

EXPERIMENTAL SUBSTANTIATION OF OPERATING MODES OF CONVECTIVE INFRARED DRYING OF FLAX STRAW

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Key words: flax straw, combined drying, energy saving, drying agent, air parameters, heat.

The development of flax complex in Russia should be based on reducing the cost of fiber, while it is important to improve the quality of long flax fiber. The first process, on which the quantity and quality of flax fiber depends, is the drying of the straw to technological humidity. Federal State Budgetary Institution "Federal Scientific Center of fiber crops" conducts scientific work on the development of an energy-saving drying machine, which works by means of convective-infrared drying method. The article presents a structural and technological scheme of an innovative energy-saving drying machine for flax plants and a universal experimental drying unit, which in addition to three electric heaters has infrared heaters. We studied the drying duration of linen flax straw of normal aging degree using various modes, temperature change in the process and determined heat energy saving. The studies were carried out with various combinations of switching on electric heaters with infrared heaters and air flow - drying modes: mode 1 - convection with three electric heaters at a flow rate of the drying agent entering the flax straw of $2200 \text{ m}^3 / \text{h}$, average drying agent speed of $4.3 \text{ m} / \text{s}$; mode 2 - convection with three electroheaters at a flow rate of the drying agent of $2500 \text{ m}^3 / \text{h}$ and its speed of $4.8 \text{ m} / \text{s}$; mode 3 - combined (convective-infrared) when three electric heaters and two infrared heaters are turned on simultaneously, the flow rate of the drying agent is $2500 \text{ m}^3 / \text{h}$ and its speed is $4.8 \text{ m} / \text{s}$. Experimental drying graphics and dependence of air temperature changes of different states on drying duration are presented. According to the research results, the parameters and modes of flax straw drying necessary for development of an energy-saving drying machine which works by means of combined method are scientifically substantiated, the saving of heat energy of the drying machine is by 4.8 times.

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IMPROVEMENT OF THE EFFICIENCY OF DRYING PROCESS OF GRAIN DURING CONTACT HEAT SUPPLY

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Key words: *drying, grain, transporting working tool, contact heat, helix length, warming surface.*

The question of improvement of the efficiency of drying process of grain in contact grain drier is considered. The result is achieved by using of transporting working tool in the shape of Archimedes helix. As a result of patent constructional features more qualitative spreading of grains by unit fibers onto heating surface supply with the effective, uniform heating of cultivated product. Theory- based, that fulfillment of transporting working tool in the shape of Archimedes helix allows to supply qualitative grain heating in strictly fixed time duration . It is explained that during helix rotation each bruchid will move on the heating surface from periphery to the centre, having the same way length. This phenomenon determines the same time of transmission of given trajectory of each bruchid and supply them with uniform heating as the

result of multiple rotation around its radial axis during the action. Through this process target figures of quality of contact drying of grains are achieved. Control of theoretical suppositions is carried on created physical model. In this case developed experimental model allows to conduct research in determination of characteristics of drying grain process using different characteristics of determination of different variations of the following technological parameters: temperature of contact surface, speed of grain movement, residence time in dryer camera). Findings confirm high effectiveness of developed mechanic means for contact grain drying with SRW, made in the shape of Archimedes helix. At average temperature of 75 ° C and rate speed of SRW 87 min⁻¹ outgoings of heat on exhalation of moistness from grains are 4,5 mJ/kg, it is much less than commercial units used at present time in agricultural sector.

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YIELD AND FEED ADVANTAGES OF CHICKPEA IN CASE OF CULTIVATION UNDER THE CONDITIONS OF THE DRY-STEPPE OF THE TRANS-VOLGA REGION

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Key words: chickpea, seed treatment, growth stimulators, crop structure, mass of 1000 seeds, metabolic energy, productivity.

The results of studies for 2016-2018 are presented with an assessment of parameters of the crop structure, productivity and feed value of chickpea varieties: Privo 1, Volgogradsky 10, Volzhanin with different methods of treating crops with such growth stimulators as Growth matrix, Megamix Profi, Aminokat + Raikat Development. The multi factor experiment in studying different varieties of chickpeas, doses of mineral fertilizers and crop treatment during vegetation included: two backgrounds of mineral nutrition: control without fertilizers, fertilizer $N_{12}P_{52}$ (factor A); three varieties of chickpea: "Privo 1", "Volzhanin", "Volgogradsky-10" (factor B); treatment during vegetation: control (without treatment), growth matrix, Megamix Profi, Aminokat + Raikat Development (factor C). Studies have shown that all treatment variants increase chickpea productivity and harvest quality. The maximum yield of chickpeas was achieved by applying $N_{12}P_{52}$ for Volzhanin variety in the variant with treatment with Megamix Profi and Aminokat + Raikat Development during vegetation and amounted to 2.04 t / ha and 2.00 t / ha with accumulation of dry matter of 1.83 t / ha, digestible protein of 0.34 and 0.32 t / ha and a output of exchange energy of 25.19 and 24.81 GJ / ha, respectively.

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SOY PRODUCTION IN THE RUSSIAN FEDERATION: BASIC TRENDS AND DEVELOPMENT PROSPECTS

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Key words: *soybean, vegetable protein, harvested area, production volumes, productivity, import, export, products of soybean processing.*

In solving the global problem of deficiency of animal protein and replacing it with protein of plant origin, the leading position is given to soybean, which is a universal food, feed and industrial crop containing up to 48% of protein and up to 20% of fat, which makes it an extremely important agricultural raw material for strategic purposes. World soybean cultivation areas exceed 100 million hectares; they are cultivated in the main agricultural regions of 90 countries. World production of this crop reaches 300 million tons. Successful promotion is due to both its huge capabilities in food industry, and the agronomic and even environmental benefits compared to other crops. In recent years, sown areas of soybeans have expanded significantly in the Central region of Russia, largely due to adoption of the Targeted Sectoral Program "Development of Soybean Production and Processing in the Russian Federation for the Period of 2014–2020". Currently, the soybean harvesting area in Russia has reached 2.5 million hectares. So, if in 2000 soybean production volumes amounted to 340 thousand tons, then already in 2010 they reached 1 million tons, and by the end of 2018 they exceeded 3.6 million tons. The main region for soybean production in our country remains the Far East, where 70% of its crops are concentrated, and about 15% in the Central and Southern federal districts of the Russian Federation. The soybean yield in our country remains low and amounts to 15 dt / ha - according to this parametre, Russia is at the level of India and China, while in the countries of Central Europe, the USA, Argentina and Brazil, the soybean yield is 2–2.5 times higher. Currently, the State Register of soybean varieties approved for production in Russia includes about 250 varieties, of which 30% are foreign. However, the overwhelming majority of the country's soybean is of the Russian selection. Russian soybean is valued both domestically and on the world market, as it is grown from seeds that are not genetically modified.

