалы 31-ден 58 тұқымда дейін артық.

Түйін сөздер: биокөмір, сілтісізденген кара топырақ, гумус, жылжымалы фосфор, жалпы азот, алмаспалы калій.

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ВЛИЯНИЕ БИОУГЛЯ НА ЗАГРЯЗНЕННОЙ ТЯЖЕЛЫМИ МЕТАЛЛАМИ
ЧЕРНОЗЕМ ВЫЩЕЛОЧЕННОЙ ПОЧВЫ

Аннотация. В 40-суточном лабораторном эксперименте провели исследование влияние биоугля на свойства чернозем выщелоченной почвы, загрязненного тяжелыми металлами. Биоуголь обладает огромным потенциалом для эффективной борьбы с загрязнителями почвы, учитывая широкую доступность сырья, низкую стоимость и поверхность благоприятные физико-химические характеристики. Хорошо распределенная сеть пор, которая включает микропоры <2 нм, мезопоры 2-50 нм и макропоры >50 нм. Установлено, что внесение биоугля привело увеличению NPK, снижение тяжелых металлов Zn и Pb в почве. Показано, что внесение 2% биоугля положительно влияет на рост растительности и всхожесть семян по количеству увеличивается 31 до 58 семян.

Ключевые слова: биоуголь, чернозем выщелоченный, гумус, подвижный фосфор, общий азот, обменный калій.

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ACCELERATED REPRODUCTION OF BREEDING STOCK USING SEXED SEMEN IN CONDITIONS OF «BAYSERKE-AGRO» LLP

Abstract. During the estrus, 63 heifers were inseminated with sexed semen, of which, within one estrous cycle (35 days) after the insemination, 19 animals were bulling again. After 38-40 days at the examination on the ultrasound scanner, 30 animals were determined as pregnant (47.6% of fruitful insemination) and corresponded to the date of artificial insemination, and 14 animals were dry (22.2%). Among 18 heifers treated hormonally within 35 days, 4 animals remained barren and 8 animals were pregnant, which amounted to 38.8%.

Key words: sexed semen, hormonal stimulation, mating heifers, Holstein breed, artificial insemination, pregnancy.

Sexed semen is the sperm of servicing bulls, divided by sex (carriage of X or Y chromosomes). The flow cytometry in the late 1970s to separate living cells through a high-speed sorter was a breakthrough in the field of livestock reproduction. In the 1980s, there were attempts to separate sperm containing the X chromosome from those containing the Y chromosome. However, at that time, there were no positive results. In 1992, the first calf was obtained using sperm, divided by sex [1, 2].

Back in the early 80s, scientists began to carry out experiments on the separation of sperm containing the X chromosome (female) or Y chromosome (male). For this, they used various methods: sedimentation, gradient centrifugation, electrophoresis, processing with specific antibodies, etc. However, in practice, the effectiveness of these methods have not been convincingly proven. Tests that were carried out on 211 farms in the United States showed that Holstein heifers fertilized by the X-containing sperm fraction gave offspring, in which there were 89% females [3].

The Cogent (UK) was the first company in the world, which began to use the method of separating the servicing bulls' semen by sex under production conditions (1999). The method of dividing semen by sex was developed by X&Y Inc. (USA). It is based on the fact that gamete (germinal cells) of bulls contain a haploid set of chromosomes. Consequently, some sex cells contain X chromosomes, and others - Y chromosomes. Gametes with the X chromosome contain 4% more of DNA than sperm with the Y chromosome. While staining chromosomes of germinal cells, it was found that gametes with X chromosomes absorb 4-5% more of stain than gametes with Y chromosomes [4].

As it is known, the economic efficiency of dairy cattle breeding is primarily based on feed payment with milk, which, in turn, is ensured by more or less comfortable conditions of housing, balanced diet and reproduction work. Reproduction is the most important task of veterinarians, as only full reproduction can safely fill the mortality or female culling, especially from experience in keeping imported cattle it is impossible to return the full health after serious illness of animals (ketosis, postpartum complications, postpartum paresis, etc.) and it is not effective to keep these animals, since subsequently, they do not pay for themselves the money spent on them (veterinary drugs, feed, etc.) [5-7].
The foundation for the implementation of research work. State order by the Ministry of Agriculture of the Republic of Kazakhstan for 2018 - 2020. Budget Program 267 "Increasing Accessibility of Knowledge and Research", subprogram 101 "Program-targeted funding of research and activities" on the topic "Transfer and adaptation of technologies for automatization of manufacturing processes of livestock production on the basis of model farms in dairy cattle breeding using 100 cows from different regions of the Republic of Kazakhstan".

Materials and research methods. The objects of the research were the Holstein mating heifers of the dairy unit of the Bayserke-Agro LLP of the Talgar district, Almaty region.

To carry out artificial insemination with same-sex semen, animals (12 months old heifers, with a live weight of 360 kg) were used naturally during the estrus (63 animals), as well as using hormonal stimulation according to the Ovsynch program (18 animals). The main points of the scheme are the introduction on day 0 of gonadotropin-releasing hormone, on the 7-9 days, the introduction of prostaglandin F2-α drugs and artificial insemination after 56 hours.According to this scheme, animals can be inseminated without signs of estrus and mating call. Prostaglandin is administered intramuscularly at doses indicated in the administration manual, as a rule, animals become bulling 48-72 hours after the drug injection.

Artificial insemination of heifers with sexed semen was carried out up to 3 times, after the third unfruitful insemination of heifers, they were taken into account and in subsequent estrus, they were inseminated with ordinary semen.

Research results. The effectiveness of the use of semen divided by sex is the main factor of its limited distribution in the production in Kazakhstan. The main reason for this is the lack of highly qualified specialists in the field of reproduction. The concentration of this semen is ten times lower than the ordinary one, and in the course of preparation it undergoes several stress factors that adversely affect the fertilizing ability of sperm. These are the staining of each sperm cell, laser cytometry at the division, cryopreservation and thawing, which ultimately reduce the fertilizing and viable traits, although the semen of the highest quality and high fertility is used for sexing. With the existing methods of insemination in cattle breeding, the fertilization of cow ova reaches, on average, 85%, with fluctuations from 60 to 90%. With these indicators, only 45% of the fruitfully inseminated (after single insemination) cows bring calves. With this in mind, the level of pregnancy, recorded three months after single insemination, reaching 55%, is considered a very good indicator.

In dairy cattle breeding, the economically feasible efficiency of breeding stock reproduction is of exceptional importance. Currently, despite the undoubted achievements in reproductive physiology, the efficiency of reproduction has a steady tendency to decrease. In this sense, embryonic mortality is considered the main factor for the low reproductive activity of the livestock, resulting in significant economic costs.

S can be seen from the table, during the natural estrus 63 heifers were inseminated with sexed semen, of which, within one estrous cycle (35 days) after the insemination, 19 animals were bulling again. After 38-40 days at the examination on the ultrasound scanner, 30 animals were determined as pregnant (47.6% of fruitful insemination) and corresponded to the date of artificial insemination, and 14 animals were dry (22.2%). Among 18 heifers treated hormonally within 35 days, 4 animals remained barren and 8 animals were pregnant, which amounted to 38.8%.

Analyzing, we can come to the conclusion that the result of the fruitful insemination of heifers during the natural estrous cycle exceeds the indices of insemination during hormonal stimulation by 8.8%. At the same time, in 30% of unfertilized heifers, a repeated estrus was revealed, which were further inseminated,
whereas with hormonal stimulation, only 22.2% of animals became bulling again (repeated estrus), and 44.4% of heifers were found barren. It should be noted that the number of heifers for hormonal stimulation was selected from the number of animals that were without signs of estrus for more than 30 days, which is probably the reason for the relatively low percentage of fruitfulness due to some dysfunction of the germ glands. In the future, it is advisable to use a progestogen stimulation scheme for these groups of animals to more effectively use the sexed semen.

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ЖШС «БАЙСЕРКЕ-АГРО» НЕГІЗІНДЕ 
АНАЛЫҚ МАЛДЫ БИР ЖЫНЫСТЫ УРЫҚТЫ КОЛДАНУ НӘТИЖЕСІНДЕ 
ЖЕДЕЛТЕТІП БАСЫН ОСІРУ

Аннотация. Табиғи құйғу кезінде бір жынысты ұрықпен 63 бас кашарлар қолдан ұрықтандырдылды, оның ішінде бір жыныстық айналым (35 күн) ұрықтандырыудан кейін 19 бас кайта құйғады. 38–40 күн откен кейін, УДЗ сканерінде зерттеу нәтижесінде 30 бас ұрық деп танылды (47,6% тімді ұрықтандыралды) және де қолдан ұрықтандағы адісі оң күніне сейкес қелді, ал 14 бас қысық (22,2%) болып шықты. Кашарлар тобында, 35 күн ішінде, гормоналық ұрық болды 18 бас күйледі, 8 бас зерттеу кезінде ұрық әр түрінде бас болып шықты – 38,8% көрсетілді.

Түйін сөздер: бір жынысты ұрық, гормоналық инталтындық, кашарлар, голштин тұқымы, қолдан ұрықтандау, ұрық.

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УСКОРЕННОЕ ВОСПРОИЗВОДСТВО МАТОЧНОГО ПОГОЛОВЬЯ 
НА ОСНОВЕ ИСПОЛЬЗОВАНИЯ СЕКСИРОВАННОЙ СПЕРМЫ 
В УСЛОВИЯХ ТОО «БАЙСЕРКЕ-АГРО»

Аннотация. По естественной охоте было осеменено секированым semenem 63 гол телок, из них в течение одного полового цикла (35 дней) после осеменения пришли в повторную охоту 19 гол. По истечении 38–40 дней при исследовании на УЗИ сканере 30 голов были признаны стельными (47,6 % плодотворного осеменения) и соответствовали дате проведения искусственного осеменения, а 14 голов были яловые или 22,2%. По группе телок семя для обработанных из 18 гол. в течение 35 дней повторно перегуляло 4 гол. и 8 гол. при исследовании были стельные, что составило 38,8%.

Ключевые слова: секированное семя, гормональная стимуляция, случайные телики, голштинская порода, искусственное осеменение, стельность.
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STRUCTURE AND BASIC PARAMETERS OF NUTRITIONAL VALUE OF THE DIET OF HOLSTEIN MILKING COWS IN «BAYSERKE-AGRO» LLP

Abstract. The article presents the data of the structure and energy nutrition of the diet of the Holstein milking livestock in the «Bayserke-Agro» LLP dairy complex. Calculations of the costs of exchange energy, the net energy of lactation, protein and dry matter per unit of dairy products are given. The authors describe the technology of balancing the diet and keeping of dairy livestock, as well as ways of rational use of forage resources. The data of the chemical analysis of the diet components of milking cows and the structure of the diet, including the ratio of structural and concentrated feed in the dry matter are presented.

Keywords: exchange energy, protein, the net energy of lactation, productivity, diet, concentrates, feed, dry matter.

Introduction. When forming the productive traits of animals, the share of feeding accounts for an average of 59%, of selection - 24%, of keeping conditions and technology - 17%, therefore, the level of productivity is primarily determined by the completeness of feeding. The poor quality of the main feed leads to a large overrun of concentrates when feeding dairy cattle, especially milking cows. Some studies have shown that to obtain 30-32 liters of milk with a fat content of 3.5%, the consumption of concentrated feeds at low, medium and high-quality bulky feeds is 14 kg, 9.9 kg, and 7.6 kg, respectively, that is as the quality of the bulky feed deteriorates, the consumption of concentrates to obtain 1 kg of product is 0.45 kg at low, 0.32 at medium, and 0.25 at high quality, respectively. The low quality of the main feed leads to balancing the diet by increasing the grain feed, which causes an additional risk of acidosis of rumen, limbs, reproduction problems, and, moreover, overrun of concentrated feed, which is the most expensive of all the diet components [1-3].

In most farms with low dairy productivity of cows, the main shortcoming of feeding is still the lack of energy in the diet, based not only on the poor quality of feed, but also an elementary deficiency in concentrated feed supply. Thus reducing the cost of feed, CEOs and middle and top managers of dairy complexes personally reduce the profitability of farms, as it is well known that the higher the dairy productivity the lower the prime cost of milk and, consequently, the higher the payment of feed in products [4-6].

In this way, they not only reduce the yield of products, but in most cases lead primarily to the loss of the most high-yielding cows in the first phase of lactation because of a negative energy balance or the so-called ketosis of the digestive system. Ketosis caused by the negative energy balance of the diet or simple energy deficit in the feed is formed against the background of intensive use of fat reserves (reserve) of the body, when large quantities of free fatty acids entering the liver to convert them into volatile fatty acids do not cope with them and they accumulate in the liver and, accordingly, resulting fatty liver syndrom and accumulation of ketone bodies in the blood and urine. This disease is particularly relevant for cows of the first calving, when, along with reduced appetite (feed consumption in a small amount after calving), there
is a rapid increase in average daily milk yield, while additional energy is also required to increase live weight. The negative energy balance of feed usually brings a massive mortality of newly-calved cattle, which can be clearly seen with the large importation of dairy cattle from abroad, especially Holstein breed, against the background of rounded calving when it occurs up to 100-150 calves per month.

The foundation for the implementation of research work. State order by the Ministry of Agriculture of the Republic of Kazakhstan for 2018 - 2020. Budget Program 267 "Increasing Accessibility of Knowledge and Research", subprogram 101 "Program-targeted funding of research and activities" on the topic "Transfer and adaptation of technologies for automatization of manufacturing processes of livestock production on the basis of model farms in dairy cattle breeding using 100 cows from different regions of the Republic of Kazakhstan".

Research results. When formulating diet depending on the productivity of milking cows, the following parameters should be kept - the hay content in the daily allowance in the region is 0.8-1% of the live weight of the cows, the total mass of feed is preferably not more than 50 kg, dry matter is on average 20-21 kg, the ratio of dry matters concentrated to the main feed is not more than 55-60%, and the amount of concentrated feed per liter of milk in the average is 0.4 kg, depending on the diet structure, i.e. the content of high-protein and energy-intensive concentrated feed and the quality of bulky feed. Balancing and compensating vitamins, as well as macro and micronutrients in the diet is most rational by adding vitamin-mineral supplements (premixes) for milking cows, depending on the level of productivity from 0.1 to 0.2 kg and on the concentration of active substances or the use of special vitamin and mineral saltlicks for dairy cattle.

The diet of milking cows with average productivity in the group of 33-35 liters with the fat content of 3.6-3.7% on the dairy complex of Bayserke-Agro LLP

<table>
<thead>
<tr>
<th>Feed name</th>
<th>Mass, kg</th>
<th>Dry matter, kg</th>
<th>Digest. protein, g</th>
<th>Metabol. energy, MJ</th>
<th>Crude fiber, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn silage</td>
<td>19.7</td>
<td>3.9</td>
<td>275.8</td>
<td>45.3</td>
<td>1477</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>6</td>
<td>4.9</td>
<td>600</td>
<td>40.2</td>
<td>1518</td>
</tr>
<tr>
<td>Soybean cake</td>
<td>2.2</td>
<td>1.9</td>
<td>702</td>
<td>36.7</td>
<td>175</td>
</tr>
<tr>
<td>Barley</td>
<td>7.5</td>
<td>6.4</td>
<td>639.4</td>
<td>78.9</td>
<td>368</td>
</tr>
<tr>
<td>Wheat</td>
<td>1</td>
<td>0.83</td>
<td>83.6</td>
<td>10.4</td>
<td>47</td>
</tr>
<tr>
<td>Feed yeast</td>
<td>1</td>
<td>0.9</td>
<td>419</td>
<td>12.2</td>
<td>2</td>
</tr>
<tr>
<td>Corn</td>
<td>1.5</td>
<td>1.3</td>
<td>97.5</td>
<td>18</td>
<td>57</td>
</tr>
<tr>
<td>INR-18 premix</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39.3</strong></td>
<td><strong>20.1</strong></td>
<td><strong>2 817</strong></td>
<td><strong>241.7</strong></td>
<td><strong>3644</strong></td>
</tr>
</tbody>
</table>

*Analysis data of the Bayserke-Agro LLP laboratory.

As can be seen from the table at actual average daily milk yield of 33-35 liters in the group of 60 animals, the cost of metabolizable energy (ME) and digestible protein met the standards. With an average deduction of 54-56 MJ in metabolizable energy for the body’s need, the cost of producing each liter of milk averaged 5.6 MJ of ME and 151 MJ of NEL, of which 38 MJ is the body consumption and 3.3 MJ of NEL - for each liter of products. According to the calculations of the digestible protein, taking into account 480 grams per organism with 600 kg average live weight of dairy cows, in the production of 1 liter of milk the indicators were in the region of 70 grams considering the fact that at a rate for the production of one kg it is necessary from 70 to 90 grams of digestible protein, depending on the percentage of fat in milk, and in this case it is in the range of 3.6-3.7%. Protein consumption is quite reasonable, that is its maximum use. The cost of concentrated feed for each unit of production amounted to 0.388 kg, i.e. the quality of bulky feeds can be described as below average.

In the formulation of diets, the parameters for metabolizable energy, digestible protein, the ratio of dry matters of structural and concentrated feeds, the content of crude fiber and the vitamins and minerals compensation at the expense of ready-made premixes were taken into consideration. So the ratio of the
dry matter of concentrated and structural feed for cows with a milk yield of 32-34 liters was 52.2 / 47.8%, respectively. Calculation of NEL per 1 liter of milk is 3.2 MJ and 80 grams per liter of milk for digestible protein, with an additional view on the use of its own organism. The content of crude fiber is 14.7%, which corresponds to the norms of feeding milking cows.

It should also be noted that the most important aspect of the rational use of forage resources and the preservation of cow health is based on the rearrangement of cow groups by the phases of lactation and the actual average productivity over the last 7-10 days. The grouping of dairy cows is based on daily monitoring of productivity, while the transfer of cows is carried out every 7-10 days according to the milk yield for the last 3-4 days.

