AGRICULTURAL SCIENCES

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APPLIANCE OF MICRONUTRIENTS IN NANOFORM IN OATS CULTIVATION TECHNOLOGY

The reaction of oats varieties Ulov and Gunter to pre-seeding treatment with micronutrient fertilizers in various forms is studied. The purpose of research is to determine the relative effectiveness of pre-sowing seed treatment with various forms of micronutrient fertilizers in the cultivation process of grain varieties of oats Ulov and Gunter in the sod-podzolic soil. Pre-sowing seed treatment of oats grain Ulov with micronutrient fertilizers provides an increase in grain yield by 12-25%, the variety Gunter by 12-19%. The average crop yield of oat varieties in versions with nanometal of copper and zinc was on the same level as in the versions with cobalt and copper sulfates. The productivity increase was formed due to the increase of plant density of productive stems to the harvest and grain content of panicles. Micronutrient fertilizers contributed to the raise of the protein content of the grain oats Ulov by 0.5 - 1.9%, Gunter by 0.6 - 2.1%. The highest protein content in the grain of 12.1 - 12.4% was observed with pre-sowing seed treatment with solutions of nanometals on average. Pre-sowing seed treatment of oats varieties with different forms of fertilizers raised the fat content in the grain yield by 0.2 - 0.7% on average. With the application of micronutrient fertilizer ZhUSS in grain oats Ulov the methionine content was higher by 0.12%, valine by 0.08% and threonine by 0.25% as compared to similar values in the control variant. The application of micronutrient fertilizer in Gunter grain increased the methionine content by 0.06%, valine by 0.32%, threonine by 0.1%.

Key words: oat; variety; grain yield; pre-sowing seed treatment; micronutrient fertilizers; nanometals; ZhUSS; protein; fat; amino acids.

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FEED CAPACITY AND AMINO ACID COMPOSITION OF DRY SUBSTANCE OF PURE AND MIXED SOWING OF SUDAN GRASS

The mixed sowing substantially improves not only the chemical composition but also the palatability and digestibility of feed nutrients. The investigations were carried out in the experimental crop rotation of the Plant Cultivation department in the instructional farm Iyulskoe ISAA on sod-mesopodzol medium loamy soils with low and average content of humus, with weakly acidic and close to neutral pH_{KCl}, average and increased content of labile phosphorus, high and very high content of exchange potassium in 2013-2015. The aim of study was to determine the reasonable harvesting time of agrocoenoses of Sudan grass early Chishminsky for feeding purposes. In the experiment we studied the various agrocenoses of Sudan grass (Sudan grass in pure sowing, Sudan grass + spring vetch, Sudan grass + winter vetch and Sudan grass + peas) and harvesting time (the shooting stage, the heading stage and the milk stage of Sudan grass grain). The presented results of long-term research proved the expediency of Sudan grass cultivation in mixture with grain legumes and later harvesting. In this case the herb proportion in the harvest reduces, crude protein grows (by 0.68-0.98 t / ha), as well as the largest feed capacity forms 69.2-83.3 GJ / ha. The analysis of amino acid composition revealed an increase in the amount of essential amino acids by 0.88% in dry substance of agrocoenosis of Sudan grass with peas.

Key words: Sudan grass; agrocoenosis; harvesting time; feed capacity; amino acid composition.

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CONTENT OF CHEMICAL ELEMENTS IN THE ARABLE LAYER OF SOD MESOPODZOL MEDIUM LOAMY SOIL WITH THE APPLICATION OF LIME, MANURE AND MINERAL FERTILIZERS