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EFFECT OF URBAN WASTE WATER AND ITS COMBINATIONS WITH ZEOLITE CONTAINING AGRO ORE ON FERTILITY OF MEADOW BLACK-SOIL AND PRODUCTIVITY OF GRAIN-FALLOW-TILLED CROP ROTATIONS

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Key words: meadow-black soil, urban waste water, zeolite-containing ore, humus, nitrogen, phosphorus, potassium.

The study of the effect and aftereffect of urban waste water and their combinations with zeolite-containing agro-ore on fertility of meadow-black soil and the productivity of grain-fallow-tilled crop rotation was carried out at the collection site of FSBEI HE Penza SAU in 2014-2018. As a result of the studies, a positive effect of amelioratory norms of urban waste water and their complex use with zeolite-containing agro-ore on the content of humus, nutrients and crop productivity of grain-fallow-tilled crop rotation is established. At the same time, the maximum accumulation of humus and nutrients in the arable layer of meadow-black soil ensured a one-sided effect and aftereffect of urban waste water with rates from 100 to 180 t / ha and their combination with zeolite-containing agro ore. The content of humus increased by 0.18-0.39%, alkaline hydrolyzable nitrogen - by 42.4-93.6 mg / kg of soil, mobile phosphorus - by 19.1-33.8 mg / kg of soil, mobile potassium - 22.2-40.0 mg / kg of soil. The effect and aftereffect of urban waste water in combination with zeolite-containing agro-ore increased the productivity of grain-fallow-tilled crop rotation by 51.7-73.7%.

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WINTER CROPS IN KURGAN REGION

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Key words: winter crops, productivity, agroclimatic conditions, varieties, grain quality.

Research objective: based on the analysis of climatic conditions and varietal composition, to identify the possibility of practical use of winter crops in local conditions. The studies were performed at Kurgan Scientific Research Institute of Agriculture - a branch of the Federal State Budgetary Institution of the Ural Branch of the Russian Academy of Sciences, in the laboratory for wheat selection. The research material was varieties of soft winter wheat, winter rye, triticale, parameters of yield and grain quality of the selection laboratory and data of state plots of Kurgan region were used. Temperature conditions, dynamics of precipitation in

recent years in the Trans-Urals indicate an improvement in the bioclimatic potential for winter cultivation. In Kurgan region, areas for winter wheat were increased to 19.737 thousand ha in 2019, winter rye – 17.642 thousand ha, triticale - 1.689 thousand ha. The data obtained in the public network of Kurgan region for 2013-2018 show a higher yield of winter rye - 28.5 kg / ha and triticale - 30.7 kg / ha compared to winter wheat - 21.6 kg / ha . As a result of the selection of winter wheat at Kurgan Research Institute of Agriculture, a number of winter-hardy varieties adapted to local conditions were created, of which the varieties Albina 45, Umka were zoned, and a new variety Isaura was passed on for state testing. Characterized by increased winter hardiness, new varieties showed a yield increase on average from 2.6 to 5.0 dt / ha. Favorable conditions during the formation and filling of grain allow to get early high-quality grain with a gluten content of up to 30%. To increase grain harvest in the Trans-Urals, the rational combination of winter crops with spring crops is of great importance. The increase of winter crops of the total grain crops can be at least 10-15%.

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BIO-ENERGY AND ECONOMIC EVALUATION OF APPLICATION EFFICIENCY OF ZINC AND MANGANESE MICROELEMENTS IN THE TECHNOLOGY OF WINTER WHEAT CULTIVATION

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Key words: microelements, winter wheat, pre-sowing seed treatment, foliar treatment, economic and energy efficiency, mathematical model.

The article is devoted to assessing the energy and economic efficiency of the use such elements as Mn and Zn in winter wheat cultivation technology. The studies were conducted on the experimental field of FSBEI HE Ulyanovsk SAU. The soil of the experimental plot is leached black soil, medium loamy. The scheme of the experiment included 10 variants: 1. Control (water treatment); 2. $MnSO_4$ (pre-sowing treatment of seeds); 3. $ZnSO_4$ (pre-sowing treatment of seeds); 4. $MnSO_4 + ZnSO_4$ (pre-sowing treatment of seeds); 5. $MnSO_4$ (+ during vegetation) (pre-sowing seed treatment + foliar feeding of plants); 6. $ZnSO_4$ (+ during vegetation) (pre-sowing seed treatment + foliar feeding of plants); 7. $MnSO_4 + ZnSO_4$ (+ during vegetation) (pre-sowing seed treatment + foliar feeding of plants); 8. $MnSO_4$ _during vegetation (only foliar top dressing of plants); 9. $ZnSO_4$ _during vegetation (only foliar top dressing of plants); 10. $MnSO_4 + ZnSO_4$ _during vegetation (only foliar top dressing of plants). As a result of the studies (2013 - 2017), it was found that the use of these compounds contributed to yield increase with relatively low energy and economic costs. Profitability level exceeded control by 9.7 - 15.8%; 16.2 - 18.1% and 1.0 - 10.6%, respectively. The microelements used contributed to the increase in the amount of energy stored in the products. The variants with application of microelements were characterized by high energy efficiency in comparison with the control. The greatest economic effect was obtained when treating seeds before sowing and foliar application of microelements.

