# RESEARCH OF ANAEROBIC DIGESTION PROCESS OF COW MANURE AND PLANT-BASED WASTE

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Key words: biogas, cow manure, anaerobic digestion, biomass, Amaranthus retroflexus L., Amaranthus cruentus L.

*Anaerobic digestion of cow manure is characterized by low biogas productivity, therefore, it is necessary to improve technological parameters of this process. In this research, an increase of biogas output was due to a synergistic effect caused by a combination of technological (ultrasonic processing) and microbiological (immobilization of microorganisms) intensification methods. To immobilize microorganisms during biogas production, dried and cut biomass of Amaranthus cruentus L. stalks, Amaranthus retroflexus L., and sawdust were used. The experiments were carried out in a laboratory installation, on the mesophilic mode of fermentation (at a temperature of 37 ° C). One- factor analysis of variance was used to evaluate the reliability of the experimental data. The biogas output was 5.92 ml / g of VS in the control variant. The biomass of Amaranthus cruentus L. stalks turned out to be the most effective during anaerobic digestion; its use increased the gas output by 32.3%. Using the biomass of Amaranthus retroflexus L. stalks, the biogas output was 6.32 ml / g of VS, which is 6.8% higher than in the control. The application of sawdust deteriorated the course of anaerobic digestion process, which resulted in a decrease of biogas output by 39.4% compared to the control. In addition, the potential biogas output in this test is 1.5 times lower than in the tests with application of stems of the amaranth*

*family. In all experiments, a long lag phase from 14 to 26 days was observed. Parameters of the modified Gompertz model were obtained for all the experiments.*

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## STUDY OF THE WORKING BODY OF A RIDGE-SEEDER IN LABORATORY CONDITIONS

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Key words: *energy saving, energy, technology, soil, crop production, cultivation*

*The state of the issue and its analysis showed that the existing methods for tilling the field surface before sowing and the ridge method of sowing tilled crops are implemented by various tillage and sowing units, in particular, seeders equipped with working bodies in the form of flat rotating disks. However, there is still a problem of forming a soil ridge over seeds laid in the soil with the help of flat disks, which will satisfy the quality criteria. Therefore, the need arose for theoretical and experimental substantiation of the appropriate structural and operational parameters of the working body of the ridge seeder, the main element of which is a flat disk. We suggested using an innovative seeder for ridge*

*cultivation of tilled crops, which combines the operations of cutting weeds, loosening the soil, sowing seeds, as well as forming soil ridges above them with specified sizes and the required density. The article discusses the process of soil ridge formation by working bodies with flat disks in laboratory conditions. Considering the agrotechnical requirements and the physical and mechanical properties of the soil, a model profile of the soil hill formed during sowing, which conditionally can be accepted as ideal, has been adopted. For reliable quality assessment of the formed soil hill, original optimization criterion* $k_{сэ}$ *was used in accordance with agrotechnical parameters for sowing and position of the soil hill to the standard one. After practical implementation of soil hill formation by working bodies with flat disks and statistical processing of the research results, the corresponding equations were obtained in which the independent process factors were expressed both in natural and in coded values. After analyzing the equations, it was found that the coefficient* $k_{сэ\ max} = 0{,}92$ *is maximum when a flat disk with a diameter of 0.35 m is used.*

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# REDUCTION OF ENERGY UNIT COSTS FOR GRAIN ROASTING IN AN INSTALLATION OF CONTINUOUS TYPE

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Key words: *grain roasting, heat supply, electric heater, energy consumption, screw conveyor.*

*The article discusses the process of roasting of grain which is used as a component of animal feed in pig farms and other farms engaged in animal breeding. Currently, more than 50% of compound feeds may include roasted grain, since it is irreplaceable in nutritional value and can increase the weight gain of animals up to 30%. As a result of the analysis, it was found that there are almost no modern plants for roasting of grain which is used as a component of compound feed and only technical means for roasting coffee beans, peanuts, sunflowers and other bulk food products are known. Therefore, we proposed an installation of a continuous type for grain roasting with electric heating of grain by a contact method from a screw conveyor. The article describes the main features of the proposed design of the installation, describes the principle of its operation and the features of grain particle movement during heating. A theoretical formula has been obtained for determining the installation throughput, which was used for creating its physical model. The developed physical model of a continuous type installation with electric heating of grain was studied in laboratory conditions. As a result of the research, appropriate values of independent factors were obtained - the temperature of the screw conveyor and the time of grain roasting, at which* the

specific energy consumption is minimal - 76.2 J / (kg °C), and the developed installation allows high-quality roasting of 28 kg of grain per 1 hour.

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## SUBSTANTIATION OF THE RIDGE PROFILE FORM FOR CULTIVATION OF TILLED CROPS WITH APPLICATION OF RIDGE TECHNOLOGY

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Key words: *productivity, ridge technology, soil ridge profile, tilled crops, devices for soil ridge formation, natural slope angle.*

*The question of cultivating tilled crops using ridge technology is considered. The result is achieved by using a universal device for ridge formation and its post-sowing treatment. The distinctive differences of the proposed universal device are that compactors are made in the form of a tape spiral, the surface of which is a spherical segment. At the same time, the outer whorl of the spiral is closed in the form of a circle. A compacting-ripping element in the shape of a cylinder with spikes is installed in the central part of the device with the possibility of displacement. During work, it simultaneously compacts the soil in the above seed space, and also destroys lumps of large diameter, which contributes to better germination of the seeds. Based on the theoretical and laboratory studies, appropriate operating parameters of the universal device have been identified. With a compliance coefficient with the standard of 0.94, the proposed universal device forms a ridge of the following sizes: height - 0.115 m (standard - 0.12 m); the width of the lower base - 0.395 m (standard - 0.4 m); the width of the upper base is 0.155 m (standard is 0.16 m), the angle of inclination of the sides to the base is 44 degrees. (standard - 45 degrees.). A ridge of this shape is formed when the speed of the unit is 4.8 km / h, the spring compression force is 627 N, the angle of attack of the compactors is 12.9 degrees and displacement of the compacting-ripping elements by 0.083 m.*