So, in a highly productive group, animals are selected mainly from a newly-calved group with an average daily milk yield of over 32 liters, i.e. from the group of newly-calved cows before the peak of dairy productivity. At the same time, animals with a decline in productivity are transferred to the group with a lower yield, respectively, depending on the average daily milk yield over the last 3-4 days.

Formation of groups by productivity and rearrangement of cows allows to avoid obesity, acidosis, ketosis and, accordingly, more efficient use of forage resources. Also the multiplicity of distribution of feed plays an important role, so according to the results of our own research, when transferring from three times (after each milking, with an interval of 8 hours) to a two times delivery (morning and evening with an interval of 12 hours), the average daily milk yield of cows decreased to 1.5 - 2 liters, while the fat content of the gross daily milk yield of the herd decreased on average by 0.2-0.3% with an increase in protein by 0.2%, while the ratio of fat to protein in milk was less than 1.2%, and this is the risk of rumen acidosis.

This is connected, firstly, with a large amount of one-time delivery (eatability) of concentrated feed, and this is more than 6 kg, and, secondly, a decrease in palatability of bulky feed due to loss of moisture and, accordingly, feed eating qualities, since consumption of non-fresh and dry feed is much lower. Therefore, when formulating diets for dairy livestock, it is advisable to reliably determine the indices of the feed nutritional value in the diet and, accordingly, to determine the net energy of lactation per 1 kg of dry matter of the feed in the diet.

Determining this indicator, it is possible to more objectively describe the digestibility, eatability and ultimately its productive action. Since the net energy of lactation (NEL) is related to dairy productivity, and knowing the NEL content in the feed and the proportion of this feed in the diet, it is possible to calculate how much milk will be obtained when it is fed. Definitely, it is important to impose these data on a specific diet, live weight of the cows and the estimated productivity of the dairy herd or group, and knowing the NEL content in the feed and the proportion of this feed in the diet, it is possible to ultimately its productive action. Since the net energy of lactation (NEL) is related to dairy productivity, and accordingly, feed eating qualities, since consumption of non-fresh and dry feed is much lower.

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"БАЙСЕРКЕ-АГРО" ЖШС-ГІ ГОЛШТИН ТУҚЫМЫНЫҢ САУЫНДЫ СИЫРЛАРДЫҢ РАЦИОНЫНЫҢ ҚҰНАРЛЫНГЫҢ ЖЕНЕ КЕЛТІРІЛГІН ЭНЕРГЕТИКАЛЫҚ ҚОРЕКТЕРІ 

Аннотация. Макала "Байсерке-Агро"ЖШС сүт көшенинің голштин тұқымының сауылынатын мал басы раціонның энергетикалық қоректілігі мен құрылымы бөлігі. Сүт өнімдерінің бірлігіне алу мүмкіндігі, таза энергия, протеин және құрықат зат шығындарын ысқа көздерілген. Төлкің құрылымының техноло- гиясы осы сауын мал басының дұрыс ұсталуы, сондықтан құрылым құрылымдарының түрліді пайдалану жолдары сипат- талған. Сауын сірірлірді азықтану құрылымның құрылысына химиялық қоғамда дерекері және оның көп құрылымның құрылымы, оның ішінде құрықат заттарына Құрылымдық және концентрацияланған жемділік арқана құрылымдарына көздерілген.

Тұйық сөзлер: алу мүмкіндігі, таза, энергиясы, өнімде, протеин, раціон, концентраттар, азык, құрықат зат.
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СТРУКТУРА И ОСНОВНЫЕ ПАРАМЕТРЫ ПИТАТЕЛЬНОСТИ РАЦИОНА ДОЙНЫХ КОРОВ ГОЛШТИНСКОЙ ПОРОДЫ В ТОО «БАЙСЕРКЕ-АГРО»

Аннотация. В статье приведены данные структуры и энергетической питательности рациона дойного поголовья голштинской породы молочного комплекса ТОО «Байсерке-Агро». Приведены расчеты затрат обменной энергии, чистой энергии лактации, протеина и сухого вещества на единицу молочной продукции. Описана технология балансирования рациона и содержания дойного поголовья, а также пути рационального использования кормовых ресурсов. Приведены данные химического анализа составляющих рациона кормления дойных коров и структура рациона, в том числе соотношение структурных и концентрированных кормов в сухом веществе.

Ключевые слова: обменная энергия, протеин, чистая энергия лактации, продуктивность, рацион, концентраты, корма, сухое вещество.

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THE CALCULATION OF THE IMPELLER OF THE PUMP

Abstract. The article presents the results of theoretical studies of the parameters of the impeller of a centrifugal pump, sets limits on the width of the blades, which will not have a negative impact on the effective performance of the pump and provides optimal capacity with a minimal power consumption, as well as the performance of the reactor accelerator.

Key words: parameters of the pump, the impeller, the acceleration process of petrification reaction, the reactor production of biodiesel, the number of blades.

Introduction. The mechanism of accelerating the process of obtaining biodiesel is considered, which represents the screw-shaped surface of the accelerator and Laval's snout, accelerates the methanolysis reaction (triglycerides in vegetable oil being reacted with methanol), which takes place in a reactor with a constant working volume and in the presence of alkali (as a catalyst) when heating the initial components. The main elements of the mechanism of acceleration reaction is the vane pump and by improving its parameters, the optimum performance of the accelerator is achieved. On the basis of the above, the theoretical studies to justify the parameters of the pump is conducted. As a parameter, that affecting for the number of blades, often acts a coefficient of specific speed, which depending on the flow rate, head and shaft speed.

This approach has the following disadvantage - the lack of consideration of the thickness of the blades when determining their quantity. If, when calculating high-pressure pumps with a large flow, the influence of the blade thickness is not significant enough, then for low-flow pumps, the effect of the blade thickness is so significant that the number of blades, which obtained when considering only the coefficient of specific speed, is incorrect. This leads to the need to find a universal formula for the optimal number of impeller blades for all ratios of thickness, flow and shaft speed of the pump.

Suppose that all the essential design parameters of the pump as the rotational speed of the pump shaft, the impeller inlet and outlet diameters, the width of the blades at the inlet and outlet of the impeller, the angles of the blades at the inlet and at the blade output and the design of the outlet at the time of determining the optimal number of blades have already defined and unchanged.

Methods. It is also assumed that this calculation is being done at a fixed rate. The design scheme of the considered pump is a single-stage cantilever pump with a spiral outlet. To solve this problem, we will determine the optimization criterion - pump head, since this is one of the most important parameters of the pump [1, 2].

To reduce head pressure losses, the width of the blades at the entrance is selected in such a way that the speeds of the blades at the entrance to the wheel and at the entrance of the blades are equal. Therefore, the area of the corresponding sections will be equal.

\[
\frac{\pi}{4} \left(D_0 - d_{ct}^2\right) = \pi \, D_i \, b_i; \quad \text{hence} \quad b_i = \frac{(D_0 - d_{ct}^2)}{\eta \, 4D_i},
\]

where \(\mu \approx 0.9\) – the coefficient of constraint in the input section by the impeller blades.
As there is no flow swirl at the impeller inlet, then

\[ C_{1v} = C_1 = \frac{Q}{\pi D_b h \eta_0} \]

The peripheral speed at the impeller inlet and the blades inclination angle will be determined by the formulas:

\[ u_1 = \frac{D_r \omega_0}{2}; \quad \beta_1 = \arctg \frac{C_{1v}}{u_1} \]

Usually this angle of the blades ranges from 20 to 30°.

To reduce hydraulic losses in the impeller, the normal [3] component of the liquid flow rate in the impeller is taken constant, that is,

\[ C_{2r} = C_{1r} = C_1. \]

Outlet blade angle \( \beta_2 \) ranges from 20 to 70°, in that regard we choose \( \beta_2 = 45^\circ \). Then from the basic equation of the impeller, we can determine the necessary peripheral speed at impeller exit:

\[ u_2 = \frac{1}{2} \left[ C_{2r} \arctg \beta_2 + \sqrt{(C_{2r} \arctg \beta_2)^2 + \frac{4gH}{\eta}} \right] \]

considering \( \arctg 45^\circ = 1 \),

\[ u_2 = \frac{1}{2} \left[ C_{2r} + \sqrt{C_{2r}^2 + \frac{4gH}{\eta}} \right] \]

The impeller outer diameter, the blades width on the outer diameter and the blades number are determined by the formulas:

\[ D_2 = \frac{2u_2}{\omega_0}; \quad b_2 = \frac{b_1 D_1}{D_2}; \quad Z = 6.5 \mu \frac{(D_2 + D_1)}{(D_2 - D_1)} \sin \left( \frac{\beta_1 + \beta_2}{2} \right) \]

Typically, the number of blades \( Z = 8 \).

Based on the foregoing calculations of the pump impeller parameters and the equations of the pump shaft power \([4]\).

\[ N = \frac{\rho g H Q}{\eta} \tag{1} \]

As well as the pump capacity is associated with the average speed at the exit of the impeller with the ratio:

\[ Q_p = \pi D_2 b_2 C_{2r} \tag{2} \]

Taking into account the expression of the pump capacity through the parameters of the disk \( D_2 \) and \( b_2 \) equation (2) to get the form:

\[ N = \frac{\rho g H \pi D_2 b_2 C_{2r}}{\eta} \tag{3} \]

Considering \( \eta = 0.96 \); \( \rho = 0.850 \text{kg/m}^3 \) for oil; and by the Euler equation, we determine the theoretical head of flow at the outlet of the centrifugal pump:

\[ H = \frac{u_2 C_{2u}}{g}, \text{and in } \beta_2 = 45^\circ \text{ then } C_{2u} = C_{2r} \text{ and considering } u_2 = \frac{D_r \omega_0}{2} \]
Taking into account the above values, as well as the expressions \( Q = C_2^2 \omega_b \) and after some abbreviations, equation (3) transforms into:

\[
N = \frac{4D_2b_2Q}{\eta}
\]  

(4)

Equation (4) allows the construction of operating characteristics of the pump, taking into account the regulation of consumed \( N \) - the pump shaft power, kW; \( Q \) - volumetric pump flow, m\(^3\)/h; \( H \) - pump head, pump head, (m water column) m w.c.; and \( \eta \)- the pump efficiency, depending on blade width \( b_2 \) changes, based on the use of proportionality formulas.

In the majority of literary sources [5, 6], for constructing the operating characteristics of pumps in the frequency control of performance, an approach, based on the use of proportionality formulas has been proposed.

The formulas of proportionality, obtained from the provisions of the theory of similarity of dynamic machines, reflect the change in the operating parameters of the pump with a change in the rotor speed, impeller diameter, etc. So, if the pump characteristics are known at the nominal rotor speed, when its changing, the operating parameters can be determined by the expressions

\[
\frac{Q}{Q_p} = \frac{n}{n_p} \eta_{rot,p}; \quad \frac{H}{H_p} = \left(\frac{n}{n_p}\right)^2 \eta_{b,p}; \quad \frac{N}{N_p} = \left(\frac{n}{n_p}\right)^3 \eta_p;
\]

(5)

where \( Q \) - volumetric pump flow, m\(^3\)/h; \( H \) - pump head, m.w.f.; \( N \) - pump shaft power, kW; \( n \) - the number of revolutions of the pump rotor, r/min; \( \eta_{rot}, \eta_{b}, \eta \) - volume, hydraulic and full efficiency of the pump, respectively; the index "n" indicates the value of the parameter in the nominal mode of the pump, i.e. at the nominal rotor speed.

For practical calculations, formulas (5) are applicable only conditionally, since the functions of changing \( \eta_{rot} \) and \( \eta_{b} \) depending on the rotor speed in most cases are absent. In this regard, it is recommended to use simplified expressions obtained under the assumption that the hydraulic and volumetric efficiency of the pump remain unchanged at any rotor speed:

\[
\frac{Q}{Q_p} = \frac{n}{n_p}; \quad \frac{H}{H_p} = \left(\frac{n}{n_p}\right)^2 \eta_p; \quad \frac{N}{N_p} = \left(\frac{n}{n_p}\right)^3 \eta_p; \quad \eta = \eta_p.
\]

(6)

Taking into account the presented results of the analysis, it became necessary to develop a more universal mathematical model, which allows to predict with sufficient accuracy the character of pump performance at varying rotor speed even in the absence of a large amount of experimental data [7, 9].

The resulting equations are refined to fully account for the physical nature of the processes occurring in the pumps when the rotor speed changes, as well as to summarize many experimental data. Basic calculation expressions:

\[
Q = Q_p \left(\frac{n}{n_p}\right)^{r+2} \left(\frac{H}{AQ_p/H_p}\right)^{0.5}; \quad H = H_p \left(\frac{n}{n_p}\right)^2
\]

\[
N = \frac{\rho Q_p}{1000*3600\eta_p} \left(\frac{n}{n_p}\right)^3 \left(\frac{H_p}{AQ_p/H_p-1}\right)^{0.5}; \quad \eta = \eta_p \left(\frac{n}{n_p}\right)^{r+1}
\]

\[
A = \frac{1}{1620000g\pi} \left(\frac{1}{d_b} - \frac{1}{d_s}\right)^3
\]

(7)

(8)

(9)
where \( Q \) – volumetric pump flow, \( m^3/h \); \( H \) – pump head, m.w.c; \( N \) – the pump shaft power, kW; \( \eta_p \) – full efficiency of the pump; \( n \) – the pump rotor speed, r/min; \( A \) – auxiliary complex; \( g \) – acceleration of gravity, m/s\(^2\); \( \rho \) – the average density of water in the pump, kg/m\(^3\); \( d_h \) and \( d_s \) – diameters respectively of the head and suction nozzles of the pump, m; \( r \) – the model identification parameter; the index "n" indicates the value of the parameter at the nominal rotor speed.

To determine the characteristics of the pump at different rotor speeds (\( Q_p, \eta_p \)), we perform calculations in tabular (in table 1) and in a functional, graphical form (figure 1), specifying the parameters of fluid flow and calculating efficiency indicators (\( \eta_p \)) of the pump at various numbers of revolutions, can be calculated the operational characteristics and build a graph.

Table 1 – Indicators of variation of the pump efficiency

<table>
<thead>
<tr>
<th>Fluid flow ( Q ) m(^3)/h</th>
<th>( \eta_p ) pump efficiency at various numbers of revolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n=1000 ) r/min</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>0.4</td>
<td>0.8</td>
</tr>
<tr>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>1</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Figure 1 – The graph of changing the pump efficiency (\( \eta_p \)) depending on the increase in flow rate (\( Q_p \)) when the numbers of revolutions equals (\( n \)) (from 400 to 1000) r/min

Figure 1 presents the results of calculations using formulas (4, 7, 8) for the above example with a pump. In this case, the deviation of the calculated values (\( \eta_p \)) of the pump efficiency from various flow rates and numbers of revolutions was 5.8%.
To clarify the characteristics of the pump at different rotor speeds ($N_p$, $Q_p$), we will perform calculations in tabular (in table 2) and in a functional, graphical form (figure 2), specifying the parameters of fluid flow and calculating indicators ($N_p$) of the pump power consumption at various number of revolutions, can be calculated the operational characteristics and build a graph.

Table 2 – Indicators of variation of the power consumption

<table>
<thead>
<tr>
<th>Fluid flow Q m$^3$/h</th>
<th>$N_p$ (kW) power consumption of the pump at various numbers of revolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n=1000$ r/min</td>
</tr>
<tr>
<td>0</td>
<td>0,7</td>
</tr>
<tr>
<td>0,2</td>
<td>0,85</td>
</tr>
<tr>
<td>0,4</td>
<td>0,98</td>
</tr>
<tr>
<td>0,6</td>
<td>1,1</td>
</tr>
<tr>
<td>0,8</td>
<td>1,2</td>
</tr>
<tr>
<td>1</td>
<td>1,4</td>
</tr>
</tbody>
</table>

Figure 2 presents the results of calculations using formulas (4,7,8) for the above example with a pump. In this case, the deviation of the calculated values ($N_p$) of the power consumption from various flow rates and numbers of revolutions was 3,8%.

Figure 2 – The graph of changing of the power consumption ($N_p$) depending on the increase in flow rate ($Q_p$) when the numbers of revolutions equals (n) (from 400 to 1000) r/min

To clarify the characteristics of the pump at different rotor speeds ($H_p$, $Q_p$), we will perform calculations in tabular (in table 3) and in a functional, graphical form (figure 3), specifying the parameters of fluid flow and calculating indicators ($H_p$) fluid pressure generated by pump at various number of revolutions, can be calculated the operational characteristics and build a graph.

Figure 3 presents the results of calculations using formulas (4,7,8) for the above example with a pump. In this case, the deviation of the calculated values of the fluid pressure generated by pump at various number of revolutions was 4,8%.
Table 3 – Indicators of variation of the fluid pressure

<table>
<thead>
<tr>
<th>Fluid flow Q m³/h</th>
<th>Hₚ (mm.w.c.) fluid pressure at various numbers of revolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=1000 r/min</td>
</tr>
<tr>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>0,2</td>
<td>117</td>
</tr>
<tr>
<td>0,4</td>
<td>112</td>
</tr>
<tr>
<td>0,6</td>
<td>105</td>
</tr>
<tr>
<td>0,8</td>
<td>92</td>
</tr>
<tr>
<td>1</td>
<td>78</td>
</tr>
</tbody>
</table>

Figure 3 – The graph of changing of the fluid pressure (Hₚ) generated by pump depending on the increase in flow rate (Qₚ) when the numbers of revolutions equals (n) (from 400 to 1000) r/min

We will calculate the liquid flow rate Q, m³/h (capacity) and power consumption N, kW, depending on changes in the blade width of the pump disk, the results are shown (in table 4) and in a functional, graphical form (figure 4). Given parameters of the blade width (b₂), we calculate the pump indicators - (Q) capacity and (N) power consumption of the pump for different widths of the blades of the pump disk and construct a graph of f (b₂) = (Q, N).