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EFFICIENCY OF MODIFIED FERTILIZERS FOR CULTIVATION OF AGRICULTURAL CROPS IN THE MIDDLE VOLGA REGION

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Key words: *biomodified fertilizer, oats, yield, biological product, nutrient utilization coefficient.*

A sharp reduction in use of organic and mineral fertilizers in agricultural technologies necessitates the search for additional nutritional sources for field plants. There is another side to intensification of agriculture - the use of high doses of mineral fertilizers is fraught with negative environmental consequences for the environment and product quality. The latter necessitates studies aimed at reducing doses of mineral fertilizers while increasing utilization rates of nutrients from them. The purpose of the work is to study the comparative effectiveness of mineral and biomodified mineral fertilizers, as well as Bisolbifit biological product in oats cultivation on leached black soil of the Middle Volga. The studies were carried out on the experimental field of Ulyanovsk Research Institute of Agriculture in 2016–2018 in a grain-crop rotation: clean fallow - winter wheat - spring wheat - barley - oats. The experiment scheme included 5 variants: 1) Control without fertilizers; 2) Bisolbifit - presowing treatment of seeds with a dose of 400-600 g / t; 3) NPK – Azofoska at a dose of 15 kg AI / ha; 4) NPKm - treatment of Azofoska granules with biological product at a dose of 15 kg AI / ha; 5) ½ NPKm - treatment of Azofoska granules with biological product at a dose of 7.5 kg AI / ha. Fertilizers were added to the rows when sowing the crop. The use of fertilizers was accompanied by an increase of NPK intake with oats gain and straw harvest: nitrogen - by 26-71%, phosphorus - 3 - 9% and potassium by 6-25%, with the main intake share from grain. Biomodification of Azofoska with BisolbiFit fertilizer allowed to increase the utilization rates of nitrogen from fertilizer by 4-8%, phosphorus by 7-16%, potassium by 5-15%. The yield of oats increased by 0.13 - 0.15 t / ha (2.15 t / ha in the control). The yield increase from a half dose of biomodified Azofoska was the same as from its full dose. The latter indicates the effectiveness of biomodification of mineral fertilizers.

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EFFICIENCY OF SELECTION OF SPRING SOFT WHEAT FOR YIELD INCREASE (ON THE EXAMPLE OF VARIETIES IN ULYANOVSK REGION)

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Key words: spring soft wheat, variety, variety change, productivity.

Spring soft wheat annually occupies an area of more than 100 thousand ha in Ulyanovsk region and it is capable of producing grain yields of more than 5.0 t / ha with good quality parametres. For effective use of selection achievements, it is necessary to conduct variety-change timely. The aim of the research was to study changes in the yield of spring wheat in selection process on the example of varieties recommended for cultivation in Ulyanovsk region in different years which make up the history of crop variety change. Field experiments were laid in 2014-2018. on the experimental field of the Federal State Budgetary Scientific Institution of Ulyanovsk Research Institute of Agriculture. As a material for the research, there was a set of 18 varieties of spring soft wheat, divided into six periods of variety change: 1 - Lutescens 62; 2 - Saratovskaya 36; 3 - Volzhanka, Kutulukskaya, Simbirka; 4 - Isheevskaya, L-503, Zemlyachka; 5 - Ecada 6, Ecada 70, Ecada 66, Simbirtsit, Margarita; 6 - Ulyanovskaya 100, Ecada 109, Ulyanovskaya 105, Burlak and Nikon. As a result of the studies, it was found that the varieties of each new stage of varietal change significantly exceeded the initial variety Lutescens 62 in terms of yield. The largest contribution to yield increase was provided by varieties of the fifth (+ 36%) and sixth periods (+43%), due to the high level of potential productivity realization of varieties

of their constituents. Varieties of the last period have the smallest yield fluctuations, depending on cultivation conditions, except Ecada 109. Regression analysis showed that with each cultivating period, the yield increased by 0.22 t / ha, with an increase of 16.2 kg or 0.56% per 1 year.

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WINTER RESISTANCE OF WINTER SOFT WHEAT IN THE FOREST STEPPE OF THE MIDDLE VOLGA REGION

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Key words: winter hardiness, winter soft wheat, selection, variety, productivity.

Winter hardiness is one of the main parameters for winter soft wheat. The aim of the research was to identify wintering factors in the forest steppe of the Middle Volga region and to assess the level of winter hardiness of the range of varieties of winter soft wheat of various ecological and geographical origin. The research material was 18 varieties of winter soft wheat included in the State Register of selection achievements approved for use in the Middle Volga Region and 102 variety samples transferred for study from the All-Russian Research Institute of Plant Production named after N.I. Vavilov. The laying of field experiments, winter hardiness assessment, and productivity registration of the range of varieties of winter soft wheat were carried out according to the methods recommended for variety testing. It has been established that among many stressful factors of the winter period which cause damage and death of plants of the studied culture, the most frequent in recent years is damping-out (40% probability). Reliable positive correlation dependencies of a strong and medium degree between winter hardiness and yield were established in years with stress factors in the winter period. It was revealed that the greatest differentiation in winter hardiness between the studied varieties of winter soft wheat was observed in years with the worst wintering conditions. Such varieties of winter soft wheat of domestic selection as Volzhskaya 16, Skipetr, Bagrationovskaya, Novosibirskaya 32, Novosibirskaya 51, Biyskaya winter, Filatovka, Kulundinka, Poema have a stable and high level of winter hardiness (4.0-5.0 points) in the forest-steppe of the Middle Volga region.

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INFLUENCE OF FORMATION PROCESS ON PLANT PRODUCTIVITY OF WINTER SOFT WHEAT HYBRIDS IN THE CONDITIONS OF WESTERN SIBERIA

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Key words: winter wheat, plant productivity, formation process, transgression, heritability, homeostaticity, variation coefficient, dispersion, correlation coefficient.