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## INFLUENCE OF SEEDING AMOUNT AND SEEDING PERIOD ON BARLEY YIELD IN THE CONDITIONS OF TRANS-SAYANS OF IRKUTSK REGION

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Key words: barley, seeing time, seeding amount, harvest

*The results of barley cultivation of Acha variety in the conditions of the sub-taiga and taiga zone of Irkutsk Region at seeding amount of 4; 5; 6 and 7 million viable seeds per 1 ha are presented. Hydrothermal conditions of the growing season have a greater effect on grain yield than the sowing time and seeding amount. In case of early sowing time, the growing season of barley lengthens and dependence of the grain yield on atmospheric precipitation decreases. In case of standard sowing time (second decade of May) on fallow land in Trans-Sayans, grain harvest is provided by moisture reserves in the meter layer and is determined by the conditions of heat and moisture in the first half of barley vegetation. When choosing the sowing time, it is necessary to take into account the moisture reserves in the meter layer, and in case of low stocks, one should start barley sowing as*

*soon as possible, while the seeing amount on fallow land should be reduced by 30-35% of the recommended amount. In case of lower seeing amount, competition of cultivated plants is reduced and conditions are created to reveal the varietal potential of two-row barley. Due to an increase of productive bushiness of Acha barley, a fairly high productive stalk is formed, on average over 4 years, and grain yield is ensured at the level of 4.7 t / ha with early seeding time and 5.0 t / ha with standard sowing time.*

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# AGROMETEOROLOGICAL CONDITIONS OF DEVELOPMENT AND CAUSES OF WINTER CROP FAILURE DURING ACTIVE WARMING PHASE

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Key words: drought, productive moisture, productivity, temperature, precipitation, soil freezing, snow cover, winter crops, warming.

*Agrometeorological conditions of wintering of winter crops for 2016 / 17-2018 / 19, as well as additional spareness and death of winter plants in 2018/19 in the changing conditions of the regional climate are summarized. The relevance of the studies arises from importance of analyzing agrometeorological events that affect the wintering of crops and identification of main agrometeorological conditions in some years, which are a limiting factor in formation of crop yields and do not make it possible to fully reveal the adaptive potential of plants. The leading approach to the study of this problem was application of proven statistical methods, correlation and trend analysis, as well as a method of comparing, analyzing and summarizing data to identify the causes of significant yield decrease and death of winter crops in 2018-2019 agricultural year. Analysis of climatic conditions showed that over the past 105 years, in general, the average annual temperature increased by 2.0 degrees, while the average annual rainfall increased by 227 mm. These changes have a significant impact on the state of winter grain crops both during the growing season and during the dormant period in winter. Winter crops were more affected by snow mold and sclerotiniosis with an increase of rainfall and climate warming in autumn and winter. The main cause of plant*

*death was heavy rainfall on thawed soil in winter, which contributed to formation of rotting diseases, absence of effective rainfall in combination with wind activity and low relative air humidity in spring, sharp daily temperature drops and long spring frosts from -2 ° C to -9.5 ° C. Moreover, due to lack of precipitation and stable high temperatures, there were adverse weather conditions in autumn of 2018, during the sowing season.*

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## HARVEST FORMATION AND SPRING SOFT WHEAT GRAIN QUALITY IN BIOLOGIZATION OF CROP ROTATIONS OF THE FOREST-STEPPE OF THE VOLGA REGION

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Key words: *biologization, crop rotation, spring wheat, productivity, grain quality, field germination.*

*The aim of the research was to assess the harvest formation and grain quality of spring soft wheat in biologization of crop rotation of the forest-steppe zone of the Volga region. It is proved that in order to improve the water-physical, agrochemical and biological properties of the soil, to form a high-quality spring wheat grain harvest, it is recommended to develop grain-grass crop rotation with perennial grasses and with annual leguminous crops using alfalfa and peas as forecrops. The greatest density of plants, their preservation and survivability is formed in agrocenoses of spring wheat after peas, alfalfa and alfalfa-grain mixture in case of combined soil tillage at an increased level of nutrition - $N_{60}P_{45}K_{45}$. Our studies showed that the yield of spring wheat grain varied depending on the forecrops, the obtained data can be arranged in the following series: peas (3.86 t / ha) ≥ alfalfa (3.77 t / ha) ≥ alfalfa + brome (3.72 t / ha) ≥ spring wheat (3.36 t / ha) ≥ brome (3.18 t / ha). Awnless brome is the worst forecrop for spring wheat, so it is preferable to cultivate a mixture of awnless brome and alfalfa in grain-grass rotations. Spring wheat yield increased in case of combined soil tillage in the crop rotation. Increased nutritional background (straw + $N_{60}P_{45}K_{45}$) also increased productivity in comparison with the average level (straw $N_{30}P_{30}K_{30}$). Qualitative characteristics of grain increased after leguminous forecrops. The biologization system of agriculture in the forest-steppe zone of the Volga region will reduce the negative effect of technogenic intensification, contribute to reproduction of soil fertility and increase economic and energy efficiency of agricultural production.*

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## INFLUENCE OF MINERAL FERTILIZERS AND NAGRO PRODUCT ON FEED BARLEY PRODUCTIVITY

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Key words*: feed barley, liquid fertilizer mixtures, productivity, grain quality.*

*The aim of the study was to study the effectiveness of complex macro-fertilizers and NAGRO product, as well as their combinations in cultivation of feed barley in the forest-steppe of the Middle Volga. The applied factors positively affect water balance of feed barley plants. The greatest increase is provided by the use of NAGRO in combination with sulfur-containing mineral fertilizers. This parametre increases by 0.4-4.8% (2 hours), 0.7 - 4.4% (4 hours), 0.5-3.6% (6 hours). The germination energy in case of seed treatment with the test product increased by 0.5 - 1.6%, in relation to the control. The application of NAGRO product had a positive effect on laboratory germination, which increases by an average of 0.4 - 2.3%. Under the effect of the studied product, an increase of growth force occurs due to an increase of the length of germinal roots and seedlings. The greatest increase of dry matter in the test variants was observed in the phase of milk-wax ripeness. The applied factors contribute to an increase in productivity by 2.49 - 6.32 dt / ha, the highest increase to control is provided by*