As a result of the calculations, a dependency graph of the capacity (Q) and pump power consumption (N) from changes of blades width of the pump disk was drawn which is shown in figure 4.
Table 4 – Indicators of variation of the fluid flow and pump power consumption

<table>
<thead>
<tr>
<th>Blade width of the pump disk $b_2$</th>
<th>Fluid flow $Q$ $\text{m}^3/\text{h}$</th>
<th>$N_p$ (kW) power consumption of the pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>0.015</td>
<td>0.4</td>
<td>0.68</td>
</tr>
<tr>
<td>0.02</td>
<td>0.6</td>
<td>0.62</td>
</tr>
<tr>
<td>0.025</td>
<td>0.8</td>
<td>0.72</td>
</tr>
<tr>
<td>0.03</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>0.035</td>
<td>1.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Figure 4 – A dependency graph of the capacity ($Q$) and pump power consumption ($N$) from changes of blades width of the pump disk

After approximation of the results of analytical studies, an empirical dependence of the power consumption on the change in the width of the blades of the pump disk is obtained.

$$N = 0.10 \ b_2^2 - 0.52 \ b_2 + 1.23 \quad \text{herewith} \quad (R^2 = 0.9986) \quad (10)$$

where $0.10$ – initial power consumption of the pump at minimum rotation, kW.

and pump capacity by the equation:

$$Q = 0.2 \ b_2 \quad \text{herewith} \quad (R^2 = 1) \quad (11)$$

where $0.2$ - initial pump capacity at minimum rotation, $\text{m}^3/\text{h}$.

It can be seen from the graph that the previously accepted width of the blades is in the range of 0.015 m to 0.025 m, which is almost two times smaller than the width of the blades of existing pumps, which is equal to 0.052 m. At the same time, the maximum value of capacity $Q = 0.8 \ \text{m}^3/\text{h}$, and with further changes in the width of the blades towards an increase, the pump power consumption and its capacity increases abruptly.

**Results and discussion.** As a result of the calculations, the proposed limit of the width of the pump blades was set from 0.015 m to 0.025 m, with an average rotation, the maximum capacity value was reached $Q = 0.8 \ \text{m}^3/\text{h}$, which ensures optimum pump capacity with minimum power consumption. In the
results of analytical studies, an empirical dependence of the power consumption on the change in the width of the blades of the pump disk is obtained.

In view of the above, it can be concluded that the proposed limit of the width of the pump blades would not affect negatively for the effective performance indicators of the pump, while ensuring optimal capacity of the pump with minimal power consumption and efficiency of the reactor in general.

**REFERENCES**


DEVELOPMENT MANAGEMENT SYSTEM IN AGRICULTURE

Abstract. The article deals with the main directions of development of agro-industrial complex (hereinafter AIC) of the Republic of Kazakhstan against the background of globalization. In the context of the new global reality, priority is given to the accelerated development of the agricultural sector. In the next five years, the production and processing of agricultural products should become the main source of diversification and driver of economic growth. The implementation of the new role of agriculture will balance the sustainable development of the country, increase productivity and improve the standard of living of the majority of the population. Rural residents, who run subsidiary farms, will have new opportunities to engage in commodity production through large-scale cooperation and targeted state support. The article describes the main ways to improve the management system in the field of agriculture; optimization of priority areas of foreign economic activity in the era of globalization.

Key words: agribusiness, agriculture, globalization, governance, economic growth.

Introduction. Agriculture is one of the important sectors of the economy, which forms the food and economic security of the country, as well as labor and settlement potential of rural areas [1].

The agro-industrial complex of the Republic of Kazakhstan (hereinafter-RK) has good prospects for further development: export positions of oilseeds, meat industry is strengthened, and in grain and flour Kazakhstan has become one of the largest exporting countries in the world in the shortest possible time. Kazakhstan's membership in the Eurasian economic Union (hereinafter-the EAEU) and the world trade organization (hereinafter - the WTO) creates new opportunities and at the same time imposes high requirements for competitiveness in the domestic and foreign markets. In this regard, the role of state regulation of agriculture is extremely important [2].

The agricultural sector of Kazakhstan has the following characteristics:

* total area of agricultural land-222.6 million hectares, of which 24 million hectares are under arable land (85 %) (data of the Committee on statistics, 2018);
* rural population-7.3 million people, or 47.2 % of the total population;
* pronounced horizontal and vertical zoning of soil and vegetation. In forest-steppe and steppe zones there are 10% of all lands, in semi-desert and desert-about 60 %, in mountain areas-about 5 % ("Agribusiness-2020");
  * all agricultural areas of the country are characterized by low annual rainfall-150-320 mm;
  * lack of access to the sea, which creates significant difficulties for access to foreign markets [3];
* self-sufficiency in most foods except sugar, vegetable oil, poultry, vegetables and fruits in the off-season [4];
  * specialization of the Northern regions in the cultivation of grain crops and livestock; southern regions where irrigation is essential have a greater diversification of cultivated crops (cereals, oilseeds, fruit and berry crops, vegetables, cotton);
* the livestock sector is traditional in Kazakhstan, where almost 90% of the livestock is accounted for by households (the Concept of the state program for the development of agriculture for 2017-2021) [5];
Methodology. In the course of the study, general research methods were used: methods of analysis of financial statements: horizontal, vertical, ratio, comparison, and others.

The following methods were used to study the development of the agro-industrial complex management system in the context of foreign economic activity:
- review of the legal and regulatory framework;
- analytical method;
- study of foreign experience;
- the possibility of using public-private partnership instruments;
- collection and processing of statistical data;
- economic and mathematical calculations.

Theoretical and methodological basis of the study consists of the fundamental provisions of domestic and foreign scientists on issues of management theory, the development of agriculture, such as Sagaidak, I. G. Usacheva, A. A., Kaigorodtsev A. A., Aubakirov E. A., Gritsenko, M. P., A. A. Abuov, N. Ibrashev, etc [6].

Problems of state regulation of agriculture, which should also be considered by such scientists from neighboring countries, as Antonova N. B., Babushkina A. M., Kushlin V. I., Morozova T. G., Oreshin V. P., Petrov A. N., Samofalova E. V., Khodov L. G., Kalina, S. V., Karpenko G. S., Kruglov V. N.

The basis for the development of the problem and the solution of the formulated problems were the principles of a system-structural approach to the study of socio-economic objects and the theory of decision-making. Information and empirical base consists of official statistics in the field of management system of agro-industrial complex in the context of foreign economic activity, actual data occurring in monographic studies and publications of domestic and foreign scientists-economists, materials of scientific conferences, Internet resources, materials of periodicals, as well as data, received personally by the author in the process of research.

Results. The main tasks in the system of agricultural development management:
* development of large-scale agricultural societies with the involvement of 500 thousand of smallholders in commodity production and the establishment of an effective system of marketing and processing of products [7];
* implementation of targeted export policy and promotion of Kazakhstan's brand of organic agricultural products;
* ensuring efficiency and accessibility of state support with maximum coverage of agricultural producers;
* increasing the efficiency of livestock farming by 40% [8];
* improvement of crop production efficiency by 30%;
* 1.3-fold increase in the share of processing and loading of enterprises;
* formation of an effective system of agricultural technology transfer [9];
* improvement of state regulation of agriculture.

State regulation in the field of agriculture provides [10]:
* addressing issues of rational use and irrigation of agricultural land;
* ensure safe epizootic and phytosanitary situation [11];
* creating incentives for the integration of science, education and production;
* formation of the regulatory and technical framework for the development of organic production [12].

As a result of the adoption of state regulation measures, the cadastral value of land will be updated and more than 600 thousand hectares of irrigated land will be involved in the turnover, which will have a positive impact on the efficiency of agricultural production. Of course, all these areas give the definition of the results (table) [13].

As a rule, all concepts and programs of agricultural development are aimed at increasing the profitability of production (except for the construction of schools and hospitals), increasing productivity [15]. The objectively inert nature of the development of this industry limits the possibility of quick results of the reform. Often adopted and implemented programs had low efficiency due to the fact that they were focused on improving economic performance [16].
Conclusions. Thus, the aim of the development of agribusiness management system is the sustainable development of all its industries and sectors. At the same time, the sustainable development of agricultural production consists in the effective reproduction of material, labor, land and financial resources, the implementation of technological improvement, ensuring the preservation of the environment, which together leads to the satisfaction of the need for agricultural products and food security. The implementation of the proposed directions for the management of the development of agro-industrial complex in Kazakhstan will create conditions for the formation of small businesses as a major participant in the agricultural production system on the basis of cooperation, expanding their production capabilities and improving the quality of products [17].

Increasing effective demand and improving the quality of life in rural areas will be the basis for stabilizing the processes of urbanization and improving the social security of rural residents. The proposed approach to the reform of management of the agricultural sector, involves the need to take into account the specifics of the industry, epistemological roots and impulses of its development. At the present stage, of course, the innovative vector of modernization of agriculture is very important. But in the development of the concept of development of the agricultural sector, it is necessary to correctly place the emphasis, both in the long and in the short term. It is planned to modernize the sphere of functioning of crop production consists in the effective reproduction of material, labor, land and financial resources, the gross output of crop production

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross agricultural output (services)</th>
<th>Among them:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>gross output of crop production</td>
<td>the gross output of animal husbandry</td>
</tr>
<tr>
<td>2010</td>
<td>1 822 074,1</td>
<td>895 425,2</td>
<td>920 777,3</td>
</tr>
<tr>
<td>2011</td>
<td>2 720 453,4</td>
<td>1 654 428,5</td>
<td>1 059 561,3</td>
</tr>
<tr>
<td>2012</td>
<td>2 393 619,0</td>
<td>1 241 517,0</td>
<td>1 145 437,3</td>
</tr>
<tr>
<td>2013</td>
<td>2 949 485,0</td>
<td>1 683 851,4</td>
<td>1 256 871,7</td>
</tr>
<tr>
<td>2014</td>
<td>3 143 678,1</td>
<td>1 739 436,4</td>
<td>1 393 762,0</td>
</tr>
<tr>
<td>2015</td>
<td>3 307 009,6</td>
<td>1 825 236,7</td>
<td>1 469 923,1</td>
</tr>
<tr>
<td>2016</td>
<td>3 684 393,2</td>
<td>2 047 580,8</td>
<td>1 621 541,4</td>
</tr>
<tr>
<td>2017</td>
<td>4 070 916,8</td>
<td>2 249 166,9</td>
<td>1 810 914,1</td>
</tr>
</tbody>
</table>

*From 2010 to 2017, the data were formed in accordance with the methodology for calculating the gross output of products (services) of agriculture, forestry and fisheries*, approved by the order of the Chairman of the Committee on statistics of the Ministry of national economy of the Republic of Kazakhstan dated November 9, 2015 № 175 [14, 3].

Source: statistics Committee of the Ministry of national economy.
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УПРАВЛЕНИЕ РАЗВИТИЕ СИСТЕМЫ АГРОПРОМЫШЛЕННОГО КОМПЛЕКСА

Аннотация. В статье рассматриваются основные направления развития агропромышленного комплекса (далее АПК) Республики Казахстан на фоне процессов глобализации. В контексте новой глобальной реальности приоритетное внимание уделяется ускоренному развитию сельскохозяйственного сектора. В ближайшие пять лет, производство и переработка сельскохозяйственной продукции должны стать основным источником диверсификации и драйвером экономического роста. Реализация новой роли сельского хозяйства позволит сбалансировать устойчивое развитие страны, повысить производительность труда и повысить уровень жизни большинства населения. Сельские жители, ведущие подсобные хозяйства, получат новые возможности для вовлечения в товарное производство за счет масштабной кооперации и адресной государственной поддержки. В статье рассмотрены основные пути совершенствования системы управления в области сельского хозяйства; оптимизация приоритетных направлений развития внешнеэкономической деятельности в эпоху глобализации.

Ключевые слова: агропромышленный комплекс, сельское хозяйство, глобализация, управление, экономический рост.

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MANAGEMENT OF COMPETITIVENESS AND DEVELOPMENT TRENDS OF THE ORGANIC SECTOR OF AGRICULTURE IN THE WTO

Abstract. Over the past five years, there has been an increase in the interest of Kazakh agricultural producers to switch to organic farming methods, as evidenced by both surveys of agricultural producers and an increase in the number of their appeals to organizations advising on the development of the organic sector. However, Kazakhstan does not maintain official statistics on the production of organic products, nor does it maintain a state register of organic producers and processing companies. The article deals with the market of agricultural products and food. The basic methods of management and regulation of agro-Industrial complex of the Republic of Kazakhstan are described. The main components of the motivation to consume organic products. The foreign experience of regulation of organic production and processing of food products is given. The methods of management of competitiveness and development of the sector of organic agriculture in the WTO.

Key words: governance, competitiveness, organic agriculture, globalization, World trade organization, economics, management, finance and accounting.

Introduction. Markets for organic agricultural products and food operate in many countries of the world, especially in the US and the EU, where an appropriate infrastructure for certification and sale of organic products has been created and successfully operates. Motivation to consumption of organic products are [1]:

- Environmental food safety [2];
- High quality and freshness of products;
- The best taste properties of organic products [3];
- Preservation of the natural environment during production;
- Lack of genetically modified organisms [4].

Analyzing foreign experience, typical consumers of organic products are identified – urban residents with high purchasing power, belonging to the middle and upper social class, caring for the health of the family and focusing on high-quality products [5]. According to experts, the market of organic products in the world is constantly growing [6]. Thus, in 1999 it was estimated at $ 15 billion. In 2006, it amounted to about $ 30 billion, and in 2017 it reached $ 110 billion [7]. USA. The turnover of organic products in comparison with 1999 increased more than 6 times. In the context of the economic crisis of 2008, its growth slowed in many countries [8].

In connection with the development of competitiveness, the main priorities of the agricultural policy of the most developed countries are:

- the formation and functioning of innovative processes [9];
- the formation of favorable conditions for attracting investment;
- the development of agricultural infrastructure [10];
- the concentration of agricultural production;
- the creation of conditions for continuous training of rural workers [11].
Methodology. Information base of the study: statistical data of the Committee on statistics of the Ministry of national economy, the program of development of agriculture of the Republic for the period up to 2020, as well as reports of a number of enterprises involved in foreign economic activity. Also the materials placed on the websites of the global Internet were involved [12].

Methodological foundations of the study of economic theory and General scientific principles of the system approach, modern analytical, statistical and graphical methods of research using the methods of expert assessments, empirical and computational data obtained by the author in the process and as a result of the study.

Results. Over the past five years, there has been an increase in the interest of Kazakh agricultural producers to switch to organic farming methods, as evidenced by both surveys of agricultural producers and an increase in the number of their appeals to organizations advising on the development of the organic sector [13].

In table 1 the factors contributing to the transition to organic farming methods and the main difficulties are presented [14].

Table 1 – Factors contributing to the transition to organic farming methods and main difficulties

<table>
<thead>
<tr>
<th>Motives</th>
<th>Hardship</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ability to sell products at higher prices;</td>
<td>• Psychological complexity of the transition to new methods of management after years of practice of traditional agriculture;</td>
</tr>
<tr>
<td>• Improving product competitiveness by improving quality [15];</td>
<td>• Due to the fact that the organic way of farming is more complex than the traditional one, the probability of the manufacturer making mistakes increases, because of which the yield can significantly decrease, the incidence of disease, weed infestation and pest infestation can increase;</td>
</tr>
<tr>
<td>• Increase of export potential due to increased demand for organic products in foreign markets;</td>
<td>• Low level of information and knowledge on organic management methods and approaches;</td>
</tr>
<tr>
<td>• Use of a wide variety of legumes in crop rotations, which allows to solve the problem of feed and maintain the level of nitrogen in the soil;</td>
<td>• Additional certification costs [16];</td>
</tr>
<tr>
<td>• The possibility of more rational use of labor and increase the profits of the enterprise through the organization of on-farm processing and direct marketing of products;</td>
<td>• The ban on the use of synthetic preservatives in products can significantly reduce the period of its implementation.</td>
</tr>
<tr>
<td>• Care about the environment and health, is also one of the factors, even for small groups of farmers;</td>
<td></td>
</tr>
<tr>
<td>• High cost of mineral fertilizers and pesticides.</td>
<td></td>
</tr>
</tbody>
</table>

Note: compiled by the author on the basis of the studied material.

Production and processing of products certified according to international standards is absent. Currently, Kazakhstan does not maintain official statistics on the production of organic products, nor does it maintain a state register of organic producers and processing companies. Despite this, the study revealed 29 producers and 19 processors of certified organic products [17].

Table 2 – Production of certified organic products in Kazakhstan

<table>
<thead>
<tr>
<th>№</th>
<th>Product</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grain crop</td>
<td>161 427</td>
</tr>
<tr>
<td>2</td>
<td>Oil crop</td>
<td>84 872</td>
</tr>
<tr>
<td>3</td>
<td>Leguminous crop</td>
<td>47 845</td>
</tr>
<tr>
<td>4</td>
<td>Fodder crop</td>
<td>8700</td>
</tr>
<tr>
<td>5</td>
<td>Medicinal herb</td>
<td>300</td>
</tr>
<tr>
<td><strong>Subtotal:</strong></td>
<td></td>
<td><strong>302 844</strong></td>
</tr>
</tbody>
</table>

Note: compiled by the author on the basis of the studied material.