The content of 53 chemical elements and 8 oxides was determined in the arable layer of sod mesopodzol medium-loamy soil of long-term field experiment in the sixth crop rotation cycle by mass spectral method with inductively coupled plasma (MS) and atomic

emission method with inductively coupled plasma (AES) in Analytical Certification Testing Center of All-Russian Research Institute of Mineral Resources named after N.M. Fedorovsky. The soil samples were taken from the arable layer of long-term field experiment in 2014, which was founded in the experimental field of Udmurt State Agricultural Research Institute in 1971 - 1972. The samples were selected from variants: without fertilizers, $(NPK)_{60}$ + manure 40 t / ha for the first crop rotation, without fertilizer +lime on 1 + 2 GK for the first and second crop rotation cycles, mineral fertilizers $(NPK)_{60}$ + lime 1 + 2 GK for the first and second crop rotation cycles. Regarding the variant without fertilizers the arable layer in the variants of manure (H^1) + mineral fertilizers $(NPK)_{60}$, lime (I^2_2) without fertilizer and lime (I^2_2) + mineral fertilizers $(NPK)_{60}$ had a higher content of elements of the 1st class of toxicity - zinc, arsenic and cadmium, the 2nd class of toxicity elements - chromium, cobalt, nickel, copper and antimony, the 3rd class of toxicity elements - scandium, vanadium, strontium, and barium. In accordance with the requirements of hygienic standards GN 2.1.7.2041-06 only the arsenic content in the arable layer in all experimental variants exceeded the MPC. The content of oxides in the arable layer of sod medium podzolic soils slightly differs in all variants of the experiment. The arable soil layer in the variant (I^2_2) - lime without fertilizers had more sodium oxide, aluminum oxide, potassium oxide, calcium oxide, titanium oxide regarding the similar values in other variants.

Key words: chemical elements; sod mesopodzol medium-loamy soil; arable layer; lime; manure; mineral fertilizers.

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CHANGES IN ONTOGENESIS OF BIOLOGICAL SYSTEMS UNDER THE CONDITIONS OF REDUCED GEOMAGNETIC FIELD BY EXAMPLES OF G.GALLUS, APIS MELLIFERA C., CUCURBITA M.

The geomagnetic field is an important environmental factor for the living nature. In this paper we set the global disposition of the magnetic field. In biophysics and ecology laboratory of Kalashnikov Izhevsk State Technical University we carried out experiments on studying the effect of reduced geomagnetic fields on various biological objects (birds, bees, plants, fish, etc.). The objective of the research was to study the impact of a weakened geomagnetic field on the ontogenesis of biological objects by examples of *G. Gallus*, *Apis Mellifera C.*, *C. maxima.* Embryos of *G. Gallus* were the main object of the study. Larvas of *Apis Mellifera C.* and seeds of *C. maxima* served as an auxiliary, but very important, material to confirm the universal nature of the problem. It is determined that the effects of the weakened magnetic field on the change of the physiological conditions of biological objects depend on its attenuation level. It is found that the attenuation of magnetic field of the Earth for more than twice is a critical level, on which the morphological and structural changes in embryogenesis of biological object (for example, the larvas of *Apis Mellifera C.*, embryos of *G. gallus*, seed of *C. maxima*) become noticeable. The larvas of *Apis Mellifera C.* and seeds of *C. maxima,* which have different level of biological complexity compared to embryos of *G.gallus*, show an identical reaction to the weakening of the geomagnetic field, which makes it possible to talk about the existence of similar mechanisms of magnetic susceptibility in different biological objects. The results can be used, for example, in the poultry farms for analysis of zones with the change in geomagnetic field and their elimination. The recommendations can be developed for the permissible level of reduced geomagnetic field in industrial areas where the biological objects are in the initial stages of ontogeny, which equals to half of the Earth's field.

Key words: reduced geomagnetic field; magnetobiology; ontogenesis of biological objects; larvas of bees; chick embryos.

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EFFICACY EVALUATION OF IMMUNIZATION WITH MONOVALENT VACCINE AGAINST PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME IN COMBINATION WITH ADAPTOGEN AND IMMUNOMODULATOR