*application of NAGRO in combination with complex sulfur-containing mineral fertilizers, which amounts to 21.5%. The growth regulator NAGRO has a noticeable effect on all elements of the harvest structure. The greatest grain-unit is observed if NAGRO is used in combination with sulfur-containing mineral fertilizers. The increase from the factors used was 7.0 - 24.0 g / L, depending on the variant. Protein content in barley grain increases from 0.07 to 1.20% under the influence of the studied factors. The total amount of amino acids increased when NAGRO product was used, both against a natural background and against a background of mineral fertilizers. The increase in comparison to the control is 0.22 - 3.64 mg / g.*

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## EFFICIENCY OF FILTRATION WASTE OF ULYANOVSK SUGAR FACTORY AS A MELIORANT OF ACID SOILS

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Key words: *leached black soil, soil acidity, liming, filtration waste, agricultural crops, productivity.*

*The paper presents results of studying the effectiveness of filtration waste of Ulyanovsk Sugar Factory as limy material for neutralizing the acidity of leached black soil. The studies were conducted on the territory of OOO "Khleborob" MO land in Ulyanovsk district. The soil of the experimental field is heavy-loamy leached black soil with pH of 5.52, $H_h$ - 6.65 mEq / 100 g of soil. The test scheme included three variants: 1. Control. 2. Filtration waste in a dose of 6.1 t / ha, calculated by hydrolytic acidity ($H_h$). 3. Filtration waste at a dose of 4.5 t / ha, calculated by exchange acidity ($pH_{KCl}$). The repetition of the experiment is four-fold, the total plot area is 88 $m^2$, record area is 54 $m^2$, plot location is randomized. As a result of the studies, it was found that application of filtration waste of Ulyanovsk sugar factory allows to reduce soil acidity in the first year after liming depending on the dose by 1,05-1,10 $pH_{KCl}$, in the second year by 0,47-1,25 and in the third year by 0.52-0.77. Soil liming with filtration waste significantly improved the nutritional (especially nitrogen) regime of leached black soil. A higher yield of barley was ensured by a dose of ameliorant of 4.5 t / ha in the first year of application, in the second and third years the same increase in grain yield was observed: winter wheat by 0.3 t / ha (17%), spring wheat 0.5 t / ha (11%).*

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# RESULTS OF RESEARCH OF ECOLOGICAL ADAPTIVITY AND STABILITY OF SPRING HARD WHEAT IN THE CONDITIONS OF THE SOUTH-EAST OF THE CENTRAL BLACK SOIL ZONE

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Key words: *spring hard wheat, variety, line, yield, plasticity, stability, adaptability*

*The purpose of the study is to assess the adaptive properties of spring hard wheat varieties for yield in the forest-steppe zone of the southeast of the Central Black Soil Zone. The article presents research results of adapted varieties of spring hard wheat for yield in the conditions of the southeast of the Central Black Soil Zone. Their plasticity and stability in different agrometeorological cultivation conditions is determined. According to the research results, varieties with various types of ecological plasticity were identified. The selection line 43/10 and the variety Donskaya Elegiya are environmentally plastic and have stable yields. There is a high probability of their usage in selection process for obtaining new genotypes with high adaptive potential. Elan variety, with bi <1 and* $Si^2$ *close to*

*zero weakly responds to improved external conditions (semi-intensive), but has a fairly high yield stability, it is also recommended for usage when creating varieties with high stable yield. It is also advisable to prepare line 43/10 as a new adaptive variety with high grain quality for state variety test.*

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## COMPOSITION OF RHIZOPLANE MYCOCENOSIS OF SPRING RAPE VARIETIES IN TRANS-URALS

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Key words: *spring rape, variety, micromycetes, rhizoplane, phytopathogens.*

*The article presents data on composition of rhizoplane micromycetes of spring rape varieties. The patterns of populating spring rape rhizoplanes with micromycetes, which were represented by populations of pathogenic and saprotrophic fungi, are studied. The dominant micromycetes include Aspergillus, Penicillium, and Cryptococcus yeast with abundance parametre of 14.0-60.0%. As for pathogenic micromycetes, this group included Fusarium and Alternaria genera with abundance of 22.0-50.0%. According to spatial frequency of occurrence, micromycetes were distributed by year as follows: in 2016, a high spatial frequency of occurrence of Cryptococcus yeast in Yubileiny, Kupol and Granit varieties was noted, which ranged from 32 to 60%, in addition, a high proportion of pathogenic fungi of Fusarium genus (18%) was noted in Granit and Start varieties. In 2017, the most frequent were phytopathogenic fungi of Alternaria genus and Fusarium practically in all varieties, saprotrophic fungi of Aspergillus*

*genus were observed in all varieties of spring rape, the spatial frequency of their occurrence in most variants ranged from 2 to 6%, and 16% on DLE variant. The possibility of using environmental parametres to analyze the structure of populations of rhizoplane micromycetes, which is important in the environmental direction of protecting oilseeds from diseases, is studied.*

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## HISTOLOGICAL CHARACTERISTICS OF GUTS OF AFRICAN SHARPTOOTH CATFISH (CLARIAS GARIEPINUS) IN CASE OF SPOROTERMIN PROBIOTIC APPLICATION

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Key words: industrial aquaculture, African sharptooth catfish, probiotics, histology, intestines.