Currently, there are about 100 manufacturers with the sign "Environmental products". In addition to agricultural producers, non-food producers have this sign, including plumbing, concrete, building materials, gypsum mixtures, rubber coatings, etc. [18]. Among the food producers with the sign "Environmentally friendly product" there are all groups of products: bread and cereal products, meat and meat products, fish and seafood, milk and dairy products, eggs, oils and fats, fruits, vegetables, sugar, jam,
honey, chocolate and confectionery. An interesting fact is that almost all large poultry farms have this sign [19]. This is due to the fact that the requirements for producers to subsidize engaged in the production of poultry meat, meat and eggs, include the presence of the sign "Environmental products" (government Decree of the Republic of Kazakhstan dated February 18, 2014 № 103 On approval of the Rules of subsidies from local budgets for the development of livestock breeding, increasing productivity and quality of livestock products) [20].

Conclusions. It can be concluded that in the conditions of modern growth of prices for petroleum products, we should expect another technological shift in agricultural production. Most likely, it will be associated with the wider introduction of genetically modified plant varieties, energy-saving techniques and technologies that will further reduce energy consumption per unit of production.

With population growth and food shortages, the prices of basic crops may rise faster than the prices of petroleum products. Such a scenario is possible with a wide spread of alternative energy sources [21].

Thus, based on the data obtained, it is obvious that the means of biologization in crop rotations are economically and environmentally justified.

However, for the successful development of organic production in Kazakhstan it is necessary to develop and approve:
- technical regulations for the production of organic products and raw materials;
- the procedure for assessing the suitability of soils for the production of organic products;
- procedure and requirements for labeling of organic products;
- national system of certification, accreditation of state control over the activities of subjects of production, transportation, storage, sale of organic products;
- to deepen scientific research in the field of production of organic products and raw materials;
- to organize training of qualified personnel in the field of organic farming, etc.

Кульжамал Блеутаева

I. Жансугиров атындағы Жетісу мемлекеттік университеті, Таңдықорған, Қазақстан

ДСУ ЖАГДАЙЫНДА ҚР ОРГАНИКАЛЫҚ АУЫЛ ШАРУАШЫЛЫГЫ СЕКТОРЫҢ БОСЕКЕГЕ ҚАБІЛЕТТІЛІГІҢ ЖӘНЕ ДАМУ УРДІСІН БАСҚАРУ

Аннотация. Сонды бас жылда қазақстандық ауыл шаруашылығы тауарының өндірушілердің шаруашылық жүргізу дің органикалық өдістеріне кошуге мүдделілігін оспі байқаулау, бұл тұралы Ауыл шаруашылығы тауарының өндірушілерінің сауалдары дә, сондай-ақ олардың органикалық секторді дамыту өсілелері бойынша қеңестері бертін ұйымдаға жүргінудері саңының артуына да қуәлдіраалық. Алаіда Қазақстанда органікалық өндіріспен оның құрамдас құралдарының, құрылымдарының мемлекеттік тізіліме жүргізілмейді. Макала ауыл шаруашылығының өндірісі мен азық-тұлқы нарықты қаражатырылады. Қазақстан Республикасының агронерекесіптік қешінің қабылдауы дә және реттедінің ұйымға бәрі қабылдалған. Органикалық өндірістің өндірістің және тамақ өндірістерінің қабылдауы дә және реттедінің ұйымға бәрі қабылдалған. ДСУ жәндайында ҚР органикалық ауыл шаруашылығы секторының дамуы мен бөсекеге қабілектілігін басқару өдістері ысқын алды.

Түйін сөздер: басқару, бөсекеге қабілектілік, органикалық ауыл шаруашылығы, жаңа, Дүние жузілік сауда ұйымы, Экономика, мендемен, қаржы және есеп.

Кульжамал Блеутаева

Жетісуыңдіқ мемлекеттік университеті им. И. Жансугуроғы, Таңдықорған

УПРАВЛЕНИЕ КОНКУРЕНТОСПОСОБНОСТЬЮ И ТЕНДЕНЦИИ РАЗВИТИЯ СЕКТОРА ОРГАНИЧЕСКОГО СЕЛЬСКОГО ХОЗЯЙСТВА РК В УСЛОВИЯХ ВТО

Аннотация. За последние пять лет, наблюдается рост заинтересованности казахстанских сельхоз- 

производителей к переходу на органические методы хозяйствования, об этом свидетельствуют как 

опросы сельхозпроизводителей, так и увеличение количества их обращений в организации, консуль-

тирующие по вопросам развития органического сектора. Однако в Казахстане не ведется официальной статистики производства органических продуктов, также не ведётся государственный реестр органических производителей и перерабатывающих компаний. В статье рассматривается рынок сельскохозяйственной продукции и продовольствия. Описаны основные методы управления и регулирования Агропромышленного
какомкества Республики Казахстан. Охарактеризованы основные мотивационные составляющие к потреблению органической продукции. Приведен зарубежный опыт регулирования органического производства и переработки пищевых продуктов. Предложены методы управления конкурентоспособностью и развитием сектора органического сельского хозяйства РК в условиях ВТО.

**Ключевые слова:** управление, конкурентоспособность, органическое сельское хозяйство, глобализация, Всемирная торговая организация, экономика, менеджмент, финансы и учет.

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king_bara@mail.ru; https://orcid.org/0000-0003-0554-4659

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T. N. Nurgasenov, A. Zh. Saikenova, K. K. Zholamanov, K. M. Erzhanova, K. S. Willis
Kazakh national agrarian university, Almaty, Kazakhstan

VALUABLE GRADES SAMPLES FOR SELECTION OF LENTIL ON FRUITFUL QUALITY OF GRAIN

Abstract. As is well-known, complex assessment of initial material has to be based on studying of morphological, physiological, anatomic and other biological features of plants that eventually it certainly affects fruitful qualities. Besides, development of morphological parameters of future grade for a specific condition is very considerable. Considering above stated in article data on phases of development and signs of efficiency of lentil are given. Highly productive samples of lentil are allocated: in the conditions of a semi-provided bogharic farming: LC046000223 L; LC046000103L; 23208; and in the conditions of the irrigated zone: K-184; LC046000223 L; LC0460000103L; LC046000156L; 23108; 39229; 39113.

Keywords: lentil, a collection, grades samples, efficiency, fruitful qualities, a transfer, a floor a provided bogharic, a gene bank, the irrigated background.

Introduction. Lentil belongs to the most valuable food leguminous crops which are grown up mainly on grain which more than on a third consists of protein. Amino acids, irreplaceable for an organism, are a part of protein of lentil. Lentil dishes serve for us as suppliers of the main vitamins and minerals which are completely acquired by a human body. On iron content, for example, it does not have equal. Lentil has one more very valuable property – it does not accumulate in itself any harmful or toxic elements (nitrates, radionuclides and so forth). Thanks to it, the lentil which is grown up in every spot on the globe can be considered as an environmentally friendly product. Successful introduced and distribution of lentil on regions has to be based on development of basic and applied researches with involvement of selectors, agrotechnologists.

Cultivation of this culture causes certain difficulties is connected with biological features of plants of lentil. To number of such shortcomings refer low unstable productivity and insufficient technological effectiveness – as a short stalk, low attachment of the lower beans, degree of lodging, low tolerance to herbicides, unevenness of maturing, cracking of beans and falls of seeds [1-7].

Relevance. The lack of interest in cultivation of lentil at producers agricultural products is explained mainly by low productivity of the existing grades. Proceeding from a being of a problem, as the studied questions in terms of formation of potential efficiency of this culture, in the future it is necessary to turn and to separately decipher water and thermal balance and balance of nutritious elements that is necessary at removal of new grades [15].

Purpose of researches. Now a main objective of modern researches is diversification of crop production, this introduction of crops, removal of the grades having tolerance with good consumer and biotechnological properties. We were faced by a task to give a complex assessment of a grade to lentil samples on two backgrounds of agriculture of the southeast in the conditions of the pilot site (KazRSIFaPG).

In this regard the leading role in expansion of an area of cultivation of lentil belongs to studying and introduction in production of grades on the terms of a transfer allocated from a collection those numbers.
which by results a research acceptable for this zone and also in the subsequent it would be possible to use as initial material for creation of new grades, in it the purpose of this work appears.

Methods of researches. Experiments were made on two scientific field hospitals (a semi-provided bogharic and the irrigated zone).

Crops consistent in triple frequency. Holding all agrotechnological actions on preparation for crops, care of crops (watering, loosening of row-spacings, destruction of weed vegetation), harvesting by the methods described in a technique of field experiment according to Dospekhov V. A.

Studying of elements of efficiency, assessment of grades samples on relative drought resistance were carried out by a technique of studying of a collection of leguminous cultures.

On the first year of a research studied the 96th grades of examples of various ecology-geographical origin of lentil, by results a research were selected on economic and valuable signs of 31 grades a sample for further studying in two scientific field hospitals of LLP "KazRSIFaPG” [6, p. 27], [7, p. 226].

Results of a research. It should be noted, as a result of the conducted researches grades samples which differ in the best indicators, according to research problems were established.

Morphological features were analyzed as their chronological manifestation, since crops time, finishing with cleaning.

Characteristic of the genetic resources of lentil kept in genebanks of the different countries is important for increase in efficiency of use of collections.

During the researches on two backgrounds the main economic and valuable signs were studied: duration of the vegetative period, height of plants, height of attachment of the lower beans, quantity of beans from a plant, weight is 1000 seeds from a plant, efficiency of a grade of samples, and indicators of quality of seeds (table 1).

<table>
<thead>
<tr>
<th>Name Sample</th>
<th>The vegetative period (from shoots before maturing), the number of days</th>
<th>Height plants, cm</th>
<th>Height attachments of lower beans, cm</th>
<th>Quantity beans with plants, pieces</th>
<th>Weight 1000 seeds, Gram</th>
<th>Weight with grain allotments, gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vekhovskaya standard</td>
<td>77</td>
<td>35,9</td>
<td>21,7</td>
<td>28,6</td>
<td>59,5</td>
<td>19,11</td>
</tr>
<tr>
<td>LC046000246 L</td>
<td>80</td>
<td>39,8</td>
<td>21,1</td>
<td>25,5</td>
<td>56,1</td>
<td>21,59</td>
</tr>
<tr>
<td>K-6</td>
<td>79</td>
<td>37,2</td>
<td>21,4</td>
<td>20,8</td>
<td>49</td>
<td>23,12</td>
</tr>
<tr>
<td>LC04600023L</td>
<td>80</td>
<td>41,4</td>
<td>24,5</td>
<td>28,1</td>
<td>56,8</td>
<td>20,54</td>
</tr>
<tr>
<td>39227</td>
<td>81</td>
<td>35,8</td>
<td>18,9</td>
<td>27,4</td>
<td>58,0</td>
<td>14,5</td>
</tr>
<tr>
<td>LC046000202 L</td>
<td>80</td>
<td>36,7</td>
<td>21,6</td>
<td>23</td>
<td>59,4</td>
<td>29,11</td>
</tr>
<tr>
<td>LC04600010 L</td>
<td>80</td>
<td>42,1</td>
<td>26,1</td>
<td>23,5</td>
<td>55,9</td>
<td>29,47</td>
</tr>
<tr>
<td>LC046000103L</td>
<td>79</td>
<td>40</td>
<td>24,5</td>
<td>28,2</td>
<td>60,3</td>
<td>37,29</td>
</tr>
<tr>
<td>LC046000156 L</td>
<td>80</td>
<td>38,2</td>
<td>22</td>
<td>25,3</td>
<td>55,7</td>
<td>18,78</td>
</tr>
<tr>
<td>4605</td>
<td>81</td>
<td>40,5</td>
<td>23,2</td>
<td>23,7</td>
<td>62,9</td>
<td>23,81</td>
</tr>
<tr>
<td>LC046000170 L</td>
<td>80</td>
<td>36,6</td>
<td>25,3</td>
<td>25,3</td>
<td>59</td>
<td>24,88</td>
</tr>
<tr>
<td>LC046000270 L</td>
<td>80</td>
<td>36,8</td>
<td>20,9</td>
<td>23,7</td>
<td>60,9</td>
<td>19,41</td>
</tr>
<tr>
<td>LC046000213 L</td>
<td>80</td>
<td>39,1</td>
<td>24,3</td>
<td>19,3</td>
<td>60,1</td>
<td>14,8</td>
</tr>
<tr>
<td>K-2849</td>
<td>80</td>
<td>40,6</td>
<td>24,4</td>
<td>31,6</td>
<td>60,1</td>
<td>24,96</td>
</tr>
<tr>
<td>LC046000223 L</td>
<td>78</td>
<td>36,5</td>
<td>24,7</td>
<td>43,3</td>
<td>23,7</td>
<td>46,98</td>
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<tr>
<td>39119</td>
<td>80</td>
<td>41,8</td>
<td>22,7</td>
<td>31,4</td>
<td>51,6</td>
<td>19,56</td>
</tr>
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<td>K-1975</td>
<td>79</td>
<td>37,4</td>
<td>22,3</td>
<td>27,1</td>
<td>57,0</td>
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</tr>
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<td>79</td>
<td>35,6</td>
<td>20,7</td>
<td>32,6</td>
<td>26,6</td>
<td>22,13</td>
</tr>
</tbody>
</table>
As appears from table 1 by results of a research a number of a grade of grades samples on economic to valuable signs, of special interest is revealed. So, for example, on height of attachment of the lower beans that gives the chance to reduce losses of seeds of the lower tier at the mechanized cleaning. Grades samples which have compact habitus and high attachment of the lower beans (more than 20 cm) in this regard are valuable.

It should be noted what is high – productive samples of a collection, branched usually stronger, besides, between height of attachment of the lower bean and long a stalk positive communication is noted.

One of the destabilizing factors of productional process and formed a harvest of lentil is drowning of plants. When drowning conditions functioning of all physiological systems worsens that leads to decrease in efficiency and promote considerable losses of a harvest when cleaning.

Resistance of samples to drowning which was defined as the relation of height of an agrotsenozis to length of a stalk of plants a phase of full maturing on a semi-provided bogara, variation on these indicators special difference was not observed among a grade of samples, were allocated on valuable signs separate economicallythat can be in the future used as initial material for selection work on drought resistance [8-11].

In this regard the leading role in expansion of an area of cultivation of lentil belongs to creation and introduction in production new highly fruitful, technological and highly qualitative the grades which are selected by results of researches [10, p. 959].

It is known that the aridization of climate of the planet will proceed therefore it is necessary the irrigated lands as it is possible to use effectively taking into account and selection of structure of the cultivated cultures.

The main feature of water balance of this region are sharply expressed deficiency of humidity of air caused by high summer temperatures at limited rainfall [16-18].

In the course a research in the irrigated zone (a hospital "KazRSIFaPG") grades samples are of special interest for selection: K-2849; LC046000213L; K-1975; LC046000223;39119; 23209; K-6; 4605; 39203; LC0460000270L.

It is confirmed that between length of a stalk and height of attachment of the lower bean there is a significant positive communication. Therefore at long and stem forms, attachment of the lower beans was allocated: LC04600068L; LC04600023L; LC046000103L.

<table>
<thead>
<tr>
<th>Name Sample</th>
<th>The vegetative period (from shoots before maturing), the number of days</th>
<th>Height plants, cm</th>
<th>Height attachments of lower beans, cm</th>
<th>Quantity beans with plants, pieces</th>
<th>Weight 1000 seeds, gram</th>
<th>Weight With grain allotments, gram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vekhovskaya standard</td>
<td>88.4</td>
<td>52.1</td>
<td>25.7</td>
<td>29.3</td>
<td>72.2</td>
<td>23.59</td>
</tr>
<tr>
<td>LC046000246L</td>
<td>87.3</td>
<td>42.9</td>
<td>22.7</td>
<td>30.7</td>
<td>74.6</td>
<td>22.3</td>
</tr>
<tr>
<td>LC046000150L</td>
<td>87.3</td>
<td>44.3</td>
<td>27.3</td>
<td>37.3</td>
<td>50.1</td>
<td>18.9</td>
</tr>
<tr>
<td>K-6</td>
<td>87.3</td>
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<td>22.3</td>
<td>42.3</td>
<td>75.3</td>
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<td>LC04600023L</td>
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<td>72.3</td>
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</tr>
<tr>
<td>39227</td>
<td>96.3</td>
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<td>26.5</td>
<td>31.3</td>
<td>70.3</td>
<td>22.69</td>
</tr>
<tr>
<td>LC046000202L</td>
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<td>38.9</td>
<td>76.1</td>
<td>29.6</td>
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<tr>
<td>23209</td>
<td>90.3</td>
<td>51.3</td>
<td>27.3</td>
<td>28.7</td>
<td>69.7</td>
<td>30.83</td>
</tr>
<tr>
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<td>25.2</td>
<td>35.7</td>
<td>84.9</td>
<td>40.5</td>
</tr>
<tr>
<td>LC046000156L</td>
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<td>23.0</td>
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<td>64.6</td>
<td>24.86</td>
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<td>23202</td>
<td>96.3</td>
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<td>25.5</td>
<td>24.7</td>
<td>68.3</td>
<td>16.4</td>
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<tr>
<td>LC046000170L</td>
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<td>26.3</td>
<td>26.6</td>
<td>74.2</td>
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</tr>
<tr>
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<td>50.1</td>
<td>26.3</td>
<td>25.8</td>
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<td>32.56</td>
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<tr>
<td>K-2849</td>
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<td>54.1</td>
<td>26.0</td>
<td>46.1</td>
<td>70.7</td>
<td>26.33</td>
</tr>
<tr>
<td>31215</td>
<td>96.3</td>
<td>49.4</td>
<td>25.1</td>
<td>30.3</td>
<td>69.7</td>
<td>22.8</td>
</tr>
</tbody>
</table>
If to consider formation of productivity only in the samples grouped grades on fineness of seeds, then the bogharic can note influence an amount of precipitation on a floor at the beginning of vegetation and during the period formation of seeds.

Indicators on elements of efficiency of the samples of lentil allocated grades both on a semi-provided bogharic a, and in the irrigated background are given below.

On a semi-provided bogharic in group largely seeds, on productivity it is possible to allocate grades samples as: LC04000223L; LC046000103L; 23208 with productivity respectively 15.7ts/hectare, 12.4ts/hectare, 10.9ts/hectare, with the vegetative period of 78,79,77 days.