Formation in populations is the basis of successful selection of varieties created mainly by hybridization. Combining the dominant and additive genes of the new variety, a combination of economically valuable traits and properties is guaranteed, which enable to increase the reserve of productivity and resistance to stressful environmental conditions. The purpose of this work is to study and compare the influence of formation process in fissile hybrid populations F2 and F3 using the example of grain mass of soft winter wheat. Field experiment was carried out on the basis of the Federal State Budget Scientific Institution Siberian Research Institute of Agriculture in 2014-2015. The experiment was laid down in three-fold repetition. The object of the study was 5 varieties and 1 line (Zalarinka, Minsk, Splav, Fantasiya x (Donskaya ostistaya x Mutant 114) (hereinafter Fantasiya), Yubileinaya 180, Zhemchuzhina Povolzhhiya) of domestic

and foreign selection, as well as 30 hybrids obtained by full diallelic scheme. Parent forms were sown by 40 grains, hybrids F2 and F3 - 200 grains of each hybrid. The area of plant nutrition is 10 x 20 (cm²). The forecrop was coulissee fallow. 30 elite plants were selected in each variant, plant productivity was studied after harvesting. The following parameters: average (\bar{X}), Variance (σ^2), coefficient of variation (V), homeostatic coefficient (Hom), heritability coefficient (H^2), and transgression frequency (T_f) were studied. It was revealed that productivity of soft winter wheat is determined by the properties of the parent forms, the interaction of the nucleus and cytoplasm, weather conditions and the generation of hybrids. The level of productivity and heritability increases, whereas variation decreases to the third generation. A significant positive correlation between productivity and homeostaticity indicates the possibility of combining indicators of high adaptability and productivity in one genotype. The yield of transgressive forms is higher in productive populations. The frequency of transgressions is higher in hybrids with participation of Splav variety cytoplasm in F2, and in F3 hybrid combinations showed themselves on the background of Minskaya cytoplasm.

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INFLUENCE OF PRE-SOWING SEED TREATMENT ON PRODUCTIVITY OF SPRING WHEAT

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Keywords: spring wheat, variety, pre-sowing treatment, growth regulators, treatment agents, pests, diseases, productivity

A comparative assessment of effectiveness of preparations for pre-sowing seed treatment as regulators of phytosanitary state of agroecosystems and spring wheat productivity of different zoned varieties was carried out for the conditions of the forest-steppe of the Middle Volga region. Field germination was actively increased when treated with Epin Extra, HB 101, succinic acid and Zircon. The growth regulator HB 101 effectively reduced the damage to agroecosystems by the striped flea. The growth regulators Epin Extra, succinic acid, and Zircon also significantly reduced the crop dying due to Delia platura. The data for the period of the studies reflect a certain positive effect for reducing damage to spring wheat crops by shield-backed bugs in agroecosystems where seed treatment with such growth regulators as Immunocytophyte, Epin Extra and HB 101 was used. Chemical protectants - Maxim and Vitaros steadily reduced infection rate with root rot pathogen colonies. Growth Regulators Immunocytophyte and Epin Extra also significantly reduced the population of root rot, especially on low-infected grain. Root rot pathogens were more effectively suppressed by succinic acid as the growth regulator in the agroecosystems of Kinelskaya Yubileynaya and Kinelskaya Niva varieties, and by Zircon in Kinelskaya Otrada variety. To obtain a stable phytosanitary situation in the agroecosystems of the studied crop, cultivation of Kinelskaya Yubileynaya spring wheat variety with pre-sowing seed treatment with the growth regulator Epin Extra is recommended in the Middle Volga region.

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INFLUENCE OF PLANT PROTECTION MEANS ON SOIL MICROFLORA AND YIELD OF SPRING BARLEY

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Keywords: *spring barley, productivity, plant protection, pathogens, saprotrophs, antagonists, microflora, micromycetes fungi, Extrasol, Flavobacterin, EcoOgranika, Sertikor.*

The use of plant protection products is one of the ways to combat pests (especially root rot), which is now the most relevant and promising way to increase the yield of grain crops. The aim of our research was to search for effective remedies for seeds and crops of spring barley and to reduce the micromycetic complex of phytopathogenic fungi and root rot pathogens. To achieve it, it was necessary to solve the following problems: to reveal the dynamics of the pathogenic composition of microflora and to reduce the phytopathogenic complex in the rhizosphere of spring barley, by activating the saprotrophic and antagonistic soil microflora, to establish the most promising remedies for pre-sowing treatment of seeds and crops of spring barley in the conditions of the Mari El Republic. As a result of the studies, a positive effect of pre-sowing treatment of barley seeds and crops with plant protection products on the microflora of the soil environment and crop productivity was established. Pre-sowing treatment of seeds with a tank mixture and spraying of crops with biological products reduces the pathogenic complex of root rot pathogens in all phases of plant development from 29.8 to 19.1 thousand CFU / g of soil, increasing the number of saprotrophic and antagonistic soil microflora from 62.7 to 167.9 thousand CFU / g of soil. The most effective seed treatment is with a tank mixture of Sertikor, suspension concentrate (1 l / t) + EcoOrganica, liquid (0.2 l / t) (increases productivity by 11.0%) and spraying of crops during vegetation (seedlings, tillering, heading) with EcoOrganica, liquid (0.5 l / ha) (increases productivity by 10.4%).

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**CYTOGENETIC HOMEOSTASIS AND HEMATOLOGICAL PARAMETERS OF
AFRICAN SHARPTOOTH CATFISH (CLARIAS GARIEPINUS) IN CASE OF
APPLICATION OF SPOROTERMIN PROBIOTIC**

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Key words: industrial aquaculture, African sharptooth catfish, hematological parameters, cytogenetic homeostasis, micronucleus test.

The article considers the prospects of using Sporothermin probiotic in African sharptooth catfish breeding in industrial aquaculture. "Sporotermin" is the last generation probiotic based on spore forms of cultures of microorganisms of Bacillus subtilis and Bacillus licheniformis with lactose as a filler. "Sporotremine" exhibits an immunomodulating effect, has an anti-stress effect, normalizes intestinal microbiocenosis, stimulates the growth and increase of body weight, increases vitality and survivability. The aim of this work was to study the effect of "Sporotermin" probiotic on hematological parameters and cytogenetic homeostasis of African sharptooth catfish (Clarias gariepinus) in industrial aquaculture. The hematological parameters of sharptooth catfish were assessed using standard methods, cytogenetic homeostasis was determined using a micronucleus test. The results of our studies showed that sharptooth catfish bred with application of Sporothermin probiotic have an increase in hemoglobin, alanine and aspartic transferases and total protein. All these parameters influence the survival and growth rate of sharptooth catfish. The study of cytogenetic homeostasis revealed that the use of the

Sporothermin probiotic leads to a decrease in the number of disorders at the cellular level. When using sporotermine, the number of cells with micronuclei of the “standard” type decreased from 0.4% to 0.075%. Cells with “attached” micronuclei, as well as “chromatin thread connected to the nucleus”, with unformed nuclear material in the form of sticks, with formation of nuclear material of significant size in the form of a round shape were absent.