*A high level of bacterial content in the environment and fish tissues is noted in industrial aquaculture at high densities due to high organic pollution by metabolites. Probiotics are used to reduce the level of pathogenic and conditionally pathogenic microbiota. The article presents results of research on usage and influence of "Sporotermin" probiotic on structural and functional characteristics of the intestines of fish when breeding African sharptooth catfish (Clarias gariepinus). The article describes results of histological studies on the effects of "Sporotermin" probiotic on cells and tissues of fish intestines. Analysis of the histological structure and documentation was performed using an Axio Imager.M2 universal motorized research microscope (Carl Zeiss, Germany). Based on the results of the studies, differences were found in structural features of the intestines of fish bred with and without application of Sporothermin probiotic. Thus, fish that did not receive the probiotic had a general tendency for the intestinal mucosa to change, there was also edema of the muscle layer of the intestinal wall and serous membrane. Thinning of the villi, a decrease of their length and branching, structural disruption, and destruction were revealed. Such pathological changes were absent in the intestinal tissues of African sharptooth catfish which received the Sporotermin probiotic. Studies have shown the effectiveness of "Sporotermin" probiotic application for prevention of disorders in tissues and cells of the intestines. Bacillus subtilis and Bacillus licheniformis bacteria, which are part of Sporothermin probiotic, normalize the structure of intestinal microbiocenosis, which provides parietal digestion. The number of conditionally pathogenic and pathogenic microorganisms that cause pathological changes in intestinal tissues is reduced due to balance restoration in the intestinal normocenosis.*

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## INFLUENCE OF SPOROTERMIN PROBIOTIC ON LIVER TISSUE OF AFRICAN SHARPTOOTH CATFISH IN INDUSTRIAL AQUACULTURE

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Key words: *industrial aquaculture, African sharptooth catfish, Sporothermin probiotic, liver histology.*

*The article discusses histological features of liver tissue of African sharptooth catfish bred in industrial aquaculture. Communities of fish bred with (experimental group) and without (control group) application of Sporothermin probiotic were studied. The histological structure was studied and documented using Axio Imager.M2 universal motorized research microscope (Carl Zeiss, Germany). It was found that there are distinctive features of cell structure that form the liver tissue of fish bred with application of this probiotic and without it. It was shown there was a histotopography disorder of the liver parenchyma, lipophanerosis in combination with signs of hepatocyte necrosis and hemorrhage in the vascular area in the control group. In addition, they also had a marked necrosis and a polarity loss in hepatocyte structure, erythrocytes are found in the vessels. The structure of liver tissue was not disrupted in the experimental group, where the fish received the feed containing "Sporothermin" probiotic. "Sporotermin" probiotic, which contains Bacillus subtilis and Bacillus licheniformis, allows to improve metabolism, increase fish organism supply with biologically active and building materials, ensure high-quality food digestion and reducing the level of potentially pathogenic microorganisms in fish organs and tissues, avoid increased bacterial content. This complex of positive properties of "Sporotermin" allows to reduce toxic damage to the liver that occurs when fish is bred in the conditions of high density.*

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## CONTENT OF FATTY ACIDS IN MUSCLES AND SPAWN OF AFRICAN SHARPTOOTH CATFISH IN SPAWNING PERIOD

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Key words: *African sharptooth catfish, spawning period, fats, fatty acids.*

*According to nutritional value, this fish is among the most valuable food products. The fish protein includes all essential amino acids, which determines its special value as one of the highest quality protein sources. However, chemical composition of the fish muscle tissue is subject to significant fluctuations in different periods of its life cycle. These changes are most marked during spawning period, when there is a switch to generative exchange. Our studies of nutritional value of African sharptooth catfish meat during spawning period showed that in*

*terms of protein content this species of fish gets into category of protein products which contain a full spectrum of essential amino acids; as for the fat content in muscle tissue, it can be classified as a fatty fish variety. According to our research results, the muscle weight of this fish species contains a high level of mono- and polyunsaturated fatty acids and is characterized by a high level of linoleic acid, which is an essential fatty acid. The content of linoleic acid in the muscles of sharptooth catfish is much higher than in the muscles of pink salmon. The content of linoleic acid in spawn of sharptooth catfish is seven times higher than in that of pink salmon. Spawn of sharptooth catfish also contains a large amount of oleic acid, which plays an important role in prevention of cardiovascular diseases. The results indicate high nutritional value and unique character of meat of African sharptooth catfish, even during spawning.*

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## AGE AND GENDER PARAMETRE DYNAMICS OF PERIPHERAL BLOOD OF AFRICAN SHARPTOOTH CATFISH

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Key words: aquaculture, sharptooth catfish, adaptogen, irkutin, leukocyte formula, erythrocytes, leukocytes.

*The aim of our research was to study peripheral blood composition features of African sharptooth catfish normally and in case of introduction of "Irkutin" adaptogen with feed, depending on age and gender. Irkutin increases resistance to*

*external negative influence, strengthens the immune system, normalizes the activity of the central nervous system and hormonal profile, stimulates energy and water-salt metabolism, activates growth, improves physiological state and strengthens resistance to diseases. The results of studies of peripheral blood parametres of African catfish in age and gender aspect are presented in our work. The object of the research was male and female sharptooth catfish at the age of 6, 12 months and two years. The control groups received the main ration, the test group received "Irkutin" with the main ration. Positive changes were noted in quantitative composition of peripheral blood cells in case of application of adaptogen in the composition of fish feeds. According to results of our research, Irkutin activated erythropoiesis and stimulated production of white blood cells - leukocytes. Gender and age-related features of the stimulating effect were also identified. Changes were observed in balance of lymphocytes, neutrophils, monocytes and polymorphonuclear cells in the leukocyte formula of sharptooth catfish in case of introduction of "Irkutin". It was found that "Irkutin" has a general stimulating effect on blood formation.*

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## BIOCHEMICAL PARAMETRES OF BLOOD SERUM OF CATS IN CASE OF CHOLANGIOHEPATITIS

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Key words: cats, cholangiohepatitis, biochemical parameters, hematology.