In small seed group on productivity 2 grades of a sample: 39229 and 23108, with productivity respectively – 9.7 c/hectare and 8.6ts/hectare, with the vegetative period 78, 77 days.

In the irrigated zone in groups largely seeds on productivity the following grades samples were allocated: K-184; LC04600023L with the vegetative period 82, 79, 81 days.

Table 3 – Elements of efficiency of a grade of samples of lentil on a semi-provided bogharic (KazRSIFaPG)

<table>
<thead>
<tr>
<th>Name of a grade of samples</th>
<th>Weight from an allotment, gram</th>
<th>Productivity, c/hectare</th>
<th>Deviation from the standard, c/hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vekhovskaya standard</td>
<td>19.1</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>LC04000223L</td>
<td>47.0</td>
<td>15.7</td>
<td>+9.3</td>
</tr>
<tr>
<td>LC046000103L</td>
<td>37.3</td>
<td>12.4</td>
<td>+6</td>
</tr>
<tr>
<td>23208</td>
<td>32.9</td>
<td>10.9</td>
<td>+4.5</td>
</tr>
<tr>
<td>LC0460068L</td>
<td>30.4</td>
<td>10.1</td>
<td>+3.7</td>
</tr>
<tr>
<td>23209</td>
<td>29.9</td>
<td>9.96</td>
<td>+3.56</td>
</tr>
<tr>
<td>39229</td>
<td>29.2</td>
<td>9.7</td>
<td>+3.3</td>
</tr>
<tr>
<td>LC0400202L</td>
<td>29.1</td>
<td>9.7</td>
<td>+3.3</td>
</tr>
<tr>
<td>23108</td>
<td>25.8</td>
<td>8.6</td>
<td>+2.2</td>
</tr>
<tr>
<td>K-2849</td>
<td>25.0</td>
<td>8.3</td>
<td>+1.9</td>
</tr>
<tr>
<td>LC04600170L</td>
<td>24.9</td>
<td>8.3</td>
<td>+1.9</td>
</tr>
<tr>
<td>4605</td>
<td>23.8</td>
<td>7.9</td>
<td>+1.5</td>
</tr>
<tr>
<td>K-6</td>
<td>23.1</td>
<td>7.7</td>
<td>+1.3</td>
</tr>
<tr>
<td>K-184</td>
<td>22.4</td>
<td>7.5</td>
<td>+1.1</td>
</tr>
<tr>
<td>39203</td>
<td>22.1</td>
<td>7.4</td>
<td>+1</td>
</tr>
<tr>
<td>LC04000246L</td>
<td>21.6</td>
<td>7.2</td>
<td>+0.8</td>
</tr>
</tbody>
</table>

In small seed group on productivity were allocated: 23108 with the vegetative period of 77-79 days.

Discussion of results. In selection of lentil for receiving a grade, to the meeting requirements of production, it is necessary to pay attention to high seed efficiency with number of beans on K-6 plant; LC046000202L; LC046000103L; K-2849.

With a high weight of 1000 seeds and masses from plants 4605; 31215; LC046000270L; K-2849; LC046000202L; LC046000103L; LC046000213L.

At technology of cultivation it is recommended to use grades samples: long caulescent with the high level of a attachability of the lower beans and LC046000223L, steady against drowning: 39119; K-1975; 39203; LC046000270L; K-6.

For the purpose of increase in gross collecting seed of lentil it is recommended to introduce in agricultural production on the basis of a transfer, a grade samples the following numbers – K-1975, 39203, K6, LC04000270L. Besides these grades samples need to be used as initial material in selection of this the most valuable cultures.
Conclusions. Optimization of elements of structure of a harvest on given the moment can be considered as a tactical task. On the basis of a recombination it can be realized in a concrete soil and climatic zone in the presence of a scientifically based ideatip and the corresponding initial material. As a result of comparative studying it was established that at the disposal of selectors there is the richest material for the solution of objectives, at the same time it is necessary to pay special attention to economic and valuable signs which defines at the same time drought resistance and productivity. For this purpose basic change of very tectonics of plants which will solve the most part of problems in selection of this culture is necessary. For this purpose it is necessary to carry out search of initial material among collections for further use at removal of new grades.

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ОНИМДІЛІК САПАСЫ БОЙЫНША ЖАСЫМЫҚ СЕЛЕКЦИЯСЫНА АРНАЛГАН БАҒАЛЫ СОРТУЛГІЛЕРІ

Аннотация. Беримізге белгілі, бастанғы материалды кешепді бағалау осімдіктердің морфологиялық, ғызшылық, анатомиялық және басқа да биологиялық ерекшеліктерін зерттетуге негізделуі тиіс. Сонымен катар, нәкті жағдайларға әуелшілік сорттың морфологиялық параметрлерін зертте алып оте маньызда бәлді табылады. Жоғарыда айтқаның болғаны модельге оның жағдайында: LC046000223 L; LC046000103L; 23208; а суармалы аймақ жағдайында: K-184; LC046000223 L; LC046000103L; LC046000156L; 23108; 39229; 39113.

Түйін сөздер: жасымық, коллекция, сорт үшін, жоғары, аймақ, өңімді, өңім, морфологиялық, әдебиет, кемес, трансферт, өңім сапасы, қамтамасыз, жаратылып, қамтамасыз.

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ЦЕННЫЕ СОРТООБРАЗЦЫ ДЛЯ СЕЛЕКЦИИ ЧЕЧЕВИЦЫ НА УРОЖАЙНЫЕ КАЧЕСТВО ЗЕРНА

Аннотация. Как известно, комплексная оценка исходного материала должна базироваться на изучении морфологических, _MEDIUM_физиологических, анатомических и других биологических особенностей растений, что в конечном счёте оно безусловно влияет на урожайные качества. Кроме того, весьма значительным является разработка морфологических параметров будущего сорта для конкретного условия. Учитывая выше изложенное в статье приводятся данные по фазам развития и признакам продуктивности чечевицы. Выделены высокопродуктивные образцы чечевицы: в условиях полуобеспеченной богары: LC046000223L; LC046000103L; 23208; а в условиях орошаемой зоны: K-184; LC046000223L;LC046000103L; LC046000156L; 23108; 39229; 39113.

Ключевые слова: чечевица, коллекция, сортообразцы, продуктивность, урожайные качества, трансфер, полуобеспеченная богара, генобанк, орошаемом фоне.

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BLOODSUCKING TICKS (ARACHNIDA, ACARI, IXODIDA), COLLECTED IN «BAYSERKE AGRO» LLP

Abstract. For the territory of the fields of forage crops of «Bayserke-Agro» LLP, 4 species of bloodsucking ticks (Argas reflexus (Fabricius, 1794), Dermacentor marginatus (Sulzer, 1776), Rhipicephalus pumilio (Schulze, 1935) and Haemaphysalis punctata (Canestrini et Fanzago, 1878) have been revieled, belonging to 4 genera from 2 families - Argasidae and Ixodidae. Ixodid ticks, represented by 3 genera and 3 species, predominate both in numbers and species diversity. H. punctata had the highest abundance and occurrence rate. Due to its prevalence and high abundance, this species also has the greatest sanitary and epidemiological significance. The limited and most restricted species - A. reflexus. Mass reproduction of bloodsucking ticks on the territory of «Bayserke-Agro» LLP in 2019 was caused, apparently, by a very mild and short winter of 2018-2019, which allowed hibernating individuals to survive it without loss from freezing. When working in the fields as an agent for protection against ticks, the «Reftamid» aerosol preparation, which has a deterrent effect not only for them, but also for mosquitoes, midges and other representatives of gnats, has proven itself well. In addition, Actarofit and Entolek from the group of avermectins proved to be good in laboratory tests on two species of ticks – H. punctata and D. marginatus – - individuals died 10 and 7 minutes after treatment, respectively. In the future, production testing of preparations of this group against bloodsucking ticks should be carried out and then used as a means of controlling their numbers.

Key words: blood sucking ticks, Acari, Argasidae, Ixodidae. Argas reflexus, Dermacentor marginatus, Rhipicephalus pumilio, Haemaphysalis punctata, «BayserkeAgro» LLP.

Introduction. Representatives of the tick subclass (Acari) are the most numerous group in the arachnid class (Arachnida): more than 54,000 species, including 144 fossils, are currently described. Most species are free-living saprophagous animals or predators. Feeding on decaying organic matter, they, like earthworms, play an important role in the formation of soil humus. Some ticks feed on sap of cultivated plants and are agricultural pests. In addition to them, ticks from the family Tyroglyphidae, Glyciphagidae and others, which are serious pests of stored agricultural products and raw materials, are detrimental to agriculture. They and pyroglyphide ticks have medical importance as sources of allergens. If ingested with food can cause acute gastrointestinal diseases, and if inhaled, catarrh of the respiratory tract and asthma can occur. Some species are predators that prey on other ticks and a variety of small arthropods. Representatives of separate families are insect parasites. Some ticks are secondary aquatic animals. There are parasites of warm-blooded animals - birds and mammals. Only a relatively small number of species belong to the parasites or vectors of human diseases, but non-parasitic forms often cause skin irritation.

The species of the latter groups are of the greatest practical importance for the agricultural sector as parasites of humans and domestic animals, and vectors of dangerous zoonotic and quarantine infections. In all countries of the near and far abroad, studies of the fauna of bloodsucking ticks, their biological characteristics and the development of measures to combat them, both locally and regionally, are conducted [1-14, 23, 24]. In Kazakhstan, this group is also economically important, as it is often present not only on agricultural land, but also in places that serve as a recreation area, specially protected natural areas, etc. [22]. This explains the relevance of this work.
**Material and methods.** The material was collected by the authors of the publication in 2018-2019 during the implementation of phytosanitary monitoring and other works in the framework of the project of the Ministry of Agriculture of the Republic of Kazakhstan BR 06249249 "Development of an complex system to increase productivity and improve the breeding qualities of farm animals, on example of «Bayserke-Agro» under subproject 2 "Improving the technology of cultivation and harvesting of forage crops". There was no specific goal to study bloodsucking ticks, but when collecting material on the harmful and useful invertebrate fauna of «Bayserke-Agro» LLP crops, on which several publications have already been made [19-21], ticks were repeatedly noted by us as a passing object, and even had to take precautions to avoid their bite.

When collecting the material, standard entomological and acarological techniques were used - mowing the sweep net, manual collection, inspection of vegetation, room walls, clothing of people working in the field, including authors of the article. The collected ticks were smeared in mordant with ethyl acetate and then placed in alcohol or laid out on cotton entomological mattresses.

Identification of bloodsucking ticks species collected on the territory of «Bayserke-Agro» LLP, the specifics of their distribution, bioecology, economic and sanitary-epidemiological significance were clarified using reports and determinants from the list of references [15-18, 23].

**Research results.** As a result of the research carried out on the territory of «Bayserke-Agro» LLP, several species of bloodsucking ticks were identified. Their general characteristics, taxonomic affiliation and images in Figures 1-4 are given below.

**Family Argasidae - Argasi mites**

The family includes about 200 species, the number of genera in different systems varies from 4 to 10, and needs additional research on the taxonomy of this group of ticks. The body has a length of 3 to 30 mm, flattened, oval. The covers are leathery, the color of ticks that have drunk blood is purple, and by hungry mites it is greyish, yellow-brown. Members of the family parasitize on wild and domestic birds, mammals etc., including humans (temporary ectoparasites), cause argasidosis. Able for a long term starvation (up to 11 years). Ticks from the *Argas* and *Ornithodoros* genera (12 species) attack man. Their bites cause itching, a red rash on the skin. Saliva is toxic. Vectors of tick-borne typhoid and tick-borne borreliosis. The proboscis lies in a recess on the ventral side at the anterior end of the mite’s body. There are no dorsal scutes. Peritremes are small, lie between 3 and 4 pairs of coxa. Suckers on paws are available only in the larvae.

**Argas reflexus** (*Fabricius, 1794*) - Shell mite (figure 1). Distributed in Europe, North and South America, Africa, Asia. On the territory of the former USSR, it is found in the Caucasus, Crimea, republics of Central Asia, South and Southeast Kazakhstan in the steppe, semi-desert and foothill zones. Pumped blood adult females can reach up to 10 mm long, males – about 4 mm. The body is flat, elongated, ellipsoidal. Hungry ticks are yellowish-gray in color, fed up – dark gray to black. Prefers pigeons as a host, Figure 1 – *Argas reflexus* (*Fabricius, 1794*)
less often other birds. Found in the nests of pigeons, jackdaws, starlings, rollers, larks, turtle doves, swallows, peregrine falcons, owls, in burrows of bee-eaters and other birds, as well as in bat shelters. It can penetrate a human’s houses, if there are or there were bird nests in the attics, especially pigeons. In case of severe hunger, the shell mite sticks to humans and other mammals (horses, dogs etc.). They stay during the day in caves, holes, or crevices near the host nests. Each phase of the larvae for further development needs 1 time in a few days to drink blood. Adult females suck blood several times in 20-40 minutes, laying from 12 to 70 eggs, respectively. In humans, allergic reactions to the bite of this species have been confirmed so far, up to the pre-anaphylactic shock. A secondary infection may occur on the combed areas, with the subsequent development of edema, lymphangitis, severe pain. The species is under suspicion as a potential vector of causative agent of Q fever. In the experiment of A. reflexus, tick-borne encephalitis virus was taken from infected chickens and transmitted during subsequent feeding to healthy chickens. Vector of domestic birds spirochetosis - chickens, guinea fowl and geese.

Material: 1 specimen - 15.04.2019, triticale field behind Arkabay village, dead on the ground, I.I. Temreshev; 1 specimen - 15.05.2019, on the ground, the soybean field at the ERPC building, I.I. Temreshev; 1 specimen – 20.05.2019, on a dead pigeon, alfalfa field near the ERPC building, I.I. Temreshev; 1 specimen - May 24, 2019, on the ground, a barley field near the building of the ERPC, I.I. Temreshev.

Family Ixodidae – Ixodid ticks

There are over 650 species in the world fauna. Ixodides are common all over the world, they are found even in the Arctic and Antarctic (tick Ixodes uriae White, 1852 parasitizes penguins, guillemotes and other polar birds). Representatives of the family are bloodsucking parasites. Females of ixodid ticks lay up to 20,000 eggs, but in connection with complex ontogenesis, only few survive to the adult stage. The hatching from eggs larvae feed once, usually on small mammals (rodents, insectivores, mustelids etc.), sometimes on reptiles and birds. The fed up larva falls to the ground and after some time turns into a nymph. After feeding and molting, the nymph turns into an “adult” stage - imago. Mature females of ixodid ticks feed once, mainly on cattle, as well as on wild ungulates, large predators and humans. Vectors of dangerous diseases of humans and domestic animals (Crimean hemorrhagic fever, tick-borne encephalitis, borreliosis, rickettsiosis, plague, etc.) are among them. During their feeding with the blood of the host a tick-borne paralysis is possible, which is an acute disease of animals and humans, resulting from poisoning by a neurotoxin secreted by ticks. The proboscis is located on the front end of the mite’s body. It has a dorsal scutes. Peritremata is large and lie behind the fourth pair of coxa. There are suckers on mite’s legs.

Dermacentor marginatus Sulzer, 1776 – Bl0ordered Dermacentor (figure 2). A vector of Hemorrhagic and Crimea-Congo fevers, tick-borne North Asian rickettsiosis00000. Omsk hemorrhagic fever, tick-borne encephalitis, pyroplasmosis; host of plague, tularemia, Q fever, brucellosis, listeriosis pathogens, in livestock - vector of babesiosis of horses, donkeys and dogs, anaplasmosis of goats, sheep and cattle. It is found in southern Europe, on some islands of the Mediterranean Sea, in Ukraine, in Moldova.

![Figure 2 – Dermacentor marginatus Sulzer, 1776](image-url)
Crimea, southern part of the European Russia, Kazakhstan, North Caucasus, southern part of Western and Eastern Siberia and Central Asia. It is a plain-steppe and mountain-steppe form, but some specimens are found in forest-steppe and mountain-forest areas. Three-host species. The full development cycle takes place in a year. Larvae, nymphs feed on rodents, hedgehogs, water rats and other small animals. Imago is parasitizing on cattle, sheep, goats, horses. Adult ticks often attack people. Tick attacks begin in May (mostly imago); in summer, mature ticks don’t meet, and in the fall, there is the greatest increase in the tick’s number on animals. Before the tick begins to suck blood it makes several test punctures. Characteristic is the presence of silver-white (light enamel) spots on a dark background of the dorsal scute (marble pattern), limbs and proboscis.


*Rhipicephalus pumilio* Schulze, 1935 - Canine tick (figure 3). Pasture three-host tick. The vector of the Astrakhan spotted fever, ehrlichiosis, host of plague and tularemia pathogens, in livestock - a vector of babesiosis of horses, donkeys and pigs, anaplasmosis of goats and sheep. A bite can cause tick-borne paralysis in humans and pets. The area includes all Central Asian republics, Kazakhstan, Transcaucasia, Dagestan and Mongolia. In Kazakhstan, it populates tugai-meadow biotopes in the valleys of the lower reaches of Syrdariya, Black Irtysh rivers, and the natural water flows of the Ile basin. Three-host species.

![Image of Rhipicephalus pumilio](image-url)

**Figure 3 – Rhipicephalus pumilio** Schulze, 1935

Adult ticks were recorded on a tolai-hare, a long-eared and a long-needled hedgehogs, a wolf, a jackal, a fox, a gazelle, a onager, a dog, a rabbit, a camel, a goat, a horse and a cattle, the larvae and a nymphs are on a tolai, hedgehog, great and tamarisk gerbils. Attacks a human. The spring-summer-autumn is a parasitic season, but the maximum number on the host is observed in April-June. Relatively small ticks (hungry 2-5 mm, fed up females 10-15 mm), are reddish-brown in color.


