

AGRICULTURAL SCIENCES

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AN INNOVATIVE METHOD FOR PREDICTING THE PRODUCTIVITY OF DAIRY COWS

Improvement of the genetic potential in terms of cows' productivity and creation of high milk-yield cattle with good health and long productive lifetime characteristics is impossible without systematic evaluation of such traits as milk-yield, exterior, and constitution type. The aim of the researches conducted was to study the trends in exterior traits and genetic selection parameters changes that determine the extent of interconnection between cow productivity properties and the type of constitution between the Black-and-White and Kholmogorycows breeds in the Udmurt Republic. The scientific researches based on cow breeding-stocks took place in 2018–2020. Sampled population was equal to 449 specimens. The whole cow population to be analyzed were divided in 3 groups by the productivity level: Level 1 – low (up to 6,000 kg); Level 2 – moderate (from 6,000 to 8,000 kg); Level 3 – high (over 8,000 kg). High milk-yield cows were bigger in height – withers height by 1.5 % and 1.4 % ($P < 0.05$) – and had more elongated body (by 1.0 % and 0.8 %) as compared to the specimens from the 1st and the 2nd groups. Low milk-yield cows (up to 6,000 kg) had short stature and were of a big-boned constitution type with a better-developed skeleton. They had greater values of such parameters as the chest width (by 1.6 %), wide hip width (by 7.3 %, $P < 0.01$), width of loin (by 13.2 %, $P < 0.01$), and metacarpus girth (by 3.2 %, $P < 0.05$). The cows with productivity level exceeding 8,000 kg of milk per 305 days of lactation had proved relatively high value of the Pelvic arch length (by 2.0 % and 2.3 %, $P < 0.05$) and the depth of loin (by 1.3 % and 1.5 %) though with insignificant difference in rump bone length. The lowest value of the mean exterior index of the constitution type (by 3.0 %, $P < 0.05$) had high milk-yield cows that witnesses the constitution proportionality, namely, optimal relation between the body volume and the height of a cow. Moreover, the Pelvic arch index – the ratio of the Pelvic arch volume to the body length – is also the evidence of harmonious constitution. High milk-yield cows demonstrated this index to be the lowest (by 3.8 %, $P < 0.01$) and had more harmonious constitution.

Key words: exterior; cow constitution type; cow constitution index; Pelvic arch index; genetic selection parameters; cow milk-yield.

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THE RESULTS OF A BREEDING VALUE ASSESSMENT FOR STALLIONS-SIRES OF THE RUSSIAN HEAVY DRAFT BREED, 2020

The success of any breed development is impossible without conservation of its genetic diversity with simultaneous strict selection and use of only valuable genotypes. The main role in this issue is assigned to the assessment of stallions-sires based on the quality of the offspring. Therefore, it is necessary to constantly improve and adjust the applied assessment methods in accordance with the changing socio-economic conditions. When assessing breeders follow the quality of the offspring based on a set of traits selected in a breed devoid of a high positive correlation to each other. The methodology of evaluating heavy draft stallions in terms of the quality of the offspring is based on generalization and analysis of the main indicators characterizing economically useful traits of a heavy draft horse (typicality, measurements, exterior) that are used to evaluate the breeding young animals on farms.

Material for studies there served the data from zootechnical appraisal of horses of the Russian heavy draft breed, from the key breeding farms. The assessment was carried out according to the methodological recommendations for factory breeds selected by means of a set of features. In 2020, 15 stallions-sires of the Russian heavy draft breed were evaluated for 286 offspring heads. According to the ranging data, stallions-improvers were singled out further followed by the moderate and the worst ones.

To further work with the Russian heavy draft breed, it is necessary to take into account the results of the assessment of stallions by the quality of the offspring, and to conduct the earliest possible assessment of the stallions following their breeding value.

Key words: Russian heavy draft breed; assessment; sires; offspring quality; ranking; type; exterior; measurements.