*Cholangiohepatitis is a common hepatic cats' pathology and it often leads to death. This disease is characterized by development of a bacterial or immune-mediated inflammatory process in liver parenchyma and bile ducts, secondary changes in metabolism, body intoxication, and formation of multiple internal pathologies. Dynamics of biochemical blood parameter changes of cats with cholangiohepatitis was assessed depending on severity level. The object of the study was cats with cholangiohepatitis (n = 51) and clinically healthy animals (n = 24). The diagnosis was made taking into account the history, clinical examination, morphological and biochemical analysis of blood, ultrasonography. The serum cats was studied: the concentration of total protein, protein fractions, bilirubin, glucose, total cholesterol, urea, creatinine, the activity of alanine and aspartate aminotransferases, alkaline phosphatase, gamma-glutamyl transpeptidase. The albumin-globulin correlation was calculated. It has been established that moderate azotemia with a frequency of 25.5%, hyperbilirubinemia in 35.3%, a significant increase of serum activity of alanine aminotransferase in 68.6%, aspartic aminotransaminase in 49.0%, gamma-glutamyl transpeptidase in 60.8%, alkaline phosphatase in 52.9%, hyperproteinemia in 17.6%, severe hypoalbuminemia in 25.5%, hypercholesterolemia in 37.3%, hyperamylasemia in 27.5%, hyperlipasemia in 33.3% of sick animals. Cholangiohepatitis of cats is characterized by development of marked hepatodepressive syndrome (hypoalbuminemia), cytolysis (increased activity of alanine and aspartic transaminase in blood serum), cholestasis (increased serum concentration of conjugated bilirubin, cholesterol, alkaline phosphatase activity and gamma-glutamyl transpeptidase fractions of globulins in serum), its degree increases in proportion to severity of pathology development.*

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## MATERIALS FOR DEVELOPMENT OF A BACTERIOLOGICAL TEST - SYSTEM FOR IDENTIFICATION AND DIFFERENTIATION OF YERSINIA RUCKERI BACTERIA

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Key words: Yersinia ruckeri, bacteriological test - system, identification, differentiation.

*The article presents results of studies on basic biological properties of Yersinia ruckeri bacteria with their subsequent selection to create a bacteriological test system for identification and differentiation of these microorganisms. This system is necessary for conducting epizootological monitoring of ERM infection (enteric redmouth disease) and for conducting veterinary and sanitary assessment of food products obtained on fish farms with this infection. According to results of the study, initially using Yersinia agar together with agar containing lactose as a carbon source and incubation at low temperature (22 ° C), an acceptable level of specificity of Y. Ruckeri identification data can be achieved. When studying the saccharolytic properties, it was found that the strains do not ferment lactose, sucrose, dulcite, sorbitol. But they had enzymatic activity on maltose, mannitol, and glucose. When studying enzymatic activity, the following conclusions were made: the strains are not able to ferment malonate, but they actively ferment lysine and urea. We consider the reaction to catalase to be positive, and the oxidase to be negative. The proposed research material was first carried out in our country, since this infectious agent and the infection it causes are not included in the list of infectious noso-units existing in the Russian Federation.*

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## RESEARCH OF BORDETELLA PETRII METABOLISM IN CASE OF GROWTH ON VARIOUS SOURCES OF CARBON AND NITROGEN

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Key words: *Bordetella*, B. petrii, biochemical properties, carbohydrates, amino acids.

*The article presents results of studies on the ability of Bordetella petrii bacterium of von Wintzingerode ATCC BAA-461 strain to metabolize organic and*

*inorganic substances as the only sources of carbon and nitrogen in a salt-based nutrient medium. According to the research results, it was found that B.petrii bacteria oxidize glucose, but do not ferment, when cultured for 48 hours at a temperature of 370° C. Also, bacteria of this type are able to use potassium nitrate as a source of nitrogen. It was found that bacteria produce free nitrogen. In case of growth in a medium with nitrate source, gas formation was observed. Bacteria of B.petrii genus use sodium citrate and sodium succinate as the only carbon sources in the nutrient medium. It was found that B.petrii bacteria are able to use L-arginine, L-cystine, L-proline, L-alanine as the only source of carbon and nitrogen in the nutrient medium. But they are not able to use L-glycine as a source of nutrients. The data obtained by us will be used later in construction of accumulation medium and selective medium for isolation and identification of B. petrii bacteria*.

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## MOLECULAR GENETIC CHARACTERISTICS OF F-43 UGSKHA AEROMONAS HYDROPHILA BACTERIOPHAGE

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Key words: Aeromonas hydrophila, bacteriophage, protein, molecular weight, proteome, sequencing.

*The history of study of Aeromonas genus bacteria, which is more than 100 years, continues active development nowadays. The article presents molecular genetic characteristics of Aeromonas hydrophila F-43 UGSKhA bacteriophage. Genome-wide sequencing of the bacteriophage was carried out to determine*

*potential genetic pathogenicity loci and it was found that the size of the bacteriophage genome was 36801 bp. while potential loci of pathogenicity were not revealed. According to results of bioinformational (proteomic) analysis on sequencing data of F43-UGSKhA bacteriophage, 46 potential proteins with a molecular weight of 4.6-137.6 kDa that have their localization in the phage genome were identified. Phylogenetic position of F43-UGSKhA bacteriophage was determined in the group annotated in the NCBI system. Annotated bacteriophage Aeh1, which is active against bacteria Aeromonas hydrophila, is the closest bacteriophage in phylogenetic position of complete genome and most potential phage proteins. As a result of the studies, a linear bacteriophage DNA map was compiled. In accordance with major analogues, gene expression products were determined. Also, gene products were identified that do not have clearly defined functional characteristics, the so-called hypothetical proteins that do not have an analogy in the annotated genomes of bacteriophages that are active against the studied bacterial type. Bioinformation analysis of correspondence of open reading frames (ORF) with sequencing data of the studied bacteriophage is presented. According to the results of studies, no pathogenicity loci were detected in the genome of F-43 of UGSKhA Aeromonas hydrophila bacteriophage.*

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## MOLECULAR GENETIC CHARACTERISTICS OF LISTERIA FL.M 4 ULGAU BACTERIOPHAGE

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Key words: Listeria, Listeria monocytogenes, listeria, listeriosis, foodborne pathogens, phage, bacteriophages, bacteria.