*Haemaphysalis punctata* Canestrini et Fanzago, 1878 - spotted *Haemaphysalis* (figure 4). The vector of causative agents of Q fever, Crimean hemorrhagic fever, tick-borne encephalitis, tularemia, Lyme disease etc., in livestock, is a vector of East Asian theileriosis in cattle, goats and sheep. In Kazakhstan, western part of the range covers the valley of Syrdarya river, northern slope of the Karatau ridge, southern part of Betpak Dala desert and Chu valley. The northern border of Kazakhstan area covers the
south-western Altai, Zaisan basin, Tarbagatay ridge and foothills of Saur ridge. The southern border covers the foothill and mid-mountain belts of the Zhetsu Alatau, the entire basin of Ile river, all ridges of the Tien Shan system. It prefers moist biotopes - along the banks of reservoirs. Pasture three-host parasite. Imago feeds on mammals (several dozen species), larvae and nymphs can also feed on birds and reptiles.


Discussion of research results. Thus, for the territory of the fields of forage crops of «Bayserke-Agro» LLP, 4 species of bloodsucking ticks were identified, belonging to 4 genera from 2 families - Argasidae and Ixodidae. Ixodid ticks, represented by 3 genera and 3 species, dominate both in numbers and species diversity. *Haemaphysalis punctata* Canestrini et Fanzago, 1878 has the highest abundance and incidence of them, which was found in almost all the examined sites. Due to its prevalence and high abundance, this species also has the greatest sanitary and epidemiological significance. The smallest and limited in distribution form is the shell mite *Argas reflexus* (Fabricius, 1794). It was found only in two places - near the ERPC center and on the triticale field behind the Arkabay village. This limitation may be due to its biological features. Namely, not far from the building there is a building with a large colony of pigeons, which are its natural hosts. Not far from the triticale field on the elevator, there is also a large colony of these birds, the hosts of the shell mite. For these reasons, *Argas reflexus* (Fabricius, 1794) was found only at these two points.
Findings. Mass reproduction of bloodsucking ticks on the territory of «Bayserke-Agro» LLP in 2019 was caused, apparently, by a very mild and short winter of 2018-2019, which allowed hibernating individuals to survive it without loss from freezing. When working in the fields as an agent for protection against ticks, the «Reftamid» aerosol drug, which has a deterrent effect not only for them, but also for mosquitoes, midges and other representatives of gnats, has proven itself well. In addition, in laboratory tests on two species of ticks - Haemaphysalis punctata Canestrini et Fanzago, 1878 and Dermacentor marginatus Sulzer, 1776 - biological preparations Acarofit and Entolek from the group of avermectins – individuals died 10 and 7 minutes after treatment, well proved themselves. In the future, production testing of preparations of this group against bloodsucking ticks should be carried out and then used as a means of controlling their numbers.

Source of research funding. The work was prepared as part of the project implementation of the Ministry of Agriculture of the Republic of Kazakhstan BR 06249249 "Development of a comprehensive system to increase productivity and improve the breeding qualities of farm animals, using the example of «Bayserke-Agro» LLP" under subproject 2 "Improving the technology of cultivation and harvesting of forage crops".

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"БАЙСЕРКЕ АГРО" ЖШС ЖІНАЛҒАН КАН СОРГЫШ КЕНЕЛЕР (ARACHNIDA, ACARI, IXODIDA)


Түйін сөзлер: қан сорғыш кенелері, Acari, Argasidae, Ixodidae, Argas reflexus, Dermacentor marginatus, Rhipicephalus pomilio, Haemaphysalis punctata, "Байсерке Агро" ЖШС.

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КРОВОСОСУЩИЕ КЛЕЦИ (ARACHNIDA, ACARI, IXODIDA), СОБРАННЫЕ В ТОО «БАЙСЕРКЕ АГРО»

Аннотация. Для территории полей кормовых культур ТОО «Байсерке Агро» было выявлено 4 вида кровососущих клещей (Argas reflexus (Fabricius, 1794), Dermacentor marginatus Sulzer, 1776, Rhipicephalus pomilio Schulze, 1935 және Haemaphysalis punctata Canestrini et Fanzago, 1878), относящихся к 4 родам из 2-х семейств – Argasidae и Ixodidae. Как по численности, так и по видовому разнообразию преобладают иксодо-
Insect Growth Regulators against Rhipicephalus (Boophilus) microplus


4. The productivity effects of cattle tick (Boophilus microplus) infestation on cattle, with particular reference to Bos indicus cattle and their crosses // Veterinary Parasitology. 137(1-2) : 1-10. DOI: 10.1016/j.vetpar.2006.01 .010 (in Eng.).

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SUBSTANTIATION OF THE PARAMETERS OF A THREE-STAGE BIOREACTOR FOR MANURE DISINFECTION

Abstract. The paper reviews the energy indicators of a three-stage bioreactor for the technological production of liquid organic fertilizer. The results of the mathematical and theoretical models of the bioreactor are given. The technological parameters of the developed three-stage bioreactor based on the uniqueness of similarity theory methods and thermal similarity criteria are substantiated.

Key words: agriculture, biofertilizer, processing, manure, waste, bioreactor, animal husbandry, fermentation, manure removal.

Introduction. The basis for controlling the biosynthetic activity of microorganisms is the reaction of a microbial cell to a change in external conditions. Therefore, for the development of process conditions in microorganisms cultivation, it is necessary to investigate how the system state affects on the kinetics of methanogenesis. This would allow to obtain initial data for the development of a constructive-technological scheme of high-performance equipment.

The physical macroscopic values characterizing the system state are parameters of its state. As parameters of the state of individual elements of the simulated object consider the temperature of the substrate, the intensity of circulation, contributing to the acceleration of the rate of biochemical reactions, increasing the energy content of the substrate, the concentration of hydrogen ions (pH), in the subsequent reduction of the process time.

Geometrical dimensions: length, width, height, diameter, surface area, circulation speed, mixing intensity and volume of bioreactors and gas-holder are the design characteristics of the object under study [9].

The values of the specific growth rate of the crop and the dilution rate of the crop, the intensity of circulation are the consumption characteristics.

Research methodology. All physical quantities used for the mathematical description of the microbiological process are divided into 2 groups - variables and constants. Physical variables include ambient temperature and crop dilution rate, duration of acid and alkaline fermentation stages, circulation intensity and biogas output. Constant physical quantities are the heat capacity, density and viscosity of the substrate.

In biological redox processes, which include methane fermentation, the concentration of hydrogen ions (pH) significantly affects the activity of enzymatic reactions. Many experts believe that the optimal pH value for methane bacteria is 7–7.6, the expansion of this interval to 6.5 reduces the output of biogas by 30–40%, and to 6 - almost completely inhibits the development of methane microflora [1].

Thus, the stability and intensity of the methane digestion process in a bioreactor depends on the balance of all stages of the process, the optimal interaction of all groups of microorganisms in each phase of processing.
A model of a microbiological process can be represented as an equation describing the dilution rate of a crop in a substrate [2]:

\[
\frac{dx}{d\tau} = (V_{growth} - V_{dil}) \ast n_c \ast q \ast x,
\]

where \(x\) – the number of bacteria in 1 ml of the substrate; \(\tau\) – the time of the process; \(V_{growth}\) – the specific growth rate of the crop; \(V_{dil}\) – the dilution rate of the crop, depending on the loading dose; \(n_c\) – circulation rate; \(q\) – the circulation energy.

If \(V_{dil} = V_{growth}\), then \(\frac{dx}{d\tau} = 0\), that is, the number of bacteria in the substrate remains constant.

Anaerobic fermentation proceeds most efficiently with a constant increase in the number of microorganisms. Thus, the condition for the intensification of the process is:

\[
V_{dil} < V_{growth}, \text{ then } \frac{dx}{d\tau} \geq 0.
\]

The dependence of the growth rate of the number of microorganisms on the temperature of the medium is described by an empirical formula [56,57]

\[
\mu = 0.013 \cdot t - 0.129, \text{ day}^{-1},
\]

where \(t\) – process temperature, °C.

Then, in the psychrophilic mode \((t=20^\circ C)\) \(\mu = 0.013 \cdot 20 - 0.129 = 0.13 \text{ day}^{-1}\), in mesophilic mode \((t=30^\circ C)\) \(\mu = 0.013 \cdot 30 - 0.129 = 0.26 \text{ day}^{-1}\), and in thermophilic mode \((t=55^\circ C)\) \(\mu = 0.013 \cdot 55 - 0.129 = 0.58 \text{ day}^{-1}\).

Secondly, the growth rate depends on the dilution rate, which depends on the loading dose of the bioreactor [57]

\[
D = \frac{Q_{LS} n_c}{Q_{SB}} \times 100,
\]

where \(Q_{SB}\) – the mass of the substrate in the bioreactor; \(Q_{LS}\) – the mass of the loaded substrate; \(n_c\) – circulation rate.

Thus, the analysis of dependencies (2) – (4) allows us to conclude that the growth rate of microorganisms depends on the stage of the fermentation process, the bacterial composition, temperature, loading dose, circulation rate and time of the process.

Analysis of the research shows that to calculate the biogas output, it is advisable to use the Konto kinetic model [8], which takes into account the process temperature, the duration of fermentation (exposure) and the growth rate of microorganisms, then the objective function can be written in the form:

\[
\text{max} \left( B \right) \quad \rightarrow \quad \frac{B_{lim} S_{OM} (1 - \frac{K}{\mu \tau + 1 + K})}{\text{max}}
\]

where \(B\) – biogas output from 1 m³ of the bioreactor volume, m³/m³; \(B_{lim}\) – the limit output of methane per unit mass of the substrate for an infinitely long duration of the process; \(S_{OM}\) – concentration of organic matter in the substrate, %; \(\tau\) – duration of fermentation, days; \(K\) – kinetic parameter of the process.

The obtained data are confirmed by the experience of operating biogas plants in Denmark, in which the first stage of digestion takes place in the reactor for primary processing, and then the substrate is pumped into the reservoir for subsequent processing (“cold” reservoir). This technology allows to increase the output of biogas to 4 m³/m³.

Based on the obtained data, an improved technology of accelerated digestion of agricultural biowaste was developed, which was investigated on a laboratory sample of a three-stage bioreactor with a total volume of 0.15 m³.
The efficiency of the facility largely depends on the bioreactor thermal regime. The bioreactor is the main element of the design of biogas plants, where the process of biochemical transformation of animal waste occurs. The main criterion of the fermentation process in the bioreactor is the temperature of the substrate, as well as the intensity of biogas recovery and the processing time of the substrate.

To implement the technological process in biogas plants substrate temperature is set, then the thermal power $Q_{FB}$ is taken as an unknown quantity, and the temperature $t_p$ is an independent input.

The solution of the problem in this formulation can be carried out within the framework of both the stationary and non-stationary thermal conditions. In the first case, it boils down to determining the $P_{FB}$ rated heat power of the fuel boiler; in the second case, there is the law of temperature variations in the heat transfer media, in the system $t_i$ and the three-stage bioreactor $t_p$.

Based on the theory of heat exchangers, the following assumptions are made: the temperature of the coolant flow is assumed to be the same throughout the section of pipes, there are no internal heat sources in the coolants, the accumulating capacity of the walls of the heat exchangers can be neglected, the heat capacity of all the elements of the system is characterized by average heat transfer coefficients and heat transfer [4-6].

The heat flows of the bioreactor are shown in the schematic diagram of the heat exchange of its elements (1). Based on the above, the equations of an analytical model of a biogas plant are formed. Solving (5), we obtain a description of the dynamics of heating in individual elements.

The equation of the heating dynamics of the coolant in the fuel boiler HE:

$$t_{i_{out}} = t_{i0} e^{-\tau/T_1} + t_{i_{st}} \left(1 - e^{-\tau/T_1}\right),$$

$$T_1 = \frac{G_j c}{K_{HT} F_{HT}},$$

where $T_1$ – time constant; $t_{i_{st}}$ – stable temperature.

Equating the heat transfer $HT$ equations and the change in the enthalpy of biomass in the bioreactor, we determine the temperature $t_i$

$$t_i = \frac{t_i' - t_n (B+1)}{B},$$

$$t_i' = \frac{K_{HT} F_{HT}}{G_j c},$$

$$.. B = e^{-T_1},$$

where $t_i', t_i''$ – initial and final coolant temperature in HT.

![Structural model of laboratory installation of three-stage bioreactor](image)
Based on the above, the equations of an analytical model of a biogas plant are formed:

\[
P_{FB} \, d \tau = G_i \, c \, d \, t_i + K_{HT} \, F_{HT} \, (t_i - t_n) \, d \tau - G_q \, c \, (t_{inq} - t_{out}) \, d \tau
\]

\[
K_{HT} \, F_{HT} \, (t_i - t_n) \, d \tau + K_{TY} \, F_{TY} \, (t_q - t_n) \, d \tau =
\]

\[
= G_{BP} \, c \, d \, t_n + M_b \, c \, c \, d \, t_n + K_{BP} \, F_{BP} \, (t_n - t_0) \, d \tau
\]

\[
C_l \, \frac{d \, t_i}{d \, \tau} + K_{HT} \, F_{HT} \, (t_i - t_n) = G_i \, c \, (t_{inl} - t_{out})
\]

\[
C_q \, \frac{d \, t_q}{d \, \tau} + K_{TY} \, F_{TY} \, (t_q - t_n) = G_q \, c \, (t_{inq} - t_{out})
\]

\[
t = \frac{t_{inl} + t_{out}}{2}, \quad p = i, l, n, q; \quad t \, (\tau = 0) = t \, p_n
\]

where \(P_{FB}\) – heat power of the fuel boiler; \(t_{in}, t_{out}\) – temperatures of coolant at the inlet and outlet of the corresponding elements; \(t_a\) – ambient temperature; \(t_i, t_l, t_q, t_n\) – the temperature of the coolants in the FB, HT, TP, biogas plant; \(K_{HT}, K_{TY}\) – heat transfer coefficients of HT and TP; \(K_{BP}\) – coefficient of heat transfer to the environment in a biogas plant; \(F_{HT}, F_{BP}\) – according to heat transfer surface HT, TP; \(F_{BP}\) – surface heat transfer to the environment to fabiogas plant; \(G_i, G_l, G_q\) – respectively the costs of coolants in the FB, HT, TP; \(\tau\) – time, \(c, c_B, c_s\) – respectively, specific heat capacities of water, biomass \((C_B = 4.06 \text{ kJ/kg} \cdot \text{C})\) and steel; \(G_p, M_p\) – the mass of the substrate and the body of a biogas plant; \(C_i, C_q\) – full heat capacity of the corresponding elements.

Solving (6), we obtain a description of the dynamics of heating in individual elements.

The equation of the heating dynamics of the coolant in the fuel boiler FB.

The time of heating the biomass up to a given temperature \(t_n\) is equal [7, 8].

\[
\tau_{BP} = T_2 \ln \frac{t_n^{in} - t_l^{in}}{t_n^{in} - t_l^{in}}, \quad (B - 1)
\]

\[
T_2 = B \left( G_p \, c_B + M_p \, c_s + Q_{OC} \right) \frac{1}{G_q \, c (B + 1)}, \quad (12)
\]

where \(t_n\) – biomass temperature at the beginning and end of heating; \(T_2\) – constant time of bioreactor in biogas plant; \(Q_{OC}\) – specific heat loss.

Thermal power of the heating element (HE) required heating the bioreactor [67]

\[
P_{FB} = \frac{(C_{BM} \, G_2 + C_{BG} \, G_3 + C_{BM} \, M_b) \cdot (t_{p}^{11} - t_{p}^{1})}{\eta_i \eta_{HT} \tau_p}, \quad \text{kJ},
\]

\[
(13)
\]
where $G_2$ – biomass amount, kg; $C_{BG}$ – specific heat capacity of biogas, $C_{BG} = 2.34$ kJ/kg·h; $C_s$ - specific heat capacity of the steel of body, $C_s = 0.46$ kJ/kg·h; $M_b$ – mass of the body, kg; $G_3$ – the mass of biogas in the gasholder; $G_{BG} = V \rho$, kg; $V$ – the volume of a gasholder, m$^3$; $\rho$ – the biogas density, normal, $\rho = 1.2$ g/l; $\tau_p$ – the heating time of the biomass in the bioreactor, h; $\eta_{HT}$ – the efficiency of the heat transfer, $\eta_{HT} = 0.92$; $t'_p$, $t''_p$ – the initial and final temperature of the biomass in the bioreactor, °С.

The initial and final temperatures of the biomass in the reactors, respectively, $t'_2 = 20$°С; $t''_2 = 49$°С, $t'_3 = 69$°С, inlet and outlet of the heat transfer $t'_2 = 30$°С; $t''_2 = 69$°С, $t''_3 = 89$°С.

Analysis of the obtained data indicates that the heating time of the biomass, taking into account the intensity of circulation in three-stage bioreactors to a thermophilic temperature of 80°С is 120 h, the installed total thermal power of the HE is 5.9 kW.

To substantiate the technological parameters because of the complexity of the description of physical quantities, we use the dependencies between the similarity criteria and the “criterion equations”. For the conditions of forced flow of a thick fluid in pipelines for circulation, mixing and heat transfer by the method of the theory of similarity in the general case to functional relationships through the Nusselt criterion\[6; 7; 8\]

$$Nu = f .(Re , Gr , Pr , l/d),$$ \hspace{1cm} (14)

where $l/d$ – the ratio of the length of the pipe to its diameter, which takes into account the change in heat transfer along the length of the pipe, associated with hydrodynamic and heat flow stabilization in the initial section, $Re = \omega d/\nu$ – Reynolds criterion, $Gr = gl^2/\beta \Delta T/ \nu$ – the Grashof criterion, $Pr = gl/\nu^2$ – the Froude criterion.

