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WAYS OF BEE VARROATOSIS CONTROL DURING RUNNING ORGANIC ANIMAL HUSBANDRY

The aim of our research was to evaluate the effective use of the formic acid as an antivarroa mite drug, and to determine the possibility of its implementation in the management of organic beekeeping. Researches were conducted on nomadic apiaries of the city of Volgograd (apiary № 1), Olkhovsky (apiary № 2) and Dubovsky (apiary № 3) districts of the Volgograd Region. After the main bribe (the end of July, the beginning of August), each of the apiaries was supplied with 5 newly formed experimental and control bee families principled as analogue-pairs before to reduce the nest and to start preparation for wintering. In the experimental groups, antiparasitic measures were carried out twice with the two-week intervals using a gel containing 85 % of formic acid. The gel was packaged, each bag weighing 30 g, 1 bag per a family and canvassed on the top of the frames. In the run of the experiment, it was found that the therapeutic measures taken in the experimental bee groups had had a positive effect. In all apiaries in the groups with formic acid used, the number of mites had decreased by 14.3–28.2 %, and did not exceed 3.8 %, while in the control groups the number of mites had increased. Thus, therapeutic measures had positively affected the bees' wintering. The leave-taking of the bees in the experimental groups did not exceed 8.3 % while in the control families it was much bigger – 18.8 %. Besides, it should be noted that at 2 apiaries 1 bee family per a control group had died. Honey lay put in the end was also higher in the experimental groups since the figuring indicator «obtained honey TTL» in the experimental groups was not lower than 27.42 kg whereas in the control groups it did not exceed 17.9 kg per family. The level of profitability was also the highest in the experimental groups and ranged from 60.62 % in apiary № 3 to 40.87 % in apiary № 2 whereas in the control bee families this indicator did not exceed 24.47 %.

Key words: organic animal husbandry; honeybee; varroa-jacobsoni mite; formic acid, treatment, prevention, productivity.

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EFFICIENCY OF TREATMENT OF BARLEY SEEDS BY PLANT GROWTH REGULATORS IN DIFFERENT METEOROLOGICAL

In 2011–2017 on the experimental field of the Izhevsk State Agricultural Academy, studies were carried out on the effect of treating barley seeds with plant growth regulators during growing seasons with different meteorological conditions. The aim of the research is to analyze the effectiveness of plant growth regulators, which have an immunizing effect and allow to enhance the adaptive potential of plants to the action of unfavorable environmental factors and infectious diseases, when processing barley seeds and their effect on crop yield. The tasks of the research included: to identify the development and prevalence of diseases during the growing season, to determine the effect of biological products on the biological yield of barley. Seed treatment was carried out on barley of the Raushan variety. The plant growth regulators were studied: Epin-Extra, R, Novosil, VE, Immunocytofit, TAB. In the years of research, a significant decrease in the development of root rot in the tillering phase was noted when using Novosil, and on average, the development of the disease in terms of growth regulators was at the level of the economic threshold of harmfulness. The prevalence of root rot in the tillering phase did not change under the influence of growth regulators. The investigated plant growth regulators used on seeds were not very effective against helminthosporium spots. An increase in yield under the influence of Novosil and Immunocytophyte was noted in 4 years out of 7 studied years with different meteorological conditions. Growth regulator Immunocytophyte contributed to a significant increase in the biological yield of barley by 43 g/m² at HCP₀₅ = 42 g/m². Thus, the use of growth regulators does not always lead to suppression of pathogens, and, accordingly, to an increase in crop yields.

Key words: barley; plant growth regulators; Epin-Extra; Novosil; Immunocytophyte; root rot; helminthosporiosis of leaves; yield.

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THE BALANCE OF ORGANIC MATTER AND NUTRIENTS UNDER THE CONDITIONS OF AGRICULTURAL PRODUCTION ON THE SOD-PODZOLIC SOILS IN THE VYATKA-KAMA AGRICULTURAL PROVINCE

In modern conditions, the APC after Michurin, Vavozhsky District, Udmurt Republic, is one of the highly profitable agricultural enterprises. In the land farming of the enterprise there are prevailing the sod-strongly-podzolic soils that are typical for the conditions of the Vyatka-Kama agricultural province. The enterprise introduced an adaptive-landscape land farming system, thus involving the structure of sowing areas with more than 50 % of perennial grasses. Regular work on the soil fertility was carried out during 1981–2019. By 2019, the arable land saturation with organic fertilizers had reached 5.6 t/ha; with minerals – about 60 kg of active substance / ha. The arable land is dominated by soils with an organic matter content exceeding 2.5 %, and it makes 79 %. To slightly acidic, close to neutral and evidently neutral soils, 77.5 % of the area of arable land is referred to. The level of soil supply with mobile phosphorus allows a high yield of grain crops; soils with an average and high content of this element are prevailing (53.4 %). At the same time, the availability of soils provision with mobile potassium is insufficient; soils with low and medium contents account for more than 2/3 of the area of the arable land as a whole. The enterprise obtains sustainable high grain yield – up to 3.7–5.3 t/ha; potatoes – more than 50 t/ha, green mass of corn – more than 40 t/ha. Under these conditions, a positive balance of organic matter is being formed for the soils; however, the balance of the main nutrients remains zero and even negative. In 2019, the nitrogen balance intensity was 87 %; phosphorus – 73 % and potassium – 36 %. The indicators of the APC's production intensity allow to regard the enterprise as a highly profitable one.

