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SPECIFIC CONDITIONS OF STORING JERUSALEM ARTICHOKE

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The paper considers some specific conditions of storing the tubers of Jerusalem artichoke. After long-term storage with traditional methods Jerusalem artichoke tubers quickly lose the turgor and are easily infested with bacterial diseases. For example, when storing tubers in a room with an air temperature of 17...22°C for 10 days, the weight of tubers decreases by 7%, for 20 days – by 14%. The authors have conducted research to analyze the method of biopolymer coating of tubers with a film of nanoscale thickness using Milekons and Artafit preparations. The safety of the Skorospelka variety depending on the treatment of tubers with preparations Milekons and Artafit before storage has been determined in dynamics from October 2015 to July 2016 in polypropylene bags and vegetable nets at a temperature of +2...+5°C. It has been stated that the tubers of Jerusalem artichoke lose less moisture during storage in polypropylene bags (63% of tubers have remained on average) than in vegetable nets (56% of tubers have remained on average). The least losses during storage have been observed in case of storing tubers in polypropylene bags treated with the Artific (21%) and Milekons (34%) preparations. Thus, the film of nanoscale thickness made on the surface of tubers, allows to reduce weight loss up to 49%. The research has shown significant changes in the chemical composition of tubers during storage. In order to preserve a higher content of carbohydrates, including inulin in tubers, it is preferable to store Jerusalem artichoke tubers in polypropylene bags at a temperature of + 2... +5°C.

Key words: Jerusalem artichoke, tubers, storage, inulin.

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WAYS OF INCREASING PERFORMANCE OF UNIVERSAL GRAIN CLEANING MACHINES

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Basing on the main provisions of the theory of probability, the authors present some possible ways of doubling the productivity the universal air-grating separators by the implementation of the principle of dividing a processed heap into fractions. The authors take account of the difference in heap components in aerodynamic properties and dimensional characteristics as the main features to be observed in fractionation. These characteristics are implemented in the process of separation by an air flow on flat sieves. The selected features of fractionation are incorporated in the work of air-screen separators, which are the main machines of modern production lines. To determine the role of each working unit in the process of heap dividing into the main and forage fractions, the heap is conventionally divided into classes. The heap classes belonging to the forage fraction have been formed depending on the velocity of particle waving and their thickness. The formed classes can be separated with one working unit only, or two and more, taking account of the air velocity in the channels and the width of the sieve holes. Using the basic assumptions of probability theory, the authors have determined the probability of separating the individual components of each class and that of the entire heap as a whole into a forage fraction. They have also determined classes, for which there is less probability of separation. This is a class with particles having a thickness greater than the width of the holes in the sieve grids and a class having a winding speed greater than the air velocity in the pre-cleaning channel. The components of these classes will be separated only with the sorting grid and the post-screen cleaning channel. The possible ways of increasing the separation probability for these classes have been

established, which increase the productivity by almost two times with a total amount of forage fraction separation of at least 60%.

Key words: fractionation, aerodynamic properties, grain thickness, sorting sieves, universal grain cleaning machine.

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ON PHYSICAL-MECHANICAL PROPERTIES AND METHODS OF HARVESTING AND CLEANING OF ALFALFA SEEDS

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The paper presents the study results of physical-and-mechanical properties of alfalfa seeds Tashkent-1 and Donnik Belyi (White Sweet Clover), the morphological composition of the seed mass in the form of a heap, the moisture recovery dynamics of the alfalfa seed plant biomass as the chronology of daily measurements. The paper contains some graphs showing the dynamics of changes in humidity, temperature and height of the layer during the biomass drying. The authors consider technological methods of harvesting and cleaning of alfalfa seeds, as well as modernized technical means for their implementation. They also give account of the existing technologies and distinctive features of the developed technology for alfalfa seed cleaning. The developed technology of alfalfa seed cleaning allows to significantly reduce the applied range of seed-cleaning machines while maintaining the quality of cleaning. This technology provides for the use of a grinder-winder MV-2,5A, a modernized kleveroterka K-0,5M and a dielectric seed cleaner. Calculations have shown that the cleaning costs of 1 hwt of alfalfa seeds and material costs are reduced by more than 1.5 times. Small size, high productivity and operational reliability, as well as mobility of K-0,5M clover-seed huller allow to use it effectively on large and small farms for harvesting of alfalfa seeds. The dielectric plant has shown the principal possibility of cleaning alfalfa seeds from quarantine inclusions using the triboelectric method. The efficiency of seed cleaning for the first fraction has accounted for 53.1%, for the second fraction – 38.5% and for the third one – 11.9%.