To calculate the parameters of pipelines and injection pump in the system, we determine the volume (flow) of fluid $Q_f$:

$$Q_f = \omega^* C \sqrt{R * J},$$ \hspace{1cm} (15)

where $C$ - the Chézy coefficient, $J = h/l$ is the hydraulic slope, $\omega$ - the area of the living section, $R$ - the hydraulic radius, $d$ - the pipe diameter (m).

Power consumption of the injection pump:

$$N_n = \rho * g * Q_f * P,$$ \hspace{1cm} (16)

where $N_n$ - the net power; $\rho = kg/m^3$ density of the pumped area; $H$ - total pressure in m.

Power on the pump shaft $N_p$:

$$N_p = N_n / \eta_p, kW,$$ \hspace{1cm} (17)

where $\eta_p = 0.96$ pump efficiency; Engine power consumption $N_e$:

$$N_e = N_p / (\eta_p * \eta_d), kW,$$ \hspace{1cm} (19)

where $\eta_d = 0.98$ drive efficiency; and $\eta_e = 0.95$ engine efficiency; Installed power $N_{inst}$:

$$N_{inst} = \beta * N_e, kW,$$ \hspace{1cm} (20)

where $\beta = 1.6$ coefficient of power reserve up to 1 kW (2–1.5).

Research results and discussion. The basis for controlling the biosynthetic activity of microorganisms is the reaction of a microbial cell to a change in external conditions. Therefore, for the development of technological regimes of microorganisms cultivation, it is necessary to investigate how the state of the system affects the kinetics of methanogenesis. This will allow to obtain initial data for the development of a constructive-technological scheme of high-performance equipment.

To calculate the energy indices, the substrate temperature of the three-stage bioreactor is set, which is necessary to implement the technological process, then the total energy consumption for maintaining the $Q_{SUMM}$ process is taken as an unknown quantity, and the temperature $t_p$ is an independent input.

The technology of controlled three-stage anaerobic digestion and thermal neutralization allows to reduce costs, and the complex of automatic control and management minimizes the involvement of personnel and allows obtaining a stable quality of liquid fertilizers [5].
A pump carries out submission of the substrate to the first reactor, where the process of fermentation begins, of anaerobic fermentation at temperatures up to 50°C. To the second reactor, the substrate is pumped from the first reactor with temperature (t₀₁ = 46 °C), where the fermentation process continues, anaerobic fermentation with a higher temperature - about 70°C, which results in accelerated decomposition of organic waste.

The substrate is pumped to the third reactor from the second reactor with a temperature (t₀₂ = 66°C), where it continues, where the process of high-temperature treatment takes place with a temperature (t₀₃ = 96°C), which results in accelerated neutralization of organic waste. The substrate in the bioreactors is mixed automatically to a homogenous consistency during 15 minutes, every 4 hours.

The solution of the problem in this formulation can be carried out within the framework of both the stationary and non-stationary thermal conditions. In the first case, it boils down to determine the estimated total energy consumption QSUMM to maintain the process, the second is the law of the time variation of the loading temperature t_load1, t_load2, t_load3 and the temperature in the three-step bioreactor t₁, t₂, t₃. Based on the above, the equations of an analytical model of a biogas plant are formed.

Conclusions. The analysis results on indicators of the processes in the thermo-biological processing of the substrate in a three-step bioreactor due to the continuity of the processing stage of the substrate proves the acceleration of the anaerobic fermentation process by 3 times. The use of a three-step bioreactor allows to organize the continuous production of liquid organic fertilizers with high energy efficiency.

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КОНДІ ЗАЛАЛЫЗДАНДЫРУҒА АРНАЛГАН
УШТАЛЫЛЫ БИОРЕАКТОРДЫҢ ПАРАМЕТРЛЕРІН НЕГІЗДЕУ

Аннотация. Макалада сұйық органікалық ғысқыртқыштан технологиялық әндірісі шешіні үшсатылы биореактордың энергетикалық әндірісінің қарастырылады. Биореактордың математикалық және теориялық модельдерінің нәтижелері келтірілген. Үкіс астық теориялық әдістерін, және термиялық критерілі, үшсатылы биореактордың технологиялық параметрлерін негізделген.

Түйін сөздер: ауылшаруашылық, биоудобрение, переработка, навоз, отход, биореактор, животноводство, сбраживание, уборка навоза.

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ОБОСНОВАНИЯ ПАРАМЕТРОВ ТРЕХСТУПЕНЧАТОГО БИОРЕАКТОРА
ДЛЯ ОБЕЗЗАРАЖИВАНИЕ НАВОЗА

Аннотация. В статье рассмотрены энергетические показатели трехступенчатого биореактора для технологического производства жидкого органического удобрение. Приведены результаты математического и теоретического модели биореактора. Обоснованы технологические параметры разработанного трехступенчатого биореактора на основе условий однозначности методов теории подобия и критериям теплового подобия.

Ключевые слова: сельское хозяйства, биоудобрение, переработка, навоз, отход, биореактор, животноводство, сбраживание, уборка навоза.
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NEW INFORMATION ABOUT USING NUTRITIONAL SUBSTANCES BY HUNGERARIAN ANIMALS AT VARIOUS FEEDING TYPES

Abstract. Optimizing the nutrition of various species of ruminant animals, their relationship with different feeding conditions, types of vegetation used in feeding, evaluation of the digestive system will allow you to understand the mechanisms and possibilities for improving feed utilization and increasing the productivity of farm animals, will create the opportunity for keeping wild species in captivity. In the conditions of the SEC "Kharakhosovsky" of the Republic of Kalmykia, we conducted scientific, economic and physiological experiments. The studies were carried out by the method of analog groups on Grozny lambs of sheep from 4 to 8 months of age and on saigas (Saigatatarica L.) from 4 to 7 months of age. These two closely related species are attributed to the suborder ruminant (Ruminata) and the bovid family (Bovidae). Feeding animals were divided into 3 groups: hay, haylage, and green. In group I of lambs, the share of hay in the diet was 90.9%, saigas - 89.7% of dry matter. In group II, lambs share of haylage is 69.6%, and in saigas it is 67.9%. In the ration of group III, the proportion of green fodder prevailed, so in lambs, grass fodder was 65.8%, and in saigas 62.3%. A high level of nutrient utilization, nitrogen digestibility, elevated levels of volatile fatty acids and total nitrogen in the rumen fluid were found in saigas during green feeding. The relatively low concentration of total nitrogen in the cicatrical saiga fluid, 37.3 mg%, compared with 39.6 mg% of lambs, indicates a more intensive flow of protein metabolism in them. Young sheep use nutrients better and grow on pretreated feed such as haylage. A high coefficient of nitrogen digestibility was in lambs with hay fever and amounted to 31.03%.

Keywords: lambs, saigas, feeding type, ruminants, digestibility, nitrogen, cicatrical digestion.

Introduction. Optimizing the nutrition of various types of ruminants, their relationship with various feeding conditions, types of vegetation used in feeding, evaluation of digestion will allow you to understand the mechanisms and possibilities of increasing the absorption of nutrients. In addition, the optimization of the feeding level creates opportunities for increasing the productivity of farm animals and the prerequisites for keeping some wild species in captivity [1-6].

Studies of feed adaptations mainly concern separate production groups of animals, although LK Ernst, N.A. Zinoviev [7], J.L. Ellis, J. Dijkstra, A. Bannink [8] noted the need for a deeper study of related species in order to establish the beginning of their food separation in nature and determine the patterns of use of the main types of food resources.

A comprehensive study of the conversion of nutrients by domestic and wild animals, such as sheep and saigas, assigned to the same suborder ruminant (Ruminata) and bovid family (Bovidae) in different feeding conditions is not only of biological, but also of industrial interest [9, 10].
Biological substantiation of complete feeding of animals requires consistent studies of the processes of nutrition, digestion and metabolism [11-14]. Only a uniform tension in the work of a multi-chamber stomach of ruminants at the optimum for this type of combination in the diet of coarse, juicy and concentrated feed can greatly enhance the digestive capacity of the stomach and intestines. As a result, the total digestibility of feeds increases, and their utilization rate increases [15-17].

The aim of the work is to investigate the species differences and the influence of the type of feeding on the digestibility of nutrients and nitrogen, cicatricial digestion, growth rate in growing young sheep and the captive content of saigas.

**Materials and methods.** To solve the tasks, in the production conditions of the SEC "Kharakhusovskiy" of the Republic of Kalmykia, we carried out scientific, economic and balance experiments on young ruminants. The studies were carried out by the method of group analogs on 3 groups of lambs, the Grozny breed of 20 heads each, and on 3 groups of saigas (Saigatatarica L.) 7 heads. Growing lambs was carried out with free-range content from 4 to 7 months of age, saigas in aviary conditions from 3 to 7 months of age.

Balance experience was carried out at 7 months of age. From animals that were on scientific and business experience, 3 typical lambs and saigas were selected from each group, which were placed in individual cages. After 10 days of the preparatory period, accounting was carried out for 7 days. At this time, they were fixed individually: the amount of a given feed, its residues, excreted feces and urine per day, and average samples were taken for analysis.

On the last day of the balance sheet experiment, 3 hours after the morning feeding, the cicatricial fluid was taken from the animals using a gastrointestinal probe.

The rations for young sheep were based on the detailed feeding rates of A. P. Kalashnikov et al. [18]. The saigas were fed according to the norms recommended by Yu. N. Arylov [19].

The structure of the rations is given in Table 1. Studies have shown that animals of group I received diets consisting of 90.9% dry matter for lambs and saigas for 89.7% of hay. In group II, lambs had a share of haylage in the diet - 69.6, saiga - 67.9%. Green fodder prevailed in the rations of animals of the third group, in lambs, grass fodder was 65.8%, and in saigas 62.3%.

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<th>Table 1 – The structure of the diets of animals by groups, %</th>
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The concentration of metabolizable energy in the dry matter of the rations of lambs was different for hay, hay, and green feeding, respectively, 8.34; 8.51 and 8.24 MJ, in young saigas, respectively, 8.48; 8.58 and 8.32 MJ. To compensate for the deficit of macro and microelements, a complex of mineral substances consisting of monosodium phosphate, magnesium carbonate, feed sulfur, copper sulfate, zinc carbonate, and potassium iodide was introduced into the concentrated feed of all groups of animals. In samples of feed, their residues and feces, the total humidity was determined, the ash content was determined by burning, and crude fat was determined according to S.V. Ruszkowski, raw fiber - according to Genneberg and Shtoman. The amount of nitrogen in the samples was determined on a semi-automated complex to determine nitrogen and protein by the Kjeldahl method.
The content of the rumen was determined by the total amount of volatile fatty acids by the method of steam distillation in the apparatus of Markgam, the amount of total nitrogen by the Kjeldahl micromethod, protein nitrogen by the Barnstein method, residual nitrogen by the calculation method by the difference between total and protein, pH on a pH-150M millivoltmeter.

The data obtained during the experiments were processed using mathematical methods of variation statistics using the Microsoft Excel software.

Results. A comparative assessment of various species of ruminants, carried out by us, shows that the species differences in the digestion of food are more significant than the similarity determined by the same type of food.

The main factors affecting the metabolism of nitrogen in the digestive tract are the quality of the nitrogen source and the degree of availability of high-value plant proteins. The percentage of assimilation of raw protein and fat from feed rations in various animal species indicates an increased absorption of metabolites in the rumen (figure 1).

![Figure 1 – The coefficients of digestibility of raw protein and fat, %](image)

Saigas of group III, who received a green ration, surpassed peers from group II, in the assimilation of crude protein by 1.30; raw fat by 1.10%. As a result of the intensive protein metabolism of diets in the body of young sheep, they consumed better and digested the protein during hay feeding in comparison with saigas by 15.18%. However, saigas better digested the crude fat contained more in the rations for hay and green feeding types compared with lambs by 11.11 and 7.18%, respectively.

Saiga young, characterized by greater motor activity, regardless of the type of feeding, compared with lambs, absorbed raw fat, which has a high energy content. Proteins in the body of animals are mainly used for the growth and renewal of cells and tissues. At the same time, the protein utilization ratio of the rams was higher compared to saigas. In our opinion, this is caused by the species characteristics of animals.

Differences in feeding types have a significant effect on the digestion and deposition of nitrogen in the body in all ruminant species.

In the course of our research, it was found that in terms of deposition and the percentage of nitrogen utilization, the best lambs of group II were fed the hay diet (figure 2). Lambs that received hay feeding type (group II) in their body laid off more nitrogen compared to lambs that consumed hay feeding type (group I) by 0.76 g. It should be noted that young sheep who consumed green type feeding (group III) also exceeded the lambs that received hay feeding (group I) by 0.63 g.

Experimental saigas of group III who received the green type of feeding laid off more nitrogen in their bodies than their peers from groups II and I by 15.0 and 8.7%, respectively.
The degree of assimilation of nitrogen by the body and the intensity of nitrogen metabolism in the digestive tract of ruminants more accurately reflects the utilization rate of this element. The percentage of nitrogen used from feed taken in lambs of group II, who received a haylage ration, was 2.17% more compared with their peers of group I, who received the hay ration.

Saiga juveniles from group III, who received a green ration, surpassed in their utilization of nitrogen their peers from Group II at 2.62%, consuming hay diet. However, the percentage of nitrogen used in hay-fed feeding of lambs was higher by 13.86% compared to saigas.

The reason for the variability of the digestibility of the basic nutrients of diets during different types of feeding, apparently, is the change in the secretion of the digestive glands and microbiological processes occurring in a multi-chamber stomach of various species.

Biochemical indicators of cicatricial fluid can serve as its indicators and reflect the metabolic processes occurring in the body of animals. We have evaluated species peculiarities of nitrogen metabolism in the rumen of lambs and saigas (table 2).

Table 2 – Indicators of cicatricial metabolism

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Norm</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Lambs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>6.1-6.9</td>
<td>6.63±0.39</td>
</tr>
<tr>
<td>Total nitrogen, mg%</td>
<td>30-48</td>
<td>44.6±0.82***</td>
</tr>
<tr>
<td>Residual nitrogen, mg%</td>
<td>–</td>
<td>13.3±0.21*</td>
</tr>
<tr>
<td>JДЖК, млэкв/100мл</td>
<td>10-20</td>
<td>13.24±0.38*</td>
</tr>
<tr>
<td>Saigas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>–</td>
<td>6.71±0.41</td>
</tr>
<tr>
<td>Total nitrogen, mg%</td>
<td>–</td>
<td>38.9±0.9</td>
</tr>
<tr>
<td>Residual nitrogen, mg%</td>
<td>–</td>
<td>16.3±0.38</td>
</tr>
<tr>
<td>JДЖК, млэкв/100мл</td>
<td>–</td>
<td>11.61±0.22</td>
</tr>
</tbody>
</table>
Table 3 – Dynamics of body weight of animals

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lambs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live weight, 4 month</td>
<td>25.80±0.69</td>
<td>26.20±0.88</td>
<td>26.20±1.18</td>
</tr>
<tr>
<td>7 month</td>
<td>35.85±1.22</td>
<td>39.69±1.12</td>
<td><em>39.24±1.09</em></td>
</tr>
<tr>
<td>Absolute gain, kg</td>
<td>10.02±1.10</td>
<td>13.49±1.09</td>
<td>13.04±0.90</td>
</tr>
<tr>
<td>Average daily gain, gr.</td>
<td>111.33±12.18</td>
<td>149.93±12.12</td>
<td>144.89±10.06</td>
</tr>
<tr>
<td><strong>Saigas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live weight, 3 month</td>
<td>12.83±0.30</td>
<td>12.94±0.31</td>
<td>12.60±0.42</td>
</tr>
<tr>
<td>7 month</td>
<td>18.57±0.67</td>
<td>18.20±0.69</td>
<td>19.27±0.66</td>
</tr>
<tr>
<td>Absolute gain, kg</td>
<td>5.74±0.63</td>
<td>5.26±0.64</td>
<td>6.67±0.49</td>
</tr>
<tr>
<td>Average daily gain, gr.</td>
<td>47.83±5.24</td>
<td>43.83±5.32</td>
<td>55.59±4.06</td>
</tr>
</tbody>
</table>

The high level of protein digestion in lambs with senazhny type of feeding allowed to get from the group II by 3.47 kg (P <0.05) the absolute increase more than from peers from group I (table 3).

The use of herbal rations in feeding saigas made it possible to obtain, during the test period, 6.67 kg increase in live weight, which is 1.41 kg higher than when grown on hay rations. In absolute and average daily gains, the live weight of the lambs significantly exceeded the saigas during all types of feeding. So, when grown on hay diets, average daily gains of lambs were 3.4 times higher, and with green type of feeding, 2.6 times higher.

The growth intensity of the compared groups of young for a certain period characterizes the relative increase. A comparative assessment of the relative increase in live weight of animals over the period of experience generally reflects the peculiarities of nutrient utilization by different types of ruminants for different types of feeding (figure 3).

Figure 3 – The relative increase in animals over the period of experience

The growth rate of young sheep depended on the composition of the diets, so with the haylage type of feeding, it was 46.92% and was higher by 14.32% than with the hay. At the same time, the difference in growth among these groups of saigas was 8.06%.

**Conclusions.** Thus, the development of an animal and, consequently, its mass is not determined solely by the amount of energy supplied daily with food, but is closely related to the type of animal, the composition of the diet, and feeding conditions. Higher levels of nutrient utilization, nitrogen digestibility, volatile fatty acid concentrations and total nitrogen in the rumen fluid in saigas during green feeding. As a
result, the growth rate of saigas when grown on grass rations is much higher than on hay and hay rations. Young sheep use nutrients better and grow on feeds from pretreatment, such as haylage. Consideration of the identified features of the use of feed rations by various species of ruminant animals is necessary for the development of diets and feeding techniques that allow realizing the genetic potential of the productivity of farm animals and the adaptation of wild species to captive conditions.