The creation of a stable immune response after the vaccination of animals is one of the primary tasks of the veterinary service. Porcine Reproductive and Respiratory Syndrome (PRRS) virus is widespread all over the world. Russian Federation is no exception. Unfortunately the disease causes serious damage to pig production, manifesting itself in the form of abortions, weak progeny and respiratory pathologies. The purpose of our work is comparison of the effectiveness of vaccination against PRRSV and in combination with an immunomodulatory drug and adaptogen. Our task was to monitor the disease progression and assess the overall state of the organism, cellular and humoral immunity. Significant results were obtained during the research. In particular, ELISA serum test detected antibodies to PRRSV even before vaccination. Subsequently, the antibody titer in the control group and the first experimental group had been gradually increasing by day 14, whereas it decreased in the second experimental group. By day 21 there was a dramatic increase in all three treatment groups. However, the antibody titer also sharply declined according to the assessment of immunity intensity at 27 day post-vaccination mark. In the control group and in the second experimental group, it fell to below pre-vaccination values. In the first experimental group, the titer decreased, but still remained higher than the original data. We believe that the root cause of these changes is associated with the scheme of the PRRS vaccination used in the household, resulting in the fact that only the immunization with adaptogen enabled the persistent immune response.

Key words: porcine reproductive and respiratory syndrome of pigs; the inactivated vaccine; pigs; the adaptogen; the immunomodulator; immunity.

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EFFICIENCY JUSTIFICATION OF ULTRASONIC MATERIAL DISPERSION OF PECTIC COMPLEX OF THE FLAX STEM

The retted straw preparation is the primary operation in the process of production of high-quality long fibers. All existing methods do not provide cost-effective products with high quality indicators. Yield increase of a quality product is achieved by introducing to a technology of retted straw production the ultrasonic destruction of the pectin complex in aqueous medium. To justify the efficiency of the process we defined the conditions of occurrence of the active medium and investigated the process kinetics. The work results were assessed by the thermal gravimetric analysis and the microscopic method. The devastating effect of a gum system depends on the cavitation intensity, the speed and nature of acoustic currents, the magnitude of the radiation pressure, which in turn are determined by the amplitude and oscillation frequency of the ultrasonic transducer, the intensity of the external static pressure, properties of the liquid and its temperature. The conditions of the creation of an active medium with the ability of conducting the processes of ultrasonic destruction of organic complex of the flax stem were theoretically determined. The kinetics of the process was investigated, the following parameters were set: the optimal temperature of the stems processing was 18...20∘C, the time of rehydration - 13...16 min., the loss of dry substances during the sound processing of straw within 60 minutes reached 54%. The efficiency of ultrasonic material dispersion of the organic complex of the flax stem in aqueous medium at the stage of retted straw preparation was established and proved.

Key words: flax; retted straw; long fiber; ultrasound; insonified medium; dispersion; pectin substances; lignin; process efficiency.

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JUSTIFICATION OF THE CYCLONE SEPARATOR CAPACITY FOR GRAIN CRUSHERS

In the engineering relation the studying of grain crushing process is of particular importance as this operation is the most power-intensive and expensive. The fractionation of the crushed material in the grain crushers takes place by means of replacement sieves of a separator. The grain crusher modernization by installation of a separator in a cyclone improves technical, economic and quality indicators. Pilot studies have shown the necessity of theoretical justification of the constructional dimensions and capacity or productivity of a cyclone with a separator. Therefore the purpose of the work is to increase capacity of a hammer grain crusher by the determination of optimum volume of a cyclone separator. The following problems are solved: to justify theoretically the constructional dimensions and capacity of a cyclone with a separator; to compare theoretical parameters with experimental ones. The theoretical research under the accepted assumptions provides an opportunity to establish the equations of a particle movement of "dust gas" under gravity, centrifugal force and resistance forces of the environment. The solution of the equation of a particle movement makes it possible to define a number of dependences: the change of radial speed of particles in the diametrical section of a cyclone; the change of the maximum radial speed of particles depending on the cyclone radius; the shifts in productivity of a cyclone depending on its radius and layer thickness of a stream of particles. The comparative analysis of the theoretical dependence of cyclone separator productivity on its radius and the experimental data showed that theoretical curves with various mechanical characteristics of the gas-and-dust environment are in the limits of a confidential interval of 5%. The obtained equations for speeds and productivity of separation process have independent theoretical interest as they can be applied for the calculation of other physical, mechanical and geometrical parameters.