Key words: fertility; sod-podzolic soils; yield; balance; organic matter; nutrients.

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BIOLOGICAL METHODS OF DESTRUCTION OF THE FLAX FIBER CELLULOSE COMPLEX

Currently, there is a need to seek for the most effective and economical methods of processing fibrous materials, waste including resulting from the primary processing of bast crops. The analysis of the existing methods of flax fiber modification showed that the most promising were biological methods of destruction. The research is aimed at activating the vital activity of the natural microflora of the flax stem, creating favorable conditions for its vital activity in the workshop conditions for the subsequent destruction of pectin substances and hemicellulose in flax fiber. In this regard, a method of biodegradation of the cellulose complex of flax fiber was experimentally studied. Biologics were also identified that differ in the level of activity in respect of biopolymers of the flax complex (hemicellulose m, pectin, etc.) – Clostridium bacteria belonging to the C. Felsineum and C. Pectinovorum species, the latter functioning as catalysts for the destruction process. As a result, it was experimentally revealed that the active development and vital activity of microbial cultures during the first two weeks led to a loss of 18.2–18.8 % of the fiber mass and a sharp decrease in the breaking loads of fibers by 57–71 %.

Key words: flax fiber; cellulose; hemicellulose, butyric acid fermentation, bacteria; bio-destructors; natural microflora complex.

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ANALYSIS OF THE STRUCTURE AND PROPERTIES OF RECOVERING COATINGS OF BASED-ON-IRON POWDER COMPOSITIONS

Recovering of the worn-out working surfaces requires a search for more efficient technological processes of building-up, ensuring the synthesis of coatings commensuration with the value of the limiting wear of machine parts in thickness. The most attractive technologies are laser synthesis of thin recovering coatings. The aim of the work was the possibility of implementing thin recovering coatings on the surfaces of machine parts by the laser reflow of iron-based powder compositions. As components of the powder composition, finely dispersed carbonyl iron, graphite and powdered copper were used as the alloying phase. The coatings were obtained by fusing a slip coating on the surface of a steel product using pulsed laser radiation. The resulting coatings were investigated by means of metallographic and X-ray structural analysis, and the microhardness of the coatings was determined as well. The resulting coatings indicate the thickness ranging from 30 to 50 microns. Metallographic studies have confirmed the high adhesion degree of the coating to a part backing. The porosity of the coating is non-uniform and depends on the amount of powdered copper introduced. In particular, coatings with none-copper component have proved a porosity of 40 %, and with the introduction of copper to 2 % the porosity decreases to 15 %. A further increase in the copper component leads to an increase in porosity, at 4–18 % porosity, when reaching 10 %, the porosity makes 25 %. The structure of the coating is mainly represented by solid solutions for the interstitial α -phase and solid solutions of substitution for the γ -phase. The value of microhardness is also inhomogeneous, and is determined by the amount of copper introduced. The highest microhardness of the coating is achieved with the introduction of copper by 2 % and is 517 HV units. The presented analysis of the structure and properties of recovering coatings has a high practical potential and can be used in repairing when building up thin-porous coatings.

Key words: recovering coatings; laser radiation; powder composition.

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ABOUT TO SUBSTANTIATE THE MATERIAL FOR THE PROTECTIVE-AND-RECOVERING COATING OF THE VALVE DISC WORKING CHAMFER

The relevance of the work lies in the absence of an effective protective-and-restorative coating of the valves' working disc of highly loaded internal combustion engines operating at elevated temperatures. The research is aimed at analyzing the feasibility of modification of metal powder compositions with components that increase the thermal and wear resistance of hardening and restoring coatings. The main tasks are to analyze a priori information about heat and wear-resistant materials, to select such materials and alloying chemical elements, and to justify their use under above conditions. To carry out the work, the diagrams of the condition of chemical elements were studied, the works akin were analyzed. As a result, the materials containing basic Ni, doped with boron carbide B_4C , oxides ZrO_2 , MgO and boron nitride BN have been preferred. The compositions of these powder compositions are based on Ni that creates a matrix that perceives shock loads. Boron carbide and nitride can reduce the coefficient of friction, to increase the wear resistance. Magnesium oxide and zirconium dioxide are the strengthening chemical elements of the composition. The proposed ratio of elements allows to create coatings working at temperatures above 700 °C, not being chemically subjected to oxidation and wear.

Key words: working chamfer of the valve; protective and restorative coating; ceramics.