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КУЙІСКАЙЫРАТЫН ЖАНАУАРЛАРДЫ ӨРТУРІЛІ
АЗЫҚТАНДЫРУУЫН БОКТУУ ДАРАА САЙЛОДАПАЛАНУ

у сайгаков при зеленом типе кормления. Относительно низкая концентрация общего азота в рубцовой жидкости сайгака 37,3 мг% по сравнению с ягнятами 39,6 мг%, указывает на более интенсивное протекание у них белкового обмена. Молодняк овец лучше использует питательные вещества и растет на кормах подвергшихся предварительной обработке, таких как сенаж. Высокий коэффициент переваримости азота был у ягнят при сенажном типе кормления и составил 31,03 %.

**Keywords:** ягнят, сайгаки, тип кормления, жвачные животные, переваримость, азот, рубцовое пищеварение.

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**REFERENCES**


MONITORING OF STEM PEST POPULATIONS (SCOLYTINAЕ) WHICH STRIKES THE ENDEMIC SPRUCE SHRENK IN ZAILIYSK ALATAU

Abstract. The article presents data of the monitoring population of stem pests (Scolytinae) and their entomophages in the forests of the Trans-Ili Alatau in the Ile-Alatau State National Natural Park.

As a result of the monitoring of stem pests (Scolytinae), the species composition of bark beetles and entomophages was established on the endemic of Schrenk spruce in Zailiysky Alatau. Of the possible foci of outbreaks of mass reproduction of stem pests are withering spruce trees found in a number of gorges. In this regard, it is necessary to continue monitoring the population of stem pests (Scolytinae) on the endemic of the Schrenk spruce in the TRANS-ili Alatau.

Keywords: Shrenk's spruce, bark beetles, entomophages.

Introduction. Shrenk's spruce or Tianshan spruce – endemic species and easily vulnerable rock for the mountains of Central Asia, the importance of which in the protection of the slopes of the TRANS-ili Alatau from erosion can not be overestimated. In addition, Shrenk's spruce is an attraction for tourists. Spruce spruce have a whole set of stem pests (xylophagous) that includes a great variety of common forms, and are region-specific insects [1-6].

Windstorms which were in 2011 in the Ile-Alatau national natural Park led to an outbreak of stem pest reproduction and the formation of long-lasting foci and raised a serious question about the need to monitor pest populations.

Preservation Shrenk's spruce as an endemic and vulnerable species of Zailiysk Alatau is an urgent task not only for the Republic of Kazakhstan, but also for the entire world community. For Kazakhstan, it is important to preserve and increase the forest area of the Republic, which provides primarily the preservation of existing forests for future generations.

Research methods. Monitoring for identify the species composition of xylophagous insects Shrenk's spruce in the mountains Zailiysky Alatau. Collection and accounting of insect numbers was carried out by standard methods used in forest entomology and forest pathology [7-10].

To determine species composition and abundance of rodents on each plot are established, pheromone traps of two types: barrier and triangular after every 7-10 days collected insects for collect. On the site are selected 1-2 model trees, stumps, lying trees and drying up for inspection for the presence of xylophages. On a felled and cleared of branches the tree along the trunk make prolisky a width of about 10 cm and determine the species composition and number of pests, noting the place of settlement of them.

In the middle of settlements of each type should be take the palette (pad) 10 dm² (50x20 cm). On such pallets by counting uterine moves determine the density of the settlement, and by counting the input channels or marriage chambers (for polygamous bark beetles) determine the number of families of bark beetles. On pallets also take into account the number of young generation of bark beetles, counting the number of young beetles before departure and pupae under the bark or flight holes on the bark after departure of the younger generation. All these data are transferred to 1 dm² of the surface of the barrel.
Materials for the identification of the main types of entomophages-xylophages are carried out by manual collection, reconnaissance, detailed and other surveys, systematic records of insects.

**Research result.** As a result of the research, the species composition of bark beetles (Scolytinae) on the endemic of the Tien Shan spruce in the mountains of the Zailiysk Alatau (table 1) was revealed.

Table 1 – Species composition of bark beetles (Scolytinae) in the mountains of TRANS-ili Alatau, 2018

<table>
<thead>
<tr>
<th>The species and systematic position</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>The bark of Hauser, Kyrgyz mountain beetle</td>
<td>Ips hauseri Reitt.</td>
</tr>
<tr>
<td>Woodworm chastity</td>
<td>Ips sexdentatus Boerner</td>
</tr>
<tr>
<td>Bark beetle-double</td>
<td>Ips duplicatus Sahlberg</td>
</tr>
<tr>
<td>Bark beetle fires</td>
<td>Orthotomicus suturalis Gyllenhal</td>
</tr>
<tr>
<td>Engraver Baikal</td>
<td>Pityogenes conjunctus Reitter, (P. baikalicus Eggers)</td>
</tr>
<tr>
<td>The micrograph of the Kyrgyz</td>
<td>Pityophthorus kirgisicus Pjatnitzky</td>
</tr>
<tr>
<td>Lobed purple or small spruce lubed</td>
<td>Hylurgops palliatus Gyllenhal</td>
</tr>
</tbody>
</table>

Notation: + – singular; ++ – constantly; +++ – often and countless.

Of the registered species of bark beetles (Solytinae) dominated bark beetle (Ips hauseri Reitt), which is included in the list of particularly dangerous forest pests of the Republic of Kazakhstan. Prefers conditions of moderate light and trees at the age of 2 kalassa and more. It inhabits areas of thick and transitional crust, although it can populate the entire trunk. Winter in a stage of a bug in old courses, under bark of stumps and trunks, mainly lying. Years stretched starts from may (lower forest zone) to late June (upper zone). We have determined the density of the settlement of bark beetles of the Tien Shan spruce of the Ile-Alatau GNPP (table 2).

Table 2 – Density of the settlement of bark beetles of the Tien Shan spruce of the Ile-Alatau GNPP (on average per pallet) in 2018

<table>
<thead>
<tr>
<th>Type of pest</th>
<th>Indication</th>
<th>The density of the settlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bark of Hauser</td>
<td>Ips hauseri Reitt.</td>
<td>The number of mother galleries: 3,2; The number of mating chambers: 0,9</td>
</tr>
<tr>
<td>Woodworm chastity</td>
<td>Ips sexdentatus Boerner</td>
<td>The number of mother galleries: 0,3; The number of mating chambers: 0,1</td>
</tr>
<tr>
<td>Bark beetle-double</td>
<td>Ips duplicatus Sahlberg</td>
<td>The number of mother galleries: 0,4; The number of mating chambers: 0,2</td>
</tr>
<tr>
<td>Bark beetle fires</td>
<td>Orthotomicus suturalis Gyllenhal</td>
<td>The number of mother galleries: 1,1; The number of mating chambers: 0,3</td>
</tr>
<tr>
<td>Engraver Baikal</td>
<td>Pityogenes conjunctus Reitter, (P. baikalicus Eggers)</td>
<td>The number of mother galleries: 12,6; The number of mating chambers: 3,2</td>
</tr>
<tr>
<td>The micrograph of the Kyrgyz</td>
<td>Pityophthorus kirgisicus Pjatnitzky</td>
<td>The number of mother galleries: 11,3; The number of mating chambers: 2,1</td>
</tr>
<tr>
<td>The bark</td>
<td>Hylurgops palliatus (Gyllenhal)</td>
<td>The number of mother galleries: 0; The number of mating chambers: 0</td>
</tr>
</tbody>
</table>

In General, the density of the settlement and the number of marriage chambers of bark beetles is not high, the sanitary condition of forests is stable except for fallen and cluttered areas. The number of the young generation of bark beetles in the Ile-Alatau GNPP is given in table 3.
Table 3 – The Number of the younger generation of bark beetles in the forests of the Ile-Alatau national Park in 2018

<table>
<thead>
<tr>
<th>Вид</th>
<th>Average number of young generation per 1 sq. dm</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bark of Hauser – <em>Ips hauseri</em> Reitt.</td>
<td>11,2</td>
</tr>
<tr>
<td>Bark beetle-double – <em>Ips duplicatus</em> Sahlberg</td>
<td>12,1</td>
</tr>
<tr>
<td>Woodworm chastity – <em>Ips sexdentatus</em> Boerner</td>
<td>1,8</td>
</tr>
</tbody>
</table>

The table shows that the state of the younger generation population is relatively low, but requires constant monitoring. Given the importance of the dominant species of bark beetle (*Ips hauseri* Reitt.) we studied the features of the distribution of uterine moves (table 4).

The greatest number of uterine passages is usually observed in the region of 0-0.1 L, i.e. at the beginning of the settlement area.

Table 4 – dependence of the density of settlement of the bark of Hauser – *Ips hauseri* Reitt. from bark thickness (cm)

<table>
<thead>
<tr>
<th>Number of uterine moves per 1 dm</th>
<th>Thickness of bark, cm</th>
<th>Relative humidity of wood, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,02</td>
<td>1,73</td>
<td>45,3</td>
</tr>
<tr>
<td>1,14</td>
<td>1,67</td>
<td>47,1</td>
</tr>
<tr>
<td>1,05</td>
<td>1,2</td>
<td>50,8</td>
</tr>
<tr>
<td>1,02</td>
<td>1,08</td>
<td>51,8</td>
</tr>
<tr>
<td>1,24</td>
<td>0,91</td>
<td>51,4</td>
</tr>
<tr>
<td>1,01</td>
<td>0,7</td>
<td>53,1</td>
</tr>
<tr>
<td>0,95</td>
<td>0,78</td>
<td>52,6</td>
</tr>
<tr>
<td>0,85</td>
<td>0,66</td>
<td>55,1</td>
</tr>
<tr>
<td>0,68</td>
<td>0,57</td>
<td>53,4</td>
</tr>
<tr>
<td>0,64</td>
<td>0,51</td>
<td>54,4</td>
</tr>
<tr>
<td>1,40</td>
<td>0,3</td>
<td>48,1</td>
</tr>
</tbody>
</table>

The data in the table show that the highest density of Gauzer bark beetle (*Ips hauseri* Reitt.) in 2018 was observed in the zone with relative wood humidity during the settlement period, on average 47.1%, and bark thickness - 1.67 cm, although the number of uterine moves remains quite high (more than 1) with a humidity of 45.3-53.1% and a bark thickness of 1.73-0.7 cm.

Monitoring of bark beetles was carried out using pheromone traps - barrier and triangular type. This year from the bark beetle family (Scolytinae) were caught: coniferous timber tree (Triptodendron linatium Ol.), Gauzer bark beetle (*Ips hauseri* Reitt.), Bark beetle double (*Ips duplicates* Sahalb.), Common engraver (*Pityogenes chalcographus* L.), *Pityophtorus kirgisicus* Pjat.).

In total, 552 insect specimens and 15 spider specimens were collected, of which 267 were bark beetles. Among which the Gauzer bark beetle prevailed (*Ips hauseri* Reitt.). In the total collection of insects is 41.8%.

In 2019, on freshly felled trees from the wind, where root rot was observed at an altitude of 1560 meters above sea level. The density of the settlement of bark beetles (engravers, micrographs) in 10 pallets was collected; 87 specimens were collected adults and 142 copies larvae, their species is established.

In the regulation of the number of bark beetles are important entomophages. The recorded entomophages of the order Coleoptera include representatives of 12 families, 13 genera, 14 species; Diptera: 2 families, 2 genera, 2 species (table 5) and Hymenoptera (Hymenoptera) include 2 families, 6 genera, 9 species and Hemiptera include 3 families, 4 genera and 4 species (table 6).

In the period of our research found the predator from the order Hemiptera (Hemiptera) bed bug baby – *Scoloposcelis pulchella* Zetterstedt which in Kazakhstan has not been reported that is a new species in the TRANS-il Alatau.
### Table 5 – List of entomophages from the order of Coleoptera (Coleoptera) and Diptera (Diptera) in the mountain forests of the Ile-Alatau SSPP

<table>
<thead>
<tr>
<th>Title</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground beetle family Toslak crucifers, or cruciferous beetle</td>
<td>Carabidae <em>Amara ovata</em> F. ++</td>
</tr>
<tr>
<td>The Family Burying Beetles Mertvoe treherbert</td>
<td>Silphidae <em>Phosphuga atrata</em> L. ++</td>
</tr>
<tr>
<td>The Family Of Rove Beetles Station</td>
<td>Staphylinidae <em>Xantholinus</em> sp. ++</td>
</tr>
<tr>
<td>Stafilin</td>
<td><em>Placusa</em> sp. ++</td>
</tr>
<tr>
<td>A Family Of Beetles Toddler-plane</td>
<td><em>Hololepta plana</em> Sul. ++</td>
</tr>
<tr>
<td>Family Of Moulders Moult flat</td>
<td>Pythidae <em>Pytho depressus</em> L. ++</td>
</tr>
<tr>
<td>Family Petraki Ants</td>
<td><em>Thanasimus formicarius</em> L. ++</td>
</tr>
<tr>
<td>The Family Oskolki Uscatescu bandaged</td>
<td>Colydiidae <em>Bitoma crenata</em> F. ++</td>
</tr>
<tr>
<td>The Family Of Click Beetles</td>
<td>Elateridae <em>Ampedus sanguineus</em> L. +</td>
</tr>
<tr>
<td>The click beetle red-winged</td>
<td><em>Ampedus sanguinolentus</em> Schr. +</td>
</tr>
<tr>
<td>Blood-spotted Nutracker</td>
<td><em>Lasius niger</em> L. +</td>
</tr>
<tr>
<td>The Family Of Monotonity Bestanca pokorova</td>
<td><em>Rhizophagus bipustulatus</em> F. ++</td>
</tr>
<tr>
<td>Family Of Glitter Glittery wood</td>
<td><em>Epuraea limbata</em> F. ++</td>
</tr>
<tr>
<td>Family Of Darkling Moorish booger</td>
<td>Tenebrionidae <em>Tenebroides mauritanicus</em> L. +</td>
</tr>
<tr>
<td>The Family Of Malesci Malashka copper, or bronze</td>
<td><em>Malachiidae Malachius aeneus</em> L. +</td>
</tr>
<tr>
<td>The Family Of Ctyri Latria red</td>
<td><em>Asilidae Laphria flav</em> L. +</td>
</tr>
<tr>
<td>Family – Greenfinches Bark fly</td>
<td><em>Medetera plumbe</em> Meigen, 1824 ++</td>
</tr>
</tbody>
</table>

### Table 6 – List of entomophages from the order of Hymenoptera (Hymenoptera) and Hemiptera (Hemiptera) in the mountain forests of the territory of the Ile-Alatau GNPP

<table>
<thead>
<tr>
<th>Name</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ants family</td>
<td>Formicidae</td>
</tr>
<tr>
<td>Red-breasted bore ant</td>
<td><em>Camponotus herculeanus</em> L. +</td>
</tr>
<tr>
<td>Tugai woodworm ant</td>
<td><em>Camponotus lameerei</em> Emery +</td>
</tr>
<tr>
<td>Black Lazius (Black garden ant)</td>
<td><em>Lasius niger</em> L. +</td>
</tr>
<tr>
<td>Mirmika Dzungar</td>
<td><em>Myrmica dshungarica</em> Ruzsky +</td>
</tr>
<tr>
<td>Mirmika red</td>
<td><em>Myrmica rubra</em> L. +</td>
</tr>
<tr>
<td>Sod ant</td>
<td><em>Tetramorium caespitum</em> L. +</td>
</tr>
<tr>
<td>Thin-headed Central Asian ant</td>
<td><em>Formica mesasiatica</em> Dlus. +</td>
</tr>
<tr>
<td>Brown ant</td>
<td><em>Formica fusca</em> L. +</td>
</tr>
<tr>
<td>The Braconids Family</td>
<td>Braconidae</td>
</tr>
<tr>
<td>Highbone Rider</td>
<td><em>Atanycolus genalis</em> Thom. +</td>
</tr>
<tr>
<td>Family Predators Crumb</td>
<td>Anthocoridae</td>
</tr>
<tr>
<td><em>Bedbug baby</em></td>
<td><em>Scoloposcelis pulchella</em> Zett. ++</td>
</tr>
<tr>
<td>Predator Family</td>
<td>Reduviiidae</td>
</tr>
<tr>
<td>Predatory bug</td>
<td><em>Coranus subapterus</em> De Geer +</td>
</tr>
<tr>
<td>Rinokor ringed</td>
<td><em>Rhynocoris annulatus</em> L. +</td>
</tr>
<tr>
<td>Family Shchitniki</td>
<td>Pentatomidae</td>
</tr>
<tr>
<td>Armagh alder</td>
<td><em>Arma custos</em> F. +</td>
</tr>
</tbody>
</table>

*Baby bug – has not previously been reported on the Tien Shan of Kazakhstan.*
Conclusion. Since the trade turnover with foreign countries is growing and we have a high probability of importation of quarantine and invasive species that threatens the green spaces of Kazakhstan.

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ІЛЕ АЛАТАУЫНДА ЭНДЕМИК ШРЕНКА ШЫРШАСЫНЫҢ ДІҢ ЗИЯНКЕСТЕРІ (SCOLYTINAE) ПОПУЛЯЦИЯЛАРЫНЫҢ МОНИТОРИНГІ

Аннотация. Макалада Іле Алатай ормандарының дің зиянкестерін (Scolytinae) олардың энтомофагтарының мониторингі бағалаңды.

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МОНИТОРИНГ ПОПУЛЯЦИЙ СТВОЛОВЫХ ВРЕДИТЕЛЕЙ (SCOLYTINAE) НА ЭНДЕМИКЕ ЕЛИ ШРЕНКА В ЗАИЛИЙСКОМ АЛАТАУ

Аннотация. В статье приводится мониторинг за популяцией стволовых вредителей (Scolytinae) и их энтомофагов в лесах Заилийского Алатау на территории Іле-Алатайского государственного национального природного парка.

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