*The article presents results of genomic and proteomic studies of listeriosis bacteriophage FL.m. 4 UlGAU. The studied phage possesses a number of biological properties necessary for a production advanced bacteriophage: high lytic activity (according to agar layer method by Grazia 2.9 ± 0.1 × $10^{10}$ PFU / ml, according to Appelman $10^{-9}$), a wide spectrum of lytic activity ( 86.8%) and specificity. To confirm safety and original nature, FL.m. 4 ULGAU phage was sequenced and analyzed by genomic bioinformatics. The phage DNA genetic sequence thus obtained was compared with these genetic sequences presented in NCBI system. It was established that Listeria LP-083-2 phage gene turned out to be closest in homology. Based on genetic studies, the proteome of Listeria phage FLm4 bacteriophage was analyzed and its chart was compiled in accordance with the annotated genomes of bacteria and viruses based on triplet coding of amino acids. Each of the identified 109 proteomic components of Listeria phage FLm4 was compared with analogues and its phylogenetic mapping was compiled to look for similarities of possible pathogenicity loci. When analyzing the data of genetic and proteomic studies of bacteriophage Listeria phage FLm4 of ULGAU series, pathogenicity loci and their homologs were not detected. These results confirm its originality and safety and indicate the possibility of its further usage as a means of treating fruit and vegetable and other ready-to-eat products in order to increase storage life and prevent food poisoning.*

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## EXPANSION OF BACILLUS PUMILIS BACTERIA IN VETERINARY AND SANITARY OBJECTS

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Key words: identification, Bacillus pumilis, bacteria, samples, biochemical properties, isolates, phytopathogens

*The article presents results of a scheme development for isolation and identification of Bacillus pumilus bacteria and its testing. Based on recommendations of Bergey's Manual of Systematics of Archaea and Bacteria (2015), 74 strains of bacteria which we isolated were relegated to Bacillus subtilis group and typed as Bacillus pumilus after analyzing the following biological characteristics of the isolated bacterial strains: tinctorial and morphological properties, pigment and catalase production, growth potential under aerobic / anaerobic conditions, features of biochemical activity, including excretion enzymes that destroy the cell walls of plants. It was experimentally established that all*

*selected cultures do not significantly differ from each other according to the phenotypic parameters analyzed. However, those strains that were isolated from objects of the first and second groups (grain-flour and fruit-vegetable products) showed increased cellulolytic activity, in contrast to bacterial strains isolated from soil samples. Pectolytic activity of all isolated strains was visually recorded only after 72-96 hours in the form of halos around bacterial colonies. Analysis of the impact of adverse factors on the isolated bacteria showed that all isolated strains showed the ability to grow on meat-and-peptone agar containing 10% NaCl solution and in case of cultivation temperature decrease (growth was recorded at t + 10 ° C). However, it was noted that cellulolytic activity was actively represented in strains isolated from the first and second groups of samples (grain-flour products - 95 samples) and (fruit-vegetable products - 237 samples), but was absent in 22 soil isolates isolated from the third group (210 samples). The total percentage of contamination of 542 registered research objects amounted to 13.7%, where the percentage of insemination of grain-flour products is 12.6%, fruit-vegetable products - 16.8% and soil samples - 10.5%.*

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## DEVELOPMENT AND TESTING OF BACTERIOLOGICAL DIAGRAM OF BACILLUS CEREUS BACTERIA IDENTIFICATION

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Key words: *Bacillus cereus, bacteriological scheme, sign, test, identification, bacteria, sample*

*The article presents results of bacteriological scheme development for isolating Bacillus cereus bacteria from veterinary and sanitary surveillance objects and identification of bacteria as part of a complex test system for indicating and identifying zooanthropogenic bacteria of the Bacillus cereus group. Model microorganisms for selecting research parameters and bacteriological tests were reference strains of Bacillus cereus 8035, Bacillus cereus 2527, Bacillus cereus ATSS 14579. Based on the analysis of the following characteristics: endospore shape, spore extension of the vegetative cell, ability to move and form pigment, growth in aerobic and anaerobic conditions, the presence of catalase enzyme, biochemical activity and the presence of pathogenicity factors, 102 bacterial strains isolated by us were assigned to the first morphological group according to Gordon (1973), to Bacillus cereus group according to «Bergey's*

*Manual of Systematics of Archaea and Bacteria" (2015) and categorized as members of Bacillus cereus genus. Within 216 hours (9 days), using the developed scheme for isolation and bacteriological identification of Bacillus cereus bacteria, the above bacteria can be typed on the basis of 44 tests. 398 strains were isolated from 536 samples of objects of veterinary and sanitary supervision and the environment (210 soil samples, 67 - water from open reservoirs, waste water, 46 - animal feed for agricultural animals, 90 - spices and seasonings, 67 - milk and dairy products, 56 - meat and meat products) that were assigned to Bacillus genus and 102 to Bacillus cereus group.*

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## PRECONDITIONS FOR ISOLATION OF ESHERICHIA COLI O157: H7 BACTERIOPHAGES AND THEIR USAGE FOR INFECTION MONITORING, THERAPY AND BIOPROCESSING

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Key words: Esherichia coli O157: H, bacteriophage, biological properties.

*The article presents preconditions for isolation of Esherichia coli O157: H7 bacteriophages and their usage for infection monitoring, therapy and bioprocessing, thereby substantiating the direction of our research on isolation and study of biological properties of Escherichia coli O157: H7 bacteriophages. The results on isolation and study of its biological properties are presented. Two bacteriophages from wastewater of a pig breeding farm in Samara region were isolated. The isolated phages differed in morphology of negative colonies. According to Appelman, lytic activity of the isolated bacteriophages was* $10^{-5}$ *–*$10^{-7}$*, the titer of phage No. 1 was* $3.4 \times 10^{9}$ *according to Gratsia, as for phage No. 2, it was* $1.5 \times 10^{9}$*. The spectrum of lytic activity in relation to the studied cultures of phage No. 1 is 80%, and phage No. 2 is 100%. Selected phages are specific for E.*

*coli O157: H7 and are not active for representatives of other bacterial species. The degree of resistance of bacteriophages to inactivating factors of physical and chemical effects was studied according to methods proposed by I.M. Gabrilovich. As a result of the studies, it was found that heating of the phages at 60-80°C did not significantly affect the content of active phage corpuscles in 1 ml. When the phages were heated at 81–83 ° C, their activity decreased. At a temperature of 84–880 ° C, the number of negative colonies was counted from/to 10–$10^2$ phage corpuscles. Phagolysate was not found in 1 ml of phage above 88 ° C.*

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## TURKEY METABOLISM PARAMETRES IN CASE OF FEEDING THEM WITH MODIFIED ZEOLITE AND SOY OKARA

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Key words: turkey, supplement, metabolism, protein, enzymes.