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THE INFLUENCE OF TREKREZAN ON LEUKOCYTE FORMULA STRUCTURE OF SHARPTOOTH CATFISH IN CASE OF BREEDING IN BASIN AQUACULTURE

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Key words: aquaculture, African sharptooth catfish, trekrezan adaptogen, leukocyte count formula.

The work is devoted to study of trekrezan adaptogen influence on physiological processes in fish organism. In particular, the effect of trekrezan on content of the white blood cells of African catfish was evaluated. The leukocyte formula of African catfish is currently not well studied. The aim of our work was to study the leukocyte formula of African catfish in normal conditions and with the use of trekrezan adaptogen. White blood cells perform many functions in the body. Every type of white blood cell has many varieties, each of which solves its own specific tasks. The main function of white blood cells is to protect the body from everything foreign. Our results indicate that the leukocyte formula of African catfish is of lymphoid type. The content of lymphocytes reaches 84.9 - 88.9%. Minor differences in leukocyte formula structure of males and females were revealed. With the use of trekrezan adaptogen, a tendency toward an increase in the proportion of lymphocytes was observed due to a decrease in the proportion of monocytes. Trekrezan induces the production of interferons, increases the immune status of the body, activating cellular and humoral immunity. It strengthens the body immune system and increases resistance to adverse environmental factors. In our studies, trekrezan proved to be a mild, effective immunomodulator. Trekrezan influenced the functions of lymphocytes which already exist in the bloodstream, activating their activity, slightly increasing their number, but not so much that functionally immature lymphoid cells appear in the bloodstream.

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METAMERIC ELECTROREFLEXOTHERAPY IN CASE OF BRONCHOPNEUMONIA OF CALVES

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Key words: calves, bronchopneumonia, biologically active points, electroreflexotherapy, blood.

Objective: to determine the projection of biologically active skin points of sternum and costal areas on the respiratory muscles and study the effect of electroreflexotherapy in case of calf bronchopneumonia. The object of the research was Holstein calves aged 3-5 months with pronounced clinical signs of bronchopneumonia. Animals were divided into two groups: control and experimental. General therapy applied to all animals; as for the experimental group, calves were additionally treated with DiaDENS-PK device on biologically active points. The entire research period was carried out under the control of biochemical, hematological and immunochemical blood parameters, a comparative analysis of which was carried out in accordance with generally accepted physiological standard values before and after the experiment. The research results showed that the complex treatment of calf bronchopneumonia

with the use of metameric electroreflexotherapy contributes to a significant increase in the levels of IgG and IgA, a decrease in the level of IgM; an increase in albumin and lymphocyte parameters with a decrease in the percentage of segmented white blood cells and globulin fractions. Thus, the proposed complex method of treating bronchopneumonia of calves causes complex homeostatic changes in the body from the immune system, metabolism, and liver function, which helps to reduce general intoxication of the body with inflammatory products, reduce blood vessel porosity, reduce exudation, and restore microcirculation, thereby increasing therapeutic efficiency.

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SOME CRITERIA FOR LYMPHATIC NODES OF HEART AND LUNGS DURING EXPERT EVALUATION OF RABBIT PRODUCTS

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Keywords: rabbits, lymphatic nodes, cardiovascular system, respiratory system

Rabbit products are subject to mandatory post-slaughter veterinary and sanitary examination, which examines the internal organs, muscles, special attention is paid to the lymphatic nodes. Studies were conducted on the basis of Altai State Agrarian University, Altai State Medical University. The object of the research was regional lymphatic nodes of heart and lungs from 56 clinically healthy rabbits, aged from 0.6 to 1 year old of “White Giant” breed kept in vivarium conditions. Research methods: registration of the animal; eutanasia; autopsy; preparation of lymphatic nodes with description of topography features; morphometry and classification; statistical processing and analysis of the data. Difficulty in visualizing lymphatic nodes is in their anatomical proximity to adipose tissue or thymus. For regional lymph nodes of heart and lungs, we use the concept of “group of lymphatic nodes” - a segment of the lymphoid bed, which consists of the central (largest) and peripheral (cranial and caudal) lymphatic nodes on afferent and efferent lymphatic vessels, as well as lymphatic vessels connecting lymphatic nodes in a single group. The adipose tissue in the chest cavity of the studied animals is white-gray, homogeneous, soft, moist on the cut, and transparent drops of fat are clearly visible on the scrape. The thymus tissue is grayish-cherry in color, with a pronounced lobed structure, soft consistency, moist on the cut. Large lymphatic nodes can be identified by the following criteria: a part of the lymphatic node bulges out above the surface of adipose tissue, has a more grayish or yellowish color and a denser consistency than the surrounding tissue. For visualization of peripheral lymphatic nodes, it is necessary to make several deep cuts of the surrounding tissue

and, at the site of the node, on the background of a homogeneous adipose tissue of white or gray or grayish-cherry thymic tissue, roundish-oval formations of grayish-yellow color will be distinguished, i.e. the lymphatic nodes.

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STUDY OF BIOLOGICAL PROPERTIES OF PSEUDOMONAS STUTZERI BACTERIA

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Key words: bacterium, Pseudomonas, Ps. stutzeri, tinctorial properties, cultural properties, biochemical activity.

The article presents results of a study of the biological properties of bacteria Pseudomonas stutzeri. These microorganisms are important due to features of their metabolism, as they affect the processes of metal conversion, degradation of biogenic xenobiotics and are capable of causing diseases. At the moment, the question is about obtaining a fast and highly

specific method for differentiation of Ps. stutzeri bacteria. The work was performed on strains of Ps. stutzeri under registration numbers 1-03, 2-06, 3-92, 4-04, obtained from the collection of the museum of bacterial cultures of the Department of Veterinary medicine of Ulyanovsk State Agrarian University. Laboratory equipment, glassware, culture media and reagents were used. As a result of the studies, tinctorial, cultural properties and biochemical activity of Ps. stutzeri bacteria were studied. Most of the research results (morphological, tinctorial properties, growth on beef-extract agar-agar at 5 ° C, 37 ° C, 42 ° C, growth in the absence of free oxygen, splitting of cystine, urea, starch hydrolysis, utilization of sodium citrate, oxidase and catalase test, mannitol, glucose, lactose, arabinose, xylose, maltose) are confirmed in scientific literature. However, some of the results obtained from our own biochemical studies of Ps. stutzeri (gelatin thinning, hemolysis, rhamnase, sucrose, sorbitol, growth at 26 ° C) do not coincide with published data. In our own studies, new results were obtained on cultivation of Ps. stutzeri bacteria on beef-extract broth, the formation of hydrogen sulfide, their growth at 8 ° C, 11 ° C on beef-extract agar-agar, the characteristics of bacterial colonies on a medium with yolk and milk.