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PECULIARITIES OF FORMATION OF THE CERAMIC RECOVERING COATINGS

In modern repairing process, methods of increasing the recovery and strengthening coatings with the use of innovative adaptive technologies are increasingly used. One of the most attractive methods of coating synthesis is high-speed laser reflow of powder compositions. The properties of additive materials play a prominent role in the process of restoring parts, so it is important to make the right choice of compositions. Effective parameters of wear and heat resistance and strength of coatings can be obtained using ceramic materials. In this paper, the main purpose of the research is to analyze the

structure and characteristics of the formed ceramic coatings based on complex powder materials. In this research, the method of high-speed laser fusion was used. An experimental assembly was used for coating consisting of an ytterbium fiber laser with a maximum average power of 50 W and a wavelength of 1.065 microns. A chamber with the controlled atmosphere was used for laser processing. The quality of the coatings strongly depends on their composition, the energy modes of laser processing, as well as on the thickness of the multilayer coating. For the purpose, the following compositions like B_4C , $B_4C-40BN$, and $B_4C-40BN-10MgO$ were applied. The quality indicators are referred to the surface roughness, the presence of cracks in the coating and the uniformity of the coating composition over the surface area. Application of pure boron carbide leads to the formation of a highly distorted sample surface with high roughness and microcracks. The complementary BN in the coating composition increases the uniformity of the coatings, reduces the number of cracks, however, reducing the thickness of the resulting coatings. The addition of magnesium oxide can significantly reduce the number of cracks occurring within the coating, and to increase the thickness of the applied coatings to 200 microns. Complete crack suppression is possible on the coatings with a thickness of up to 20 microns and containing both magnesium oxide and lithium oxide.

Key words: recovering and strengthening coatings; laser reflow; ceramic materials.

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THEORETICAL STUDIES OF THE POTATO DIGGER SCREEN OPERATION

One of the ways to increase productivity and reduce energy costs when harvesting potatoes is the combined use of different working bodies. This combined use of working bodies allows you to adjust the process of separation of the pile and increase the efficiency of the unit. On the KTN-2V potato digger, for the separation of the heap, along with the bar elevator, it is planned to use a screening device. To substantiate the operating modes of the screen, it is necessary to identify the optimal conditions under which the heap, moving up the sieve, will be intensively separated, and the tubers will be separated from the soil.

As a result of theoretical studies and experiments have made it possible to obtain more effective separation and movement of material along an oscillating sieve when separation of foreign particles from

the sieve is ensured. Limit angles of the sieve inclination: up to 17° in the throw-up mode and not higher than 7° in the sliding mode. In order to achieve the necessary operating modes of the screen with a toss, it is more expedient to obtain the required accelerations by increasing the number of revolutions, and not the amplitude of oscillations. At the same time, to reveal an amplitude of more than 0.030 m as irrational.

Key words: potatoes; bolt; amplitude; frequency; speed; acceleration.

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DEVELOPMENT OF AN EXPERIMENTAL SETUP FOR A LED LAMP WITH THERMOELECTRIC EFFECT

The process of implementation of the energy saving policy, which is gradually gaining strength, is extremely necessary in agriculture, since this is a very complex and peculiar object in terms of energy supply. Currently, there is a growing shortage of electricity in the world. Therefore, it becomes necessary to develop the most energy efficient LED lamps with the possibility of autonomous operation. Today, the issue of efficient heat removal from the LED has been resolved, but in the present article suggests to use it for conversion into electrical energy through the use of the thermo-electric effect. An experimental assembly is proposed and has been developed to determine the dependence of the output voltage and current of a thermocouple on the temperature gap between cold and hot solder junctions. Approbation of the technological process of assembling a thermoelectric element revealed the most acceptable method for connecting conductors using solder paste. In the experimental sample, the junction point is next to the LED to create the maximum temperature gradient for the thermocouple. It has been determined that the use of an LED lighting device will lead to increase of its efficiency.

Key words: LED lamp; thermoelectric effect; electric energy; thermocouple.

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CALCULATION OF THE DESIGN PARAMETERS OF THE LED LIGHTING DEVICE

The present article is devoted to a calculating algorithm of the design parameters of an LED lighting device. The method of calculating the main design parameters is based on one of the optimization methods of mathematical analysis, a genetic algorithm with the objectivised coding. The genetic algorithm is a numerical heuristic p-search method used to solve optimization and simulation challenges by sequentially selecting, combining and varying the desired parameters, also finding the global minimum of the function, and not degrading the solution at each iteration. To simplify the calculation and minimize the number of calculations, a programme had been worked out based on the developed algorithm, and a certificate of state registration of the programme was obtained. The developed algorithm and calculating programme make it possible to determine the parameters of an LED lighting device that provides normalized illumination on a horizontal working surface with minimal energy consumption, and to estimate the distribution of the luminous flux with the account of the configuration and geometry of the LED lighting device.

Key words: animal husbandry; LED lighting; calculating algorithm; design parameters; illumination.

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