*The purpose of the work is to study metabolic parametres of young turkeys when a complex supplement based on modified zeolite and soy okara is introduced into their ration. Young Hybrid Credmeyker turkeys were selected into analog groups of 10 in each for physiological test. For research and production test, 1,500 birds were taken. Young turkeys of 40..45 days old were divided into groups:*

*1st — control, 2nd — test group. The experiments were carried out in Ulyanovsk region on the basis of an agricultural enterprise. The feeding scheme was the following: the 1st group of turkeys was given only the main ration, as for the 2nd, a complex supplement was additionally introduced into the main ration at the dose of of 100 g per head / day. The study of hematological and biochemical parameters was carried out by modern methods using automatic analyzers. Blood was taken from saphenous axillary vein of birds before morning feeding. Data processing was carried out with "Statistika" program. A positive effect of the complex additive on morphological composition of turkey blood and the level of their metabolism, including increased anabolic processes, amino acid transamination reactions, enhanced glycolysis with a decrease of lipogenesis was stated.*

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## USAGE OF EXCHANGE ENERGY AND PROTEIN BY YOUNG PIGS IN CASE OF FEEDING THEM WITH COMBINED FEED WITH MINERAL ADDITIVE

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Key words: compound feed, mineral additive, metabolic energy, nitrogen, energy efficiency

T*he article presents results of studies of two scientific and economic experiments on giving compound feeds to young nursery pigs, which included high-protein feed and different doses of smectite tripoli. In the first experiment, young pigs in the test groups received 4.0% of dry milk whey in the combined feed instead of dried skimmed milk substitute and 1.5 and 2.0% of smectite tripoli as a substitute for Mikosorb-A, which was included in the control group feed. In the second experiment, the test groups received the same compound feed composition as in the first experiment, but natural mineral supplement was increased (smectite tripoli of 2.5 and 3.0%). With the same energy nutritional value of compound feeds, but with different doses of natural mineral supplements, the average daily gains were greater in the test groups that received additives of 2.0, 2.5 and 3.0%, respectively by 3.5% and 4.3 % in comparison with the control groups. In the experiments, the amount of nitrogen retained in the body of young pigs was established, which can be used to judge the intensity of protein metabolism and its use in product synthesis. When 2.0, 2.5 and 3.0% of smectite Tripoli, which is rich in minerals, was included in the feed composition, it contributed to nitrogen retention and its use in the first experiment, 3.7% more nitrogen was retained in the third group, nitrogen was retained by 10.8% in the second experiment in the second test group and in the third group by 15.0% more in comparison with the control, which affected the degree of protein deposition in meat. Depending on degree of nitrogen deposition in the body of young pigs, a part of growth obtained due to protein synthesis is determined. The results of calculating the efficiency of exchange energy usage in the body of young pigs in two experiments showed that caloric coefficient of production is greater in animals of the experimental groups and was 20.3-20.6% due to more economical consumption of exchange energy for*

*heat production. It was found during production check that the cost of production in the experimental group was lower by 1.5%, and the level of profitability was 4.6% higher.*

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# INFLUENCE OF PLANT-BASED FEED ADDITIVES ON GROWTH AND FEED COSTS OF BROILER CHICKEN

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Key words: compound feed, feed additive, broiler chicken, feed consumption.

*Search for new technologies to reduce breeding time, increase final live weight and reduce feed cost remains the main issue of broiler production development at the present stage. The effect of plant-based feed additive based on essential oils and plant substances on growth and feed cost, depending on application of various doses in the combined feed, was studied. The level of feeding and quality of feed eaten by the birds has a great influence on these parametres, that is, on growth and feed cost. As a result of scientific and economic experience, it was proved that application of plant-based feed additives helps to increase the average daily gain of live weight and reduce the feed cost per unit of product. The application of Biostrong 510 plant-based supplement based on the essential oils and plant substances increases the average daily gain by 4.3-8.4% and reduces feed costs from 0.07 to 0.13 kg of feed per 1 kg of weight gain. The best parametres were obtained with application of a plant-based feed additive based on essential oils and plant substances in the amount of 0.015% of dry matter of the feed.*

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## INTERAMINATION ENZYME ACTIVITY IN BLOOD OF FATTENED PIGS IN CASE OF APPLICATION OF AN ENZYME PRODUCT IN THEIR RATIONS

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Key words: pigs, enzyme product, blood serum, aspartate aminotransferase and alanine aminotransferase, amino acids, live weight, meat productivity.

Research on the effect of the enzyme product Natufos in rations of farmed and fattened pigs on the activity of interamination enzymes was carried out in the conditions of OOO Stroyplastmas-Agroproduct of Ulyanovsk Region. The enzyme product used at a dose of 100 mg per 1 kg of the grain portion had an ambiguous effect on the activity of aspartate and alanine aminotransferases in blood serum and the amino acid content in organs and tissues of the experimental pigs. Activity of aminotransferases was 36.15 ... 6.15% more in pigs which received the enzyme product than in the control analogues, which indicates an increase of assimilation processes in their body. It had an impact on the growth rate and reduction of time to reach a live weight of 100 kg for 12 days. As a result, pigs that were given the grain treated with Natufos product fattening, meat qualities and biological protein full-value favorably differed from the corresponding parametres of the animals in the control group. Pigs which didn’t receive expensive feeds (oilcake, fish, meat

and bone meal, protein and vitamin supplements) were not inferior to control animals in all respects, this suggests that the enzyme product Natufos enhances the extraction of nutrients from grain feed ration due to destruction of their phytate complex.

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# AND INTERRELATION OF PRODUCTIVE PARAMETRES OF YOUNG CATTLE OF MEAT PRODUCTIVITY DIRECTION IN CASE OF APPLICATION OF RUSMD MINERAL FEED SUPPLEMENT

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Key words: bull-calves, mineral supplement, productive parametres, influence power, correlation.