Key words: cyclone-separator; justification; speed; trajectory; diameter; productivity.

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JUSTIFICATION OF PARAMETERS AND OPERATING MODES OF POTATO SORTER OF CONVEYOR TYPE

The conveyor operating devices of potato sorters have a simple design, little materials intensity, and provide low damageability. Their operation significantly depends on the modes of motion so the justification of critical parameters and operating modes of these devices is an urgent task. The research purpose was the development of the sorting device of conveyor type, the development of a calculation method and justification of parameters and operating modes of the sorting device. The following problems were solved: to describe a design of the proposed sorting device of conveyor type; to define the required operating modes of the feed conveyor, the operating modes of the conveyor operating device, the section length of allocation of small and average fractions. The research technique is based on the development of a mathematical model of the sorting device operation of conveyor type applying the canonical methods of theoretical mechanics and mathematics. It was revealed that productivity of the feed conveyor can be significantly higher than requirements of the small farms cultivating potatoes. The proposed sorting device of conveyor type can be incorporated into the operational line of potato sorting centers of large-scale enterprises and agricultural production cooperatives. The limitation of falling speed of potato tubers, the sizes of unloading zones provides an opportunity to reduce damageability and to increase the effective length of the sorting sites of the conveyor. The suggested calculation procedure provides an opportunity to justify the rational parameters and operating modes of similar sorting for ensuring sufficient productivity and accuracy of calibration: at a speed of feed conveyor of 0.4 m/s productivity makes 22.5 t/h. The speed of falling of tubers on a soft rubber tape is not more than 2.4 m/s, with a loading zone length on operating device 0.1 m. The speed of a tape of the sorting device is 0.44 m/s. The section length of allocation of small fraction is 1.12 m, the length of 0.78 m remains for allocation of average fraction.

Key words: potatoes; sorting; the separating surface; the calibrating opening.

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EFFICIENCY IMPROVEMENT OF LIGHT EMITTING DIODE PHYTOINSTALLATIONS IN GREEN HOUSES

The article presents the results of experiments on the irradiation of the meristem potato plants with the LED phytoinstallations consisting of different colors light-emitting diodes. The basis of the research is the hypothesis that it is necessary, first of all, to simulate the doses of the spectral density of the zone of photosynthetic active radiation (PAR) of the genetic homeland of the plant for the productivity improvement of a foreign crop. For the implementation of this statement we applied the instrumental software package of industrial automation "CoDeSys" and developed programs for programmable logic controllers (PLCs),

which control LED phyto units for doses simulating of the spectral components of the PAR areas of any geographical location for a desired period of time.

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DETERMINATION OF THE GRAIN HEAP INFLUENCE ON SIEVE PAN DYNAMICS

The significant reactive power develops during linear vibrations of massive sieve pans. The grain heap dynamics significantly influences this power. The aim of the study is to establish the inertness of the grain heap taking into account its flowability. The key problem consists in the lack of information about generalized coefficient of dynamic friction as its value is significantly influenced by the grain movement in the whole volume and not only in the contacts with sieves. The representation of the dynamic state of the heap as a superposition of its movable and stationary states can solve this and similar problems. The basic research methods of the work are the methods of mathematical modeling and analysis. The main mathematical modeling stages are model building followed by mathematical problem solving, the interpretation of the consequences of the mathematical model, validity check of the model, the model modification. The obtained results are: the state ξ_a corresponds to the maximum frequency of oscillation ω_a , in which a heap remains stationary towards sieves due to static friction. In this case it oscillates towards body of the grain cleaning machine with the same frequency and amplitude as the sieve pan. The state ξ_z

corresponds to the minimum frequency ω_z, where a heap remains stationary towards the machine frame due to inertia. In this case it oscillates towards sieves with the same frequency and amplitude. It is obvious $\omega_a < \omega_z$. At a frequency $\omega_a < \omega < \omega_z$ φ_a-th part of the heap may be considered stationary towards sieves, φ_z-th part – mobile.

Key words: superposition; boundary states; the functions of state; mobility; immobility; the variable of state; oscillation frequency.

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