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CHARACTERISTICS OF SOME BIOLOGICAL PROPERTIES OF FBM-8 UGSKHA BACTERIOPHAGE

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Key words: *bacteriophage, Bacillus pumilis, HBL enterotoxin, primer system, genome*

The article presents results of studies on the molecular genetic characteristics of Bacillus pumilis FBm-8 UGSKhA bacteriophage in order to confirm its originality, virulent nature to determine the appropriateness of its use as part of a biological product that will potentially be used in treatment of fruit and vegetable products and to develop a HBL enterotoxin detection system in the genome of bacteriophages specific for Bacillus pumilis. A linear DNA map was compiled for a three times sequenced bacteriophage, with a decoding of the coding regions of the genome. Mapping was performed for genes for which homology was determined and not defined. It was established that the qualitative composition of the proteins of the studied bacteriophage corresponds to those of annotated analogues and has clear homology of the nucleotide and amino acid sets. It was determined that the use of phenol-chloroform extraction leads to the best yield of template DNA. Based on the conserved regions of the gene, primers were selected for detection of the HBL enterotoxin gene by PCR, since the position of horizontal transfer of pathogenicity factors in bacteria of Bacillus genus is one of the most important enterotoxin. Primer characteristics: direct primer (f) 5'-3' - GAGATGCAAAAATTAATGCGGCG; reverse primer (r) 5'-3' - TGCGATTCCTAGCGGAGTTC; the calculated melting temperature of the direct primer is 60.0 ° C; the estimated melting temperature of the reverse primer is 59.9 ° C; theoretical specificity - Bacillus pumilis; the length of the amplified part (bp) is 366. As a result of the studies, we developed a PCR system to indicate the presence of the HBL gene fragment enterotoxin, which allowed us to determine that the fragments of the virulent HBL gene enterotoxin of Bacillus bacteria in the genome of Bacillus pumilis FBm-8 UGSKhA bacteriophage was not found, which indicates its possible use as part of a biological product developed for treatment of fruits and vegetables.

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EXPERIMENT OF TREATING DOGS' TUBULAR BONE FRACTURES IN CASE OF MUTUAL USAGE OF BIOCOMPOSIT AND LIGHTWEIGHT DESIGN OF THE EXTERNAL FIXATION DEVICE

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Key words: limb bone fractures, small domestic animals, tubular bones, external fixation device, nanostructured materials, complex phage preparations, carbon fiber cloth, small-size rings, reduction of fracture adherence time.

Despite more than half a century time of using external fixation devices, with prototype of Ilizarov's classic device, there is still room for a search for new and original solutions in treatment of animal bone pathology. After analysis of one hundred objects (cadaveric material and clinical cases) of animal limbs, appropriate sizes for production and testing of external fixation device rings were determined. There are 6 sizes for animals from 2-3 kg to dogs up to 50 kg. The material is selected based on the principle of strength and weight parameters. For dogs and cats of small weight up to 2 kg, light materials are used (carbon fiber or titanium alloy, the weight of one ring does not exceed 7 g.) For large animals, rings are made of stainless steel of sufficient thickness. The technological and production solution for manufacture of the set was made by Ulyanovsk branch of Tupolev design bureau under the supervision of its director Stanislav Ryzhakov. For treatment of limb bone fractures of small domestic animals (heterogeneous and of different ages), we used rings from the experimental set of external fixation device with dimensions as close as possible to the anatomical thickness of the limbs of dogs and cats. Application of carbon-plastic fiber in production of rings of the smallest diameter made it possible to reduce the weight of the general structure of the external fixation device by 5-7 times. Intraoperative injection of the LitAr nanostructured hydroxyapatite-collagen material into the fracture site in combination with antibiotics or complex phage preparations made it possible to carry out treatment without possible complications. Mutual use of these two factors resulted in reduction of adherence time of uncomplicated fractures of limb tubular bones 5-7 days earlier than in the control group.

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**INFLUENCE OF BLOOD INFLOW OF THE RED DANISH BREED TO BESTUZHEV
BREED ON MEASUREMENTS AND BODY INDEXES OF THE OBTAINED
CROSSBREEDS**

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Key words: *breed, Bestuzhev, Danish red, blood flow, first-calf heifers, exterior, measurements, body index.*

The article presents results of blood inflow of the red Danish breed to Bestuzhev breed, and its effect on measurements and body indexes of the obtained crossbreeds. As a result of blood inflow, crossbred heifers were superior to purebred in height of withers (by 0.58%) and rump (by 0.36%), they had a wider (by 4.80%) and deeper chest (by 1.60%) , a larger oblique body length (by 1.97%), as well as increased parameters of the ischial tubercles (by 2.94%) and hips (by 3.64%). The body indexes of crossbred heifers are greater than those of their Bestuzhev peers, in particular, their elongation and boniness are 1.39% and 0.28%, chest and pelvic indexes - 3.15%, and 1.12%, and such indexes as high-leggedness, blockiness, and overgrowing are lower, respectively, by 1.16%, 0.42, and 0.21%. The presented body indexes indicate that cross-breed animals are more prone to a milk-meat type of body build than purebred ones. Thus, the data presented shows that the blood flow of the red Danish breed to Bestuzhev breed had a positive effect on the exterior of the offspring, which resulted in an increase of its measurements and body indexes and, accordingly, live weight and milk productivity parametres. Consequently, this method of crossing is advisable to use in breeding work with Bestuzhev cattle.