Key words: alfalfa seeds, beans, biomass processing, drying, moisture recovery, wiping of beans, cleaning of alfalfa seeds, clover-seed huller, dielectric sorting device.

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RESULTS OF LABORATORY-FIELD RESEARCH OF WHITE LUPINE COMBING

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The paper considers some issues relating to the harvesting of white lupine. The authors have performed an analysis of technological properties of the crop under consideration and determined dimensional-mass characteristics of its seeds. It is proposed to harvest the standing crop using the combing (deseeding) method. Laboratory tests have been carried out in Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, while the field ones are exemplified by harvesting white lupine of the Dega variety on farms of the Michurinsk district of the Tambov region. The research has involved a comber-type header "OZON" produced by PAO (PJSC) "Penzmash". The header has been upgraded for white lupine harvesting. The design of combing fingers has been changed in accordance with the patents for utility models RF No. 172995 and No. 178721. The authors have carried out experimental studies of new working elements and determined technological parameters and operating modes of the comber-type header used for white lupine harvesting. The method of experiment planning has been used as well. The experimental results have been processed by the Statistic 13.0 program and two-dimensional cross-sections of the studied factors have been obtained. The analysis of the obtained data has shown that the optimal values of the studied factors include kinematic index – within 24...27; the header height measured from the soil surface to the combing fingers in the lower position 0.38...0.42 m; the height of the contact point between the fairing and the crop material 0.7...0.75 m.

Key words: combing device, white lupine, harvesting, grain combine harvester, harvesting technology.

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EXPERIMENTAL INSTALLATION WITH IVECO DIESEL ENGINE

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The paper describes the design and functionality of an installation based on the diesel engine IVECOF4HE9687P * J101. The motor installation allows to study the operation of the engine systems in both static and dynamic modes. The performance of the engine and its systems can be evaluated basing on the analysis of changes in registered parameters. The use of a motor installation allows obtaining the following parameters: engine speed, instantaneous engine speed in dynamic operation modes, air supply amount, cyclic fuel supply, fuel line pressure and boost pressure, supply air temperature, coolant temperature, ambient temperature, engine oil temperature, fuel temperature, battery voltage, supply starting point, the presence of malfunctions in a coded form. The installation allows to monitor the engine during its normal operating performance and when introducing deliberate malfunctions, as well as make an efficiency analysis of the integrated diagnostic system and its capabilities. The use of the installation is scheduled to be tested in the study process of MSc students of training field 35.04.06 "Agroengineering" and postgraduate students of training field 35.06.04 "Technologies, Means of Mechanization and Power Supply Equipment in Agriculture, Forestry and Fishery".

Key words: motor installation, study of ICE systems, ICE diagnostics.

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ESTIMATING THE DISTRIBUTION PATTERN OF THE SUPPLY AIR IN JET FLOW CONDITIONS

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The paper reports on the tests of microclimate control with heat recovery conducted in the period from 14.03.2014 to 07.07.2014 in Fattening sector No. 6 on Farm enterprise No. 7 of LLC "Firma Mortadel". The heat recovery system includes three recuperative heat exchangers and an automatic microclimate control system. The distribution pattern of axisymmetric non-isothermal swirling limited jets of fresh air is considered when using universal heat recovery facilities. The performed tests made it possible to construct velocity patterns in the longitudinal and cross sections. In addition, the authors have carried out a comparative assessment of air distribution from the device with a free outlet and equipped with an air distributor nozzle, i.e. a deflector. It has been established that the considered microclimate system with heat recovery of exhaust air ensures that the specified microclimate parameters are maintained uniformly throughout the entire room area. The supply air jet distances are sufficient for servicing the boxes with animals that are located far from the supply fan. It has been noted that equipping the recuperative heat exchanger with a deflector reduces the air flow speed in the heat exchange area and provides a more even air distribution, both vertically and horizontally. At the same time, the average speed of the jet in the outermost box decreases and accounts for 0.18 m/s, which is 0.07 m/s less than that of the recuperative heat exchanger without a deflector.