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PECULIARITIES OF PORK PROCESSING WITH DIFFERENT FUNCTIONAL-AND-TECHNOLOGICAL CHARACTERISTICS

Modern pig breeding continues to gain momentum in the meat sector and is characterized by intensive selection to improve the meat qualities of pigs. As a result, systematic selection, along with the improvement of the meat characteristics of animals has led to the appearance of undesirable properties of pork – PSE and DFD. Processing of pork infected with PSE syndrome is a laborious process and requires careful selection of moisture-binding ingredients aimed at stabilizing dispersed systems and improving the structural and mechanical characteristics of the product. In this regard, the aim of the research is to carry out a comparative assessment of the quality of ham produced from PSE pork using moisture-binding ingredients of different nature.

The article presents the results of a comprehensive assessment of the quality of pork ham with an abnormal course of autolysis using synthetic and native structure-formers. Ham obtained from the PSE pork with 1.8% injectal was inferior to the control in consistency (soft, loose); in a sample containing 1.3% injectal and 0.5% arabinogalactan, a soft consistency is notified, a defect is revealed – broth edema. In terms of physicochemical and microbiological parameters, the studied samples of ham met the requirements of regulatory documents.

It was found out that the use of arabinogalactan in an amount of 0.5% in compliance with a phosphate-containing additive in the technology of ham production makes it possible to obtain a microbiologically safe product, though the used AG portioning is not effective when processing pork with obvious PSE syndrome.

Key words: hybrid young growth; culled sows; slaughter weight; active acidity; pork; ham; PSE; phosphates; arabinogalactan; organoleptic characteristics; mass fraction of moisture; microbiology of the product.

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SITUATION IN THE BEEKEEPING FIELD IN THE UDMURT REPUBLIC

In recent decades, the situation with beekeeping in various countries of the world has become quite tense due to diseases of bees of various etiologies which entail a large percentage of bee colonies' mortality. Thus, the present article aims at learning the dynamics of the quantified distribution of bee colonies over the territory of the Udmurt Republic. Material for research was obtained from the Federal State Statistics Service for the Udmurt Republic 1970–2020, and from the Ministry of Agriculture and Food of the Udmurt Republic. A detailed analysis of the state of the beekeeping industry was carried out respective to the following indicators: the number of apiaries, the number of bee colonies in 25 regions of the republic, the presence of veterinary and sanitary passports for the apiaries.

On the territory of the Udmurt Republic. There was a prominent decrease observed in the number of bee colonies in 1970–2020, by 105 thousand families. The reasons may be a set of various infectious, invasive and viral diseases to which honeybees are susceptible, growth of the urbanization percentage of the territory of the republic. The total number of bee colonies for 2020 had been registered 46,600 families though the distribution of 4094 bee colonies and apiaries on the territory of the republic is not uniform. The largest number of bee colonies is concentrated in the southern and central zones of the republic. The total number of apiaries having been tested for infectious diseases, found safe and have been handed a veterinary-and-sanitary passport is 16.3% or 475 apiaries.

Key words: beekeeping; apiary; Udmurt Republic; veterinary-and-sanitary passport.

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ANALYSIS OF MEAT PRODUCTIVITY OF THE CATTLE BEING PROCESSED IN THE CONDITIONS OF LLC “UVINSKY MEAT PROCESSING PLANT” IN UDMURT REPUBLIC

The article deals with a comprehensive analysis of the meat productivity of the slaughtered cattle and its primary processing in the LLC “Uvinsky Meat Processing Plant”, the Uvinsky dis-

trict of the Udmurt Republic. The studies had been conducted according to plumb data 2020. In the course of research, it was found out that only two districts (Uva and Vavozhsky) provided the cattle in 2020, from which they had obtained 21 “super” category carcasses. This is the highest category rating. At the same time, the bulk of young cattle carcasses had been assessed within the categories “extra”, “excellent” and “good” (1311 pcs). However, there were also farms that received the carcasses of a “low” fatness category (Uvinsky, Seltinsky and Vavozhsky districts) (42 pcs). It is worth noting that according to the results of the commercial assessment of the carcasses for the adult cattle most of the carcasses were quite well fed and were evaluated as of the first category ones. According to the results of 2020, the company had received 608.8 tons of meat from the young cattle carcasses with 917.5 tons produced in live weight. The amount of meat in the carcasses of adult cattle was 180.1 tons, and 386.5 tons in live weight. Taking into account the yearly percentage of beef sales and the maximum yield of pulp, the company is not able to fully meet the needs of all deep processing shops.

Key words: cattle; meat productivity; fatness category; young animals; adult cattle.

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TECHNICAL SCIENCES

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COMPARISON OF FERROMAGNETIC PROPERTIES OF DIFFERENT MATERIALS

The relevance of the work lies in investigation of the air gaps formation of the magnetic core during its assembly that negatively affects the transformer's operation. The aim of the study is to analyze existing ferromagnetic materials and compare their factory characteristics for further use in ferromagnetic paste. The main tasks are to analyze and compare the properties of various ferromagnetic materials with high magnetic permeability for further use as that of the main component of the ferromagnetic paste. For the purpose, all existing ferromagnetic materials to have been used in electrical engineering were analyzed, and the factory indicators of each material were studied with the compilation of comparative tables. For comparison, such materials as ferrites, alsifers, permalloys, and sputtered iron had been selected. All materials are known to be used in electrical engineering, but in different equipment for different purposes. Having compared all the materials to their factory characteristics, it turned out to most accurately understand which material suited best for the development of ferromagnetic paste based on it. As a result, the proposed manganese zinc ferrite material of the 6000NM brand have proved to be ideal for fulfillment the tasks related to the development of a ferromagnetic paste designed to fill the air gaps of the transformer's magnetic circuit.

Key words: ferromagnetic; magnetic permeability; soft magnetic; magnetic-solid; hysteresis.

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TECHNOLOGY OF OPERATIONAL RECOVERY FOR THE GEAR-SHAFT OF THE BOSCH REXROTH AZMF HYDRAULIC MOTOR

In the work, an up-to-date technology for the restoration of the gear shaft of the Bosch Rexroth AZMF hydraulic motor has been developed. The main purpose of the research is to restore the worn-out bearing surfaces of the shaft – gear. When restoring worn surfaces, a laser surfacing technology has been implemented providing a low thermal effect on the shaft surface and high physical and mechanical properties of the restoring coatings. To achieve the goal, the following tasks were solved: micrometric analysis of the worn surfaces of the pinion shaft; development of a technology for applying a restorative coating. The method of applying restorative coatings implies surfacing of steel welding wire to build up deep wear and surfacing of a finely dispersed powder composition with wear build-up of less than 100 microns. The hardness of the restorative coatings ranges from HRC60 to HRC90, depending on the filler material used, and exceeds specifications. The roughness of the repaired surfaces after machining is Ra 0.32 and meets the specifications. High hardness of surfaces in combination with low roughness under operating conditions can provide a longer service life of the hydraulic motor's gear shaft.

Key words: hydraulic motor; pinion shaft; restoration; laser surfacing; micrometric studies.

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ENERGETIC CHARACTERISTICS OF A CONVECTIVE INDUCTION WATER HEATER

In the technological processes of most agricultural enterprises, hot water is used, depending on production, the temperature of which varies in a large range of values. Solid, liquid and gaseous fuel boilers, as well as electric water heaters can serve as sources of thermal energy for the production of hot water. The use of liquid and solid fuel boilers is rather costly in terms of transportation and stor-

age of fuel. The use of boilers with gaseous fuel is not always possible, due to the low gasification of agricultural areas. However, the use of electric water heaters appears the most appropriate. The aim of this work is to study the energetic characteristics of a convective induction water heater, i.e. the efficiency and power factors. The research applies to the energy balance method to determine the calculated efficiency factor η and the power factor P_F . To determine the experimental values of the efficiency coefficient η and the power factor P_F , a calorimetric method and an analyzer of the quality of electrical energy were used. The values of the efficiency and power factors of the convective induction water heater obtained during the experiments are in full agreement with the calculated value with an accuracy of $\pm 1\%$.

Key words: water heater; induction water heater; energetic characteristics; power factor.

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MECHANIZED COMPLEX FOR POSTHARVESTING PROCESSING AND STORAGE OF POTATOES

Potatoes belong to agricultural crops that are demanding proper conditions of their cultivation and storage. At the same time, it plays an important role in the nutrition of the population and as a technical and forage crop. If the cultivation technology is followed, it gives a high yield even in the Non-Chernozyom zone. However, in the future it is necessary to preserve the crop, which is ensured by post-harvest completion and storing. Postharvest completion is the most important element in storing as it enables to clean the pile of potatoes from soil impurities, plant residues, stones and substandard tubers. There is also a division of the crop into fractions by size (seed, food and technical). In the Izhevsk State Agricultural Academy, Department of Theoretical Mechanics and Resistance of Materials, a stationary complex for storing potatoes had been designed headed by Associate Professor R. I. Ostanin. The complex includes storage facilities, a springboard, and a sorting station. The principle of its operation enables to fully mechanize all operations for accept-

ing, cleaning, sorting and laying potatoes for storing. The only operation with manual handling remains the selection of damaged and cut tubers on the bulkhead (inspection) tables. The complex has a capacity of up to 40 t/h, the sorting area is built around the original disk sorting with low rate of injury for tubers. It can provide preplanting and postharvest processing of potatoes, is equipped with its own springboard for preparing seed material. Storage of potatoes is maintained in bulk and in boxes. The experience of springboard operation in the state farm « Mir » of Votkinsky district, UR, has proved its high operational qualities.

Key words: potatoes; heaps; sorting; fraction; potato sorting station; sorting device; storage; spring dispenser.

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INTENSIFICATION OF THE ANIMAL WASTE CONVERSION PROCESS

Nowadays, animal and poultry keeping wastes, cattle, pig and poultry manure are prohibited from being transported into the fields and to be used as fertilizers devoid of preliminary treatment. The standard decontamination process comes down to composting. And territories with an excess intake of biogenic substances into the environment can arise at large livestock enterprises. The arti-

cle is aimed at presenting the methodology for accelerated process of animal waste conversion. The following tasks were to be solved: 1) to study information on the use of the electrohydraulic effect method; 2) to look into the effect of electrohydraulic impact on various fluids; 3) to conduct microbiological investigation of liquids subjected to electrohydraulic impact. Material and methods used: when a specially formed pulsed high-voltage electric discharge is created inside the liquid volume, an ultra-high hydraulic pressure or the so-called electrohydraulic shock (EHS_h) occurs in the area of the latter. The microbial flora – bacteria and fungi - dies intensively under the influence of the electrohydraulic shock. The novelty of the approach lies in the creation of the so-called “biological shield” that guarantees the safety of fertilizers obtained by the EHS_h method, including thick or drained fluids, solutions or other biologically filled liquids.

The results of testing have shown that pathogenic microorganisms (coliform bacterium, enterobacteria, shigella) have been destroyed after the treatment of cattle manure by the EHS_h method. The energy consumption of the treatment process itself was 2000 w/h. It is possible to successfully solve the problem of purification and disinfection of liquid livestock effluents while following the general principles of electrohydraulic purification and disinfection of liquids and liquid substrates. The water obtained after animal wastes having been treated by the EHS_h method is quickly regenerated and purified.

Application of the EHS_h method makes it possible to return biologically stabilized and purified water back into the agricultural cycle. The disinfected solid residues obtained after separation have 300 % more nitrogenous fertilizers, colloidal minerals alongside with a much smaller volume that can be briquetted into pellets.

Key words: manure bactericidal activity; disinfection; electrohydraulic effect; fertilizers; environment.

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