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POLYMORPHISM OF CALPASTATINE GENES AND SOMATOTROPIN OF KALMYK FAT- TAILED BREED AND CROSSBREED (½ KALMYK FAT- BREED + ½ DORPER)

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Key words: *Sheep, polymorphism, genotyping, alleles, genotype, calpastatine, somatotropin.*

In the article research of gene polymorphism CAST and GH is shown, specifying features of productive biological characteristics of sheep with the blood ½ kalmyk + ½ dorper. Biological material for the study of gene polymorphism CAST and GH was the blood of 10 units of mongrel young sheep (½ kalmyk + ½ dorper), belonging to LLC «Farm firm «Aduchi» of Tselin district in Kalmyk republic. Genotyping was conducted in laboratory of immune genetics and DNA-technologies All Russian research institute of sheep and goat breeding branch of FSBSI «North-Caucasian Fnac» in 2019. DNA of whole blood of young sheep was detached with the use of panel Diatom™ DNA Prep 200 (IsoGeneLab, Россия) as requested in instruction of given manufacturing company. Polymorphism of gene Calpastatine is shown by alleles M and N, frequency of which was 0,65 and 0,35; genotypes MM, MN – 30 and 70% appropriately. Positive genotype NN was not found. During it almost the same frequency of desirable allele N (0,35) calpastatine gene and B (0,40) growth hormone is followed. Accordingly distribution of alleles M (0,65) and A (0,60) was uniform. Frequency of occurrence of heterozygous genotypes by gene CAST was 0,7. At that moment by gene GH the following frequency allocation of genotypes is seen. Degree of incidence of homozygous AA and heterozygous AB genotypes was equal and made 0,4, herewith degree of incidence of desired

homozygous BB genotype was 0,2. Evaluation of genetic structure of studied stock showed, that among studied animals the most frequent are sheep with complex genotype $CAST^{MN} GH^{AB}$ (40 %). Portion of genotype $CAST^{MM} GH^{AA}$ and $CAST^{MN} GH^{AA}$ happens to 22,2%. To 10% happens to genotypes $CAST^{MM} GH^{BB}$ and $CAST^{MN} GH^{BB}$.

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ADAPTATION OF HOLSTEIN BREED OF THE DUTCH AND AMERICAN BREEDING IN THE NORTH CAUCASUS IN CASE OF LOOSE HOUSING

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Key words: cows, Holstein breed, loose housing, heat resistance, coefficient of adaptation, blood composition, resistance.

The article presents results of the studies on adaptive abilities of Holstein breed of the Dutch and American breeding to the conditions of the North Caucasus region with loose housing year-round. Initially, Holstein animals of the Dutch selection had higher parameters than their American peers in hemoglobin, erythrocytes, leukocytes and total protein in blood; their superiority over American peers was 13 g / l ($P > 0.999$), $0.9 \times 10^{12} / l$ ($P > 0.99$), $0.9 \times 10^9 / l$ ($P > 0.95$) and 9 g / l ($P > 0.99$), respectively. In the second year of the adaptation period, these differences were 11 g / L ($P > 0.99$), $1.0 \times 10^{12} / L$ ($P > 0.999$), $1.2 \times 10^9 / L$ ($P > 0.99$) and 10 g / l ($P > 0.99$). In the third year of breeding in the new living conditions, the intergroup differences are smoothed out, but again with the advantage of Holstein imported from Holland. More intense phagocytosis was shown by Dutch selection heifers, which turned out to be 8.2 abs. percent higher than that of peers of American selection ($P > 0.99$), as well as bactericidal and lysozyme activity of blood serum - by 8.8 abs. percent ($P > 0.99$) - 6.9 abs. percent ($P > 0.99$), respectively. As a result, adaptation coefficients of Dutch Holstein breed were obtained at the level of favorable values (no more than 2 units) recommended by M.V. Benezra, as for their

peers of American origin, they exceeded the optimal level by 0.18 units. Differences between groups in the analyzed coefficient amounted to 0.31 units. ($P > 0.999$), which indicates an intense process of adaptation of the organism of Holstein from the USA. The indexes of resistance to high temperatures confirmed the best resistance to this factor of Holsteins of the Dutch breeding, it amounted to 0.7 units, which characterizes them as highly resistant animals. In contrast, the analyzed index in Holstein of the American breeding amounted to 1.2 units, which is the boundary value between resistant and low-resistant animals.

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RUMINAL DIGESTION AND METABOLISM OF SHEEP IN CASE OF APPLICATION OF A PROBIOTIC COMPLEX BASED ON *Bacillus subtilis* B-2998D, B-3057D AND *Bacillus licheniformis* B-2999D BACTERIA

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Key words: sheep, bacteria, probiotic, ruminal digestion, metabolism.

In order to improve sheep digestive and metabolic processes, the feasibility of including Bacillus subtilis B-2998D, B-3057D and Bacillus licheniformis B-2999D bacteria, which make up a new probiotic complex at a dose of 1 and 3 grams per head per day, was studied. Physiological studies were conducted on 6 sheep with inveterate rumen fistulas. The content of VFA in the rumen of animals of the first experimental group before feeding was higher by 4.2%, the second - by 5.5% compared with the control. After 3 hours -7.8 and 15.5%, after 5 hours – 20.9 and 29.9%, respectively. Giving probiotic supplements enhances rumen fermentation especially by 3 hours after feeding, as indicated by an increase by 63.9% of VFA concentrations in the first group and 73.4% in the second, with a decrease of ammonia by 5.8 and 18.7% , a significant increase of amylolytic activity of enzymes by 20.7 and 28.4%, respectively. More favorable conditions are created for symbiotic microflora growth, the state of nitrogen metabolism, serum proteins and albumin, especially when using 3 g of the probiotic complex.