Key words: ventilation, swirling jets, microclimate, non-isothermal jets, heating, heat recovery, hog breeding, microclimate control system, jet streams, heat utilization.

TECHNICAL SERVICE IN AGRICULTURE

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EFFECTS OF FLUORORGANIC COMPOUNDS ON PHYSICAL-AND-MECHANICAL PROPERTIES OF RUBBER FOR MANIFOLD SEALS OF FARM MACHINERY

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The paper gives account of the properties of rubber modified with organofluorine compounds (OC). Additives of various molecular weights, designated FS-1 and FS-2, have been chosen for this purpose. They have been introduced into the rubber composition of ИПП (IRP) 1068 used for the production of sealing cups, in an amount of 1 weight part per 100% weight parts of rubber. It has been established that the OC introduction leads to a certain increase in tensile strength and relative tensile elongation. The hardness of rubbers has not practically changed. The resistance of rubbers to heat aging has been noticeably improved by such factors as tensile elongation and resistance. The relative residual deformation of compression with the OC introduction practically has not changed. For rubber with the FS-2 additive, the resistance to abrasion has increased. Frictional tests have been carried out using a face friction machine and a bench simulating the performance of seals in real operating conditions. It has been established that the OC introduction in the rubber composition leads to a decrease in the coefficient of friction. At the same time, the frictional force decreases in the initial period of shearing the contacting surfaces, especially for rubber containing FS-2. The steady-state friction is also reduced for sealing cups made of rubbers containing organofluorine compounds, as compared to unmodified sealing cups. The results obtained indicate a greater efficacy of FS-2 introduction. It can be assumed that the lesser degree of the additive volatility is the determining factor for reducing the friction force, as evidenced by the large molecular weight and the boiling point of FS-2. It has been established that OS are able to improve the performance properties of sealing cups used in agricultural machinery.

Key words: rubber, sealing cups, organofluorine compounds (OC), antifriction properties.

ECONOMY AND ORGANIZATION OF AGRICULTURAL ENGINEERING SYSTEMS

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PROBLEMS OF TECHNICAL AND TECHNOLOGICAL MODERNIZATION OF RUSSIAN FARMING INDUSTRY IN MODERN CONDITIONS

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The paper discusses the main issue of technical and technological re-equipment of agriculture. The author gives account of the dynamics and specific features of the machinery and equipment availability in agricultural enterprises and states the necessity of raising the innovativeness level of farming technical facilities. The analysis of dynamics of absolute and relative indicators has shown that the innovation activity of agricultural enterprises remains at a very low level, while the observed positive dynamics in terms of funds invested in the technical innovation at the national level is negligible. The author has provided grounds for the prospects of technical and technological modernization of Russian farming industry, within the framework of the State program of agribusiness development and regulation of markets for farm produce, raw materials and food products for 2013-2020". The subprogram "Technical and technological modernization, innovative development" within the same project envisages increased innovation activity of the agribusiness industry. The author makes proposals for improving the mechanism of state incentives for technical modernization stressing that the state support mechanism of innovative development of the technical capacity of farm enterprises must include such elements as the range of objects to be stimulated, main directions of supporting the innovative development of the technical capacity of agribusiness, forms and methods of stimulation, instruments of state influence, and assessment mechanisms of the state stimulation of innovation policies aimed at technical modernization of agriculture.

Key words: farm machinery, technological modernization, innovative development, farm machinery building, imported machinery, state support.