Issues of increasing animal feed efficiency, ration biological value, by means of rational use of supplements of different spectrum are the priority areas of research to intensify cattle breeding. Therefore, the study of rational use of mineral additives in animal nutrition and their impact on productive parametres is quite relevant. In this regard, the aim of the research was to study influence and interrelation of productive parametres of young cattle of Aberdeen-Angus and Hereford breeds that were given the developed mineral feed additive RusMD based on raw materials produced by OOO Uralkhim. The experiment was conducted at OOO «Luch» of Lebyazhyevsky district of Kurgan region. The main farm ration was used for young fattening animals in the control group, 1 experimental group – main ration with RusMD supplement at a dose of 150 g, 2 experimental group – main ration with RusMD supplement at a dose of 200 g. The feeding period of the supplement was 100-120 days, until the animals reached live weight of at least 420 kg. The interrelation between live weight and meat productivity parametres of experimental animals varied from 0.10 to + 1.00 under the influence of RusMD supplement. The additive had a significant effect on the live weight of bull-calves - up to 53 %, on meat parametres - up to 99 %, on meat quality parametres - up to 95 %.

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## INFLUENCE OF “TRAU” VITAMIN MINERAL PREMIX ON CAROTIN SUFFICIENCY FOR COWS IN WINTER HOUSING SEASON

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Key words: cow, premix, carotin, feeding, ration, experimental group, dosage, lactation.

Cows have high nutritional requirements in modern animal breeding. To achieve high rates of milk production and long-term economic use, they must be provided with a sufficient and suitable content of nutrient, mineral and biologically active substances in the ration. Various additives and vitamin-mineral premixes are applied into rations for this purpose. Scientific and economic experiment was carried out in OOO Niva of Oktyabrsky district of Saransk, on a dairy farm with tethered housing system. Black-Spotted breed cows with an average annual milk yield of 7.5-8 thousand kg took part in the experiment. The farm distributes feed in the form of feed mixtures twice a day. The rations were compiled according to the

detailed norms of RAAS taking into account chemical composition of local feed. Four groups were formed at the beginning of the dry period on the basis of analogues, 10 heads in each. According to the scheme of scientific and economic experiment for dry cows, the premix was given in the following doses: I experimental group - 100 g per head per day, II - 150 g and III - 200 g, the control group did not receive any premixes. As a result of the research, the appropriate dose of TRAU premix was established for pregnant and dry cows in the amount of 150 g per head per day. As a result, the amount of carotin in blood rises, reaching the physiological norm which is often not enough in the winter housing period in the rations of cattle. Lactation made adjustments after calving, but also the 2nd experimental group was the best according to physiological status and had serum carotin parametres according to reference values.

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# BREEDING VALUE OF SERVICING BULLS DEPENDING ON ADDITIVE AND NON-ADDITIVE INHERITANCE FORM OF THEIR DAUGHTERS' MILK YIELD

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Key words: servicing bull, milk yield, father domination, overdomination, regression, intermediate form of inheritance.

As a result of studies, a certain difference was established among bulls with different breeding categories in terms of milk productivity and reproductive ability of their daughters when a breeding herd of dairy cattle was created. Thus, daughters of improving bulls have the highest milk yield of 5392 kg of milk, which is more than that of their peers - daughters of neutral bulls by 366 kg, and daughters of degrading bulls by 764 kg, P <0.001. Daughters of neutral bulls surpass their peers of degrading bulls by 398 kg of milk, which is also significant at P <0.001. By the mass fraction of milk fat, the daughters of improving bull are slightly inferior to their peers (-0.01 ... -0.04%), but this difference among the groups is not significant. Parametres of milk productivity and reproductive ability of daughters of servicing bulls have certain differences depending on inheritance form of milk yield. So, the daughters of bulls-improvers (A1) had the highest milk yield - 6291 kg with overdomination, which exceeds the milk yield of daughters of the intermediate form of inheritance by 1333 kg of milk, P <0.001. In case of father domination, the excess of milk yield over the intermediate form of inheritance is 788 kg of milk, at P <0.001, and daughters that have regression inheritance form have significantly lower milk yield - 4003 kg of milk and 955 kg less than the latter, P <0.001. Daughters from bulls with a breeding category A1 have greater parametres of the desired type Yg and Ig, and their Ig index is

significantly higher (P <0.01), which indicates their better approximation to the desired type in terms of a set of economically useful traits. In case of father domination, the daughters of improving bull also surpass the daughters of neutral producers by 362 kg of milk and the daughters of degrading bulls by 931 kg (P <0.01). The integral parametre of $F_D$ reproductive ability of daughters of improving bulls was 0.6 and 1.05 more, and the coefficient of reproductive ability was almost the same in all groups.

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## EVALUATION OF INFLUENCE OF GENETIC FACTORS ON CROSSBREEDING RESULTS

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Key words: selection, Yaroslavl breed, milk productivity, crossbreeding, heterosis.

Interbreeding usage in order to improve Russian livestock in recent decades has become widespread. At the same time, an extremely high heterosis effect was established, which is demonstrated in higher productivity parametres of the cross-breeding cattle in comparison with the initial breeds. The aim of this work was to identify heterosis share effect by maternal and paternal basis factors, the blood level of the improving breed, as well as complex environmental effect of the “year of lactation” in the overall effectiveness of selection measures associated with crossbreeding. It was found that the share effect of the improving breed practically does not change for all genotypes and ranges from 0.39 to 0.44 depending on the genotype. The share effect of maternal breed is minimal in the group of animals

with Holstein breed blood content of 50% and is 0.15 and it is maximum in the variants of backcrossing. An increase of the maternal breed effect occurs due to a decrease of heterosis effect. The increase of the maternal breed blood level effect of 75% and higher is explained by multiple selection effect. Evaluation of crossbreeding results in the herd of OAO Stud farm named after Dzerzhinsky showed that the effect of the improving breed effect is stable and practically independent of changes in blood levels, while the effect of maternal breed changes both due to a decrease of heterosis effect and due to breeding measures that take into account the selection level of cross-bred animals. The heterosis effect is reduced both in case of an increase of blood level in Holstein breed and backcrossing. Animals with a blood content of improving breed of 75% or more (be = 0.25) are more susceptible to environmental factors, HP50% genotypes (be = 0.17) are less susceptible.

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