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INFLUENCE OF FEEDING FODDER CONCENTRATE «YAROSIL» BY BRED HEIFER ON THE QUALITY OF AGRINOMIC CHARACTER OF THE YOUNG STOCK THAT WAS OBTAINED OUT OF THEM

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Key words: *polymicrobiological fodder concentrate «Yarosil», heifers, young stock, incidence of the disease, safety, growth, effectiveness.*

In the experiment, carried in S.A. «Stud farm named after Dzerzhinskiy» of Yaroslavl district, Yaroslavl region, we studied influence of feeding of polymicrobiological fodder concentrate «Yarosil» by heifers during sterility, in volume of 35 ml and 70 ml on the same animal per day, on the quality of agronomic character of the young stock that was obtained out of them from their birth till their 6 –month age: incidences of disease, safety, dynamic of life weight, expenditure of fodder, economic features and we developed one of the possible ways of improvement of effectiveness of cattle breeding field . It was established that feeding of polymicrobiological fodder concentrate «Yarosil» by heifers during sterility in volume of 35 ml and 70 ml on one animal independently of dozesize, decreased the incidents of disease of born young stock obtained out of them for 36,36%, it allowed 100% of safety, raising this feature 18,18%, that raised advantage at the cost of necessity on treatment expenses and decrease losses at the cost of death, but the difference in dosage influenced on the quality ofно разница в дозировке влияла на качество household features. Life weight of the young stock born from the heifers that took «Yarosil» was more in contrast to the control group. In each age –related month difference between groups grew and in 3- month age it overgrew in the group born from heifers that took «Yarosil» in volume of 35 ml for 9,11 kg – 11,22% ($p<0,05$), in a volume of 70

ml for 12,99 kg – 16,00% ($p < 0,05$), in 6-month age – for 15,63 kg – 11,06% ($p < 0,05$), and 21,15 kg – 14,96 по сравнению с контрольной группой. Accordingly daily live weight gain changed and in 3-month age it was greater in the group born from heifers that took «Yarosil» in a volume of 35 ml for 83 g – 14,98% ($p < 0,05$), in a volume 70 ml for 125 g – 22,56% ($p < 0,05$), in 6-month age for 77 g – 12,66% ($p < 0,05$), and 107 g – 17,60% ($p < 0,05$) at cost reduction of fodder by the kilogram of live weight gain in 6-month age by 0,480 feed unit. – 9,91% and 0,677 feed unit – 13,97 %, expense for 9,47 rub. – 10,37% and for 13,44 rub. – 14,71%, accordingly.

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IMPROVEMENT OF PRODUCTIVE ACTION OF PIG RATION WHEN APPLYING ENZYME COMPOUND NATUFOS

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Key words: pigs, phytate complexes, enzyme compound, productive action of rations, live weight, meat productivity.

Scientific, economic and physiological experiments on application of the enzyme compound Natufos in pig rations during their breeding and fattening periods were carried out in the conditions of the pig complex of OOO Stroyplastmass-Agroproduct of Ulyanovsk Region. The enzymatic activity of this medication is revealed in the environment of the gastrointestinal tract in the pH range from 2.5 to 6.0. Under these conditions, Natufos releases mineral substances, amino acids, proteins, carbohydrates hydrolyzing phytate complexes, thereby increasing the energy value of the ration. The use of the compound at a dose of 100 mg per 1 kg of the grain portion of the ration increases the bioavailability of mineral and organic substances, which ensures an increase of assimilation processes in pig's body, significantly reduces the time which takes to reach 100 kg of live weight, decreases feed cost, the morphological composition of carcasses and the chemical composition of meat, improves bone tissue mineralization. A decrease in the share of expensive feed in pig rations (cake meal, fish and meat and bone meal, protein and vitamin supplements) does not negatively affect their growth efficiency, carcass morphological composition and meat chemical composition, mineralization of bone tissue in case of application the enzyme preparation Natufos.

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FORMATION OF ABUNDANCE AND DEFICIENCY OF NUTRIENTS IN THE ORGANISM OF YOUNG CATTLE OF DIFFERENT AGE AND PRODUCTIVITY

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Key words: nutrients, intake, consumption, abundance, deficiency, primary metabolism.

Enzymatic decomposition of organic substances, oxidative processes with energy release and its subsequent consumption for synthesis determine the vital activity of animals. Metabolic energy absorbed by the body is used in the processes of primary metabolism and in adaptive reactions to maintain a constant balance of the body, as well as in the functions of reproduction and productive use of animals. Age-related changes in metabolic processes for absorption of nutrients are characterized by an increase in total costs, which is determined by an increase in live weight and a decrease in specific metabolic rates as a result of a decrease in the activity of intracellular metabolism. An indicative function of age-related changes of primary metabolism is the ruminant process. The consumption of nutrients in the intervals between the chewing causes a weakening of metabolic processes, a decrease in heat generation and a decrease in thermal state of body temperature, depending on age, by 5.818-4.799 kJ (bulls) and by 5.711-5.061 kJ (heifers), which is a signal of nutrient deficiency and excitation of ruminant process. This deficit is filled up in the ruminant period depending on the age of bulls in the amount of 5,803-4,641 kJ, and 5,073-5,116 kJ for heifers. Restoration of the necessary level of basic metabolism, the

thermal state of the body, its temperature, is a signal of the body's abundance with nutrients and the termination of the ruminant process.

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COMPARATIVE CHARACTERISTICS OF EXCHANGE ENERGY USAGE OF COMMON AND SILVER CARP

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Key words: fish, metabolism, body reactions, basic metabolism, energy consumption, growth, live weight.

The article presents data on parameters of live weight and metabolic energy of underyearling and two-year-olds of common and silver carp bred in polyculture. The material for the study was population of common carp and motley silver carp bred in polyculture with a natural feed base. According to the data obtained, the average live weight of silver carp yearlings is 40.0 g, which is 15.6% more compared to common carp yearling weight. And the live weight of two-year-old silver carp is 766.0 g, which is also more than the weight of two-year-old common carp by 29.4%. Higher growth of motley silver carp indicates a more efficient use of natural feed by this fish. It has been established that the daily energy use of silver carp is higher than that of common carp, while the same amount of energy is spent on the main metabolism - 0.42 kJ. Whereas more energy is used for production of common carp yearlings compared to this age group of silver carp, which is probably due to greater nutritional value of common carp meat (112 kcal) than silver carp (86 kcal). The oral cavity of common carp is adapted for bottom feeding, while silver carp eats mainly in the water column. The energy value of bottom sediments is higher than pelagic plant food. This also indicates high energy costs of common carp yearlings for production compared to this age group of silver carp. The silver carp had higher energy consumption for adaptive reactions, which may be associated with greater motion activity in search of food.

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