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METHODICAL APPROACH TO THE EVALUATION OF AGRICULTURAL MACHINERY BASED ON MARGINAL OPERATING COSTS

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The paper analyzes the existing methods of evaluating agricultural machinery. The authors suggest a methodology for the determination of expediency of using farm machinery based on actual operational costs per unit of production when an evaluated machine performs separate operations. The limits of the effective machinery application are considered to be the marginal (permissible) operating cost per unit of product for the particular operation, the calculation of which is based on the determination of the share of labor-intensive operations in the overall cost of labor in agricultural production, sales prices per unit and a minimum level of agricultural production profitability. According to the proposed methodology, the authors have evaluated the performance of the Grimme BR-150 potato harvester used in OOO (LLC) “Maksim Gorky” on an area of 2000 hectares. Actual operating costs have amounted to 370.65 rubles/ton and have not exceeded the marginal (acceptable) costs equaling to 518,18 rubles per ton. The application of this combine on the farm has ensured the profitability for the expanded production at the level of 32%. So, the use of Grimme BR-150 is effective at a given yield of 38 tons/hectare, a productivity of 0.28 ha/h and a selling price of potato of 7800 rubles/ton. The study results confirm the expediency of using this methodical approach, which allows determining the absolute efficiency of the utilization of agricultural machines.

Key words: economic evaluation, economic efficiency, labour intensity, product price, the limits of economic efficiency of agricultural machinery, marginal (permissible) level of operating costs.

POWER SUPPLY AND AUTOMATION OF AGRICULTURAL PRODUCTION

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EMERGENCY LANDING OF AN UNMANNED AERIAL VEHICLE FOR AGRICULTURAL PURPOSE

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The paper considers a process of aerial photography of fields with the help of unmanned aerial vehicles. The analysis shows that among all flight modes of an aerial vehicle (AV) the most difficult and tense ones are the approach and landing modes. This is due to the high AV accident rate in this mode as a result of the instantaneous manner of the landing process. Over the past forty years, this mode has accounted for about 55% of all losses. The authors suggest a new technology for landing an ultralight unmanned aerial vehicle (UAV), which does not require complex and costly ground landing equipment and thus provides a high probability of non-damage to the UAV. This technology is based on recording the fact of the UAV battery discharge using an electromagnetic relay. The actuation of the relay opens the contact in the power supply circuit of electric motors from the battery and closes off the contact in the power supply circuit of electric motors from the charged large-capacity condenser, or in the control electrode circuit of thyristor converters included in the power supply circuit of electric motors. As the condenser discharges, the voltage at the electric motor terminals drops and the rotation speed of the rotor decreases, thus ensuring smooth landing of the UAV.

Keywords: unmanned aerial vehicle, landing, accident rate, condenser, thyristor converter, rotor, electric motor, rechargeable battery.

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PRACTICAL USE OF MUTUAL INDUCTION WHEN MARKING STATOR WINDING OF THREE-PHASE ELECTRIC MOTORS

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The conventional methods of "selection" and "transformation" for marking stator windings of three-phase electric motors are characterized by considerable time consumption and significant number of switching operations. The authors offer a new method for marking stator windings, which is based on an analysis of the interaction of magnetic fluxes inside the electric motor and the phenomenon of electromagnetic mutual induction between phases of a three-phase electric motor. First, using a control lamp, an ohmmeter, a voltmeter, etc., one can determine the relationship between the two terminals and each of the three phases of an electric motor. Then three windings (phases) are connected in series (to form an open triangle). The electric circuit assembled in this way is connected to an alternating current network with a voltage of 220 V, and three identical voltmeters are connected in parallel to each phase. If the motor phases are turned on according to a "start-end-start-end-start-end" pattern, the voltmeters will show the same voltage values. If one of the phases in an open triangle turns out to be set in an opposite manner to the other two phases, a voltmeter connected to it will show a greater voltage than the voltmeter readings in the other two phases. Basing on the readings of voltmeters, one can immediately mark the beginnings and ends of the electric motor phases. Given the fact that the phases of three-phase motors are connected in series during the marking process, an open triangle can be connected to a mains voltage of 220 V with an assembled electric motor and a remote rotor. Large differences in phase voltages are observed in case of a remote rotor. The proposed method for marking the phases of three-phase electric motors is more convenient for use in practice due to its decreased time consumption and fewer switching-over acts.

Key words: three-phase electric motor, marking of stator windings.