

AGRICULTURAL SCIENCES

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MONITORING THE BEST RESULTS OF VYATKA HORSES' WORKING QUALITIES TESTING IN HARNESS

The article brings together records of the Vyatskaya breed horses, recorded in harness- tests as follows: for the urgent delivery of cargo at a trot, urgent delivery of cargo at a walk, and for traction endurance. The results of these studies were compared to those of the data of tests of Vyatskaya horses taken in in literary and archival annals of the 19th–20th centuries. Calculated indicators of working qualities of the best Vyatskaya horses in tests for urgent delivery of cargo by trot are given (S, T, V, B, P, R, N).

Key words: Vyatskaya breed of horses; trials; working qualities; urgent cargo delivery.

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EFFECT OF PIRACETAM STRUCTURE ON THE LABORATORY RATS' REPARATIVE PROCESSES OF THE MOTOR CORTEX OF THE CEREBRAL HEMISPHERES AFTER TRANSIENT BYLATERAL OCCLUSION

Vascular diseases that lead to impaired cerebral circulation are the cause of death among animals, although they are much less common than among humans. Animals of all types get sick, but most often horses. Just as in the case of cerebral circulation disorders in humans, nootropic drugs are used in veterinary practice.

It is known that the biological activity of organic substances directly depends on their crystal and chemical structure. The interrelation «structure – biological properties (therapeutic effectiveness)» is relevant. At room temperature, piracetam can be found in three crystalline forms-I, II, III. Comparative studies of the biological activity of piracetam of different crystal forms are not available in the open press, therefore, such studies stay relevant.

A study of interrelation of a crystalline and chemical structure of piracetam when its influence

on osmotic resistance of human red blood cells, and on reparative processes of the motor cortex of laboratory rats after transient bilateral occlusion of carotid arteries.

By crystallization from aqueous solutions of piracetam with different pH, different crystalline forms of piracetam were obtained – forms I and II: from a solution with a pH < 7, form I crystallizes, and from a solution with a pH > 7, form II. Mechanical activation in a spherical planetary mill results in transforming form I into form II. The crystal structure of form II does not change during mechanical activation, though the chemical structure does. The results of physical and chemical studies suggest that as a result of mechanical activation, an intramolecular hydrogen bond is being formed in the piracetam molecule. Moreover, the difference in the spatial structure of forms I, II and II with intramolecular coupling persists for some time in aqueous solutions.

There was a high survival rate of animals observed acquiring the form of piracetam after transient bilateral carotid artery occlusion. They also had a decrease in the manifestations of apoptosis and vacuolization of neurons, less pronounced manifestations of gliosis. Currently, it is assumed that piracetam molecules bind to the polar heads of phospholipids in the cell membranes, which leads to the reorganization of lipids. As a result, the elasticity of the cell membrane rises. It is possible that the restoration of cell membrane elasticity is the key factor responsible for most of the clinical effects of piracetam. Phospholipids interact with groups C = O and-NH₂, the latter possessing of an effective charge. It is admissible that the mutual arrangement of C = O and-NH₂ groups in a form II of the piracetam molecule with an intramolecular hydrogen bond provides better contact conditions for these groups with the membrane receptors compared to the molecules of form I and form II without an intramolecular hydrogen bond. In addition, an increase in the hydrophobicity of form II with an intramolecular hydrogen bond is accompanied by an increase in lipophilicity, which increases the bioavailability of piracetam and thus, increases the effectiveness of this form of piracetam. The membranoprotective effect of form II with intramolecular hydrogen bonding leads to an increase in osmotic resistance of red blood cells and to the observed post-ischemic responses of the brain after acute bilateral transient brain ischemia having been manifested.

Key words: piracetam; crystal structure; chemical structure; laboratory rats; reparative processes; large brain hemispheres; transient bilateral occlusion of the carotid arteries.

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ANALYSIS OF BREEDING CHARACTERS OF CENTRAL RUSSIAN BREED OF BEES AND THEIR CROSSES IN THE UDMURT REPUBLIC

Being subjected to the constant influence of both artificial and natural selection, bee families undergo morphometrical and economic properties. Especially, these transformations affected the Central Russian bee breed, cultivated in the Udmurt Republic. Having proved to be low-resistant honeybees succumbed to their southern counterbreeds. The aim of the research is to analyze the selective properties of the Central Russian bee breed and their crosses in the Udmurt Republic. The purebred Central Russian bees and their crosses have served as a study material. Morphological assessment followed as per the A.A. Alpatov's method, whereas the honey productivity was assessed with the account of the gross collection of honey.

The article also presents a comparative analysis of the results of morphological (direct) properties - the length of the proboscis, the width of the third tergite, the width and length of the fore wings, the cubital index; indirect properties - the behavior of bees when their hive having been observed and unlidded, the mass of a one-day bee, the mass of an infertile and a fertile queen.

Among the experimental groups, the highest length of the proboscis has been defined for the purebred bees - 6,18 mm, the wing length - 9.8 mm, though the least width of the fore wings - 3,07 mm. The seasonal honey productivity from a bee colony of the Central Russian breed was 18,2 kg, from the cross bees it has reached 13,6 kg. It is clear that the higher the morphological characteristics of the tested groups, the more they show the highest honey productivity for the season.

Key words: bee colony; breed; technology; morphological properties; proboscis length; width of the third tergite; cubital index; honey productivity.

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AFTEREFFECT OF DESICCANTS ON THE YIELD OF YAKS OATS

This article presents research data on the aftereffect of desiccants on the yield of Yak oats. In the conditions of the Udmurt Republic, such studies on oat crops had not been studied, so far. The work was carried out in 2016-2017, by conducting field experiments and going through laboratory analyses. The soil of field experimental plots is sod-podzolic medium loam. Humus content varied from 2,28 to 3,21 %, respectively, mobile forms of phosphorus (P_2O_5) – 24,4–33,7, potassium (K_2O)

– 17,2–27,0 mg per 100 g of dry soil, pH of salt extract – 5,44–5,85. The weather conditions of the growing seasons in 2016 – 2017 differed from year to year: 2016 was dry (GTC = 0,6), and 2017 – was excessively humid (GTC = 4,3). Studies in the microfield experiment included the following options: the aftereffect of the processing time in the phase of the milk-dough state (MTS) of grain, in 3, 6, 9 and 12 days as followed after MTS with roundup, BP (3 l/ha), Basta, BP (3 l/ha), Reglon Super, BP (2 l/ha). The size of the plot was 1,05 m², the repeatability was sixfold. Seeding of the micro-field experiment was performed manually in the usual drill-way, with the interrow of 15 cm, with a seeding rate of 6.0 million pcs/ha of germinated seeds to a depth of 3–4 cm with oat seeds, 2015/2016 crops. Field experiments were carried out according to the generally accepted methods of experimental work. The performed research has shown that on average for 2016–2017, sowing oats with seeds after processing with desiccants Reglon Super, Basta and roundup provides an increase in field germination by 3,6–5,4 % whereas there were no changes in the number of productive plants (350–356 pcs/m²), in the density of the productive stem (409 – 417 pcs./m²) and in the productivity of the panicle (1,05–1,12 g), since $F_F < F_{05}$. It was found out that the aftereffect of oat desiccation with roundup, Basta, Reglon Super preparations, regardless of the timing of its application, did not increase the yield, though did not reduce the yield of Yak oat grain (436–443 g/m²), either.

Key words: oats; desiccants; field germination; elements of the yield structure; yield.

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EFFECTIVENESS OF NATURAL FEED ADDITIVES IN COW FEEDING DIETS-HEIFERS'

A comprehensive scientific and economic experience was conducted to study the effectiveness of using dihydroquercetin as a natural feed additive in a dairy cattle breeding. The studies were based on the breeding farm of JSC «Uchkhoz Jul'skoye, Izhevsk State Agricultural Academy», Votkinsky District of the Udmurt Republic. To proceed with the experiment, the 2 groups of first-calf cows of black-and-white breed were formed, 10 heads in each one. Animals of the control group received the standard diet; animals of the experimental group received a natural feed additive as a supplement to the standard diet. The natural feed additive contained feed salt and dihydroquercetin (purity 92 %). Animals of the experimental group were fed with a natural feed additive a month after calving, during three months and a.m. feeding in a dry powdered form mixed with feed salt. Till the end of the lactation period, the experimental animals, as well as the control ones were fed according to the standard diet. In the run of the research, it was found out that the

highest average daily milk yield was in the cows of the experimental group, and had reached 22.5 kg ($P \geq 0.95$), and that was by 0.6 kg more than in the control group. The milk yield obtained during the first 100 days of lactation from cows of the experimental group was very close to 2250 kg ($P \geq 0.95$), and that was by 54.1 kg more than from the cows of the control group. The fat content in the milk of the experimental group showed 3.87 %, which exceeded the peers by 0.3%. When analyzing milk yield during 305 days of lactation, it was found out that in the experimental group milk yield was 6793.7 kg ($P \geq 0.95$), and that was by 7.3% higher than in the control group. At the same time, the average fat content per lactation in the milk of first-calf cows in the experimental group was 4.21 % ($P \geq 0.95$), and that was by 0.18 % higher than in the control group. At the milk sale price 24 rubles / kg, the economic effect of milk production from animals of the experimental group was 18.3 %, and that was by 13.8 % higher than for the control group.

Key words: black-and-white breed; first-calf cows; dihydroquercetin; feed salt; lactation; milk yield; mass share of fat; level of profitability.

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INFLUENCE OF FEED ADDITIVE «BIOVOX» ON THE MICROFLORA OF THE LABORATORY MICE

Feed additive «Biovox» reduces the number of conventionally pathogenic microorganisms (*E. coli*, *St. aureus*) and possesses of bacteriostatic effect on microorganisms. Biovax having been applied to, the total number of mesophilic microorganisms in the oral cavity of laboratory mice has decreased. Decreases the number of microorganisms of the *Escherichia coli* group, pathogenic included.

When using a feed additive, growth of conventionally pathogenic microflora *E. coli* and *St. aureus* has deterred during the first day of cultivation in dilutions 10^{-8} and 10^{-9} . Active growth of *Bacillus subtilis*, as representatives of normal microflora and at 10^{-8} and 10^{-9} dilution on the second day, indicates a beneficial effect of the acidified environment on this group of microorganisms.

Key words: feed additive; «Biovox»; a water acidifier; a water microflora; pathogenic microflora; microflora of the oral cavity.

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INFLUENCE OF FERTILIZERS ON THE BIOFLAVONOID COMPLEX OF EDIBLE HONEYBOARD FRUITS (*LONICERA EDULIS TURCZ. EX FREYN*) ON A LOW-TYPE PEATBOARD

The article presents the results of a comparative study of the influence of N₁₆P₁₆K₁₆, Nanoplant, Hydrohumat and Ekosil on the bioflavonoid complex of fruits of the Kamchadalka and Leningrad Giant honeysuckle edible on the developed peat bog of lowland peat, its significant transformation was established, the degree of which was determined by the plant genotype and by the type of agricultural method accepted. Compared to the control, an increase has been found in their content of the total number of bioflavonoids by 16–91 %, the anthocyanin pigments by 16–112 %, including (of which anthocyanins themselves by 12–109 %, leucoanthocyanins by 23–116 %), and flavonols by 5–49 %, against the background of a decrease in the content of catechins by 8–32 %. In the case, the Kamchadalka variety was characterized by the most significant increase of the content of bioflavonoids in the fruits, especially when Hydrohumate had been added, whereas the Leningrad Giant cultivar - when treated with Nanoplant. The use of fertilizers has contributed to the increase of fruits in the composition of the P-vitamin complex of both honeysuckle varieties by 1.1–1.2 times the share of the actual anthocyanins and, to a lesser extent, leucoanthocyanins due to the weakening of those catechins (1.8–2.7 times) and flavonols (1.3–1.4 times in the Kamchadalka variety) and ambiguous changes in the Leningradsky giant variety, with the greatest expressiveness of the indicated shifts in both varieties on the background of Ecosil treatments

Key words: *honeysuckle; bioflavonoid complex; fertilizers; variety; yield.*

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TECHNICAL SCIENCES

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FOREIGN AGRICULTURAL TRACTORS AND THEIR OPERATIONAL PROPERTIES

The Park of tractors in Russia is formed by imports from both foreign countries and the republics of Belarus' and Kazakhstan. Small-sized machinery is supplied largely from China and Japan.

The article presents the dynamics of the agricultural tractors market in the Russian Federation, which shows that for over the past three years, the availability of tractors of foreign manufacture at the Russian market has been increasing approximately with the rate of 24 % per year. The leading manufacturers' structure of import of foreign agricultural tractors to the Russian market is also presented.

It is noted that out of the total number of tractors to be imported to Russia, the main share falls on tractors with the engine power over 177 HP. In the range of engines up to 102 HP tractors of Deutz Fahr manufacture are dominating; respectively, from 102 to 177 HP – by New Holland; over 177 HP are by the Massey Ferguson, Fend Vario and John Deer companies. The characteristic of the leading manufacturers of agricultural tractors is given, then the design features of foreign tractors by John Deer, Deutz Fahr, New Holland, Massey Ferguson, Fend Vario companies have been considered.

The technique of determining the operational properties of the tractor, developed and used at the Department of «Service of transport and technological machines and equipment in the agroindustrial complex», Ural State University. Based on this technique, the rating of tractor brands of different manufacturers depending on the engine power is determined. Based on the analysis of the operational properties of foreign tractors and the structure of the import of tractors to the Russian market, conclusions have been drawn in relation to evaluation of operational properties in various power ranges.

Key words: agricultural tractors; foreign tractors; imports of foreign tractors; engine power; engine power range; operational properties of tractors.

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SURFACE CHARACTERISTICS OF SUPERHARD CERAMIC COATINGS OBTAINED WITH LASER TREATMENT OF HIGH FREQUENCY

The main task of repairing process is to ensure the competitiveness of the technologies used in the process of restoring machinery parts. It is known that the main part of the complexity of the recovery process refers to mechanical treatment in the run of bringing the surface being recovered to the required parameters of cleanliness and roughness. This is especially evident when applying hard and porous coatings, when the machining methods are limited. In the paper, analyzed the surface quality parameters are presented of reinforced ceramic coatings based on boron carbide, the qualities thus obtained by high-frequency laser processing. Laser processing technologies have been known for a long time, and their use in the repair industry is increasing. Therefore, issues of the quality analyses of the surface condition after laser processing are relevant. In the process of research, multilayer ceramic coatings were obtained, the latter based on boron carbide B₄C with additional doping with boron nitride and magnesium oxide. The characteristics of the surface and structure of the coatings are determined with the energy, kinematic processing conditions and by the composition of the powder compound. While being analyzed, all the coatings have demonstrated high density, satisfactory adhesion and thickness in the range of 40-50 microns. Pure boron carbide coatings have unsatisfactory characteristics - high combing, undulation up to 50 microns and Rz 50 roughness. The coating is susceptible to cracking throughout its thickness. Supplementary boron nitride reduces the roughness within the parameter Rz to 10 ... 15, and which is a satisfying result for corresponding rough mechanical treatment. The coating acquires a more even structure, without strong combing and undulation. However, in the coating focal formation of cracks in the concentration zones of boron carbide is perceived. Doping of the powder compound with magnesium oxide has allowed to reduce the roughness to Ra values of 0.14, according to Rz, in the range of 1.8-2.5. The waviness of the coating does not exceed 10 μm, and no combing and porosity. These surface quality characteristics correspond to fine machining. Thus, the results of the research presented demonstrate a clear evidence of high efficiency of the laser processing use under the conditions of obtaining coatings to have been hardened and restored, with prior guaranteed surface characteristics.

Key words: ceramic coating; laser processing; surface quality; roughness; boron carbide; superhard coating.

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THE IMPACT OF MICROWAVE RADIATION ON PRODUCTION OF EXTRACTS FROM PLANT RAW MATERIALS

For regular functioning the human body needs natural nutrients: macro- and microelements. Extracts obtained from plant raw materials are natural food flavourings, taste improvers and colourants. Currently known traditional methods of obtaining extractives from plant raw materials in most cases do not let to achieve the desired effect because they do not provide sufficient completeness of the process, and are usually characterized by high duration and ineffective consumption of supplied energy. Electrical processing methods are simple and do not require complex hardware support; processing by means of electricity is much shorter in relation to time needed. These methods allow to get the desired effect without raw materials' nutritional qualities degradation; electrical processing is also easy to be combined with traditional food production technology.

The research is aimed at identifying the impact microwave radiation has on obtaining extracts from plant raw materials. One of the research purposes also was to produce food products by using obtained extracts. A kefir product was chosen as an exemplified object. To achieve the goal the following tasks were set: to compare the existing methods of obtaining extractives from plant raw materials; to identify the influence of microwave radiation on the cells' walls of the processed biological objects; to obtain data on the effects microwave radiation has on microorganisms; to compare the temperature parameters of the microwave extraction process when the product is being obtained from various types of plant raw materials; to identify the impact of microwave radiation on the release of vitamin C in the run of the extraction process; to carry out the testing producing of the product; to evaluate the quality of kefir product samples with the extracts introduced; to assess the effect of plant extracts on the quality of the kefir product in the run of its shelf-life.

The research was carried out in the Laboratory of the Department of «Technologies and Equipment for Food and Processing industries» of the Izhevsk State Agricultural Academy. Experimental-production testings were carried out at the milk processing enterprise LLC «Dabrov and K». To carry out the testings dry raw materials were used, those of chamomile, peppermint, rosehips, nettle; natural raws of currant, cherry, sea-buckthorn, cranberry; frozen raws of currant, cherry, sea buckthorn and cranberry.

Finally, conclusions have been made that in food production, the usage of microwave radiation in order to obtain extractives from plant materials is effective.

Key words: extraction; microwave radiation; plant materials; technology; technological parameters.

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COMPARATIVE ASSESSMENT OF THE CORROSION BEHAVIOUR OF ZINC COATINGS IN THE CONDITIONS SIMULATING OPERATION OF THE EQUIPMENT IN THE OPEN AIR

One of the most effective means of protecting metal construction equipment in agricultural premises from corrosion today is galvanizing. Galvanizing increases the service life of the equipment by 2-3 times, i.e. up to 20 years, which makes this method economically justified. In this paper, the corrosion of pure zinc obtained from the melt and rolled, hot-zinc and galvanic zinc coatings on St3 steel in chloride solutions based on distilled and meltwater is investigated.

It was found out that the intensity of corrosion of zinc and zinc coatings (galvanic and hot-zinc) in thawed (snow) water is lower than in distilled water. The reasons are presumably the high salinity of the melt water and the low solubility of oxygen. Adding sodium chloride (10-20%) to both distilled and meltwater reduces the corrosion rate of zinc and zinc coatings.

There is a similarity in the corrosion behaviour of cast zinc and hot-zinc coating, rolled zinc and electroplating in sodium chloride solutions in distilled and melted water with the addition of inhibitors: the addition of benzotriazole and magnesium orotate does not affect the corrosion intensity of cast zinc and hot-zinc coating.

It is shown that cast zinc and electroplating are less corrosion-resistant than rolled zinc and hot-zinc coating. Nitrogen-containing heterocyclic inhibitors (magnesium orotate, benzotriazole, benzotriazole-based inhibitors) containing oxygen atoms in the molecules reduce the intensity of corrosion of zinc and zinc coatings, while in the case of nitrogen-containing inhibitors without oxygen does not lead to such an effect.

The protective ability of the zinc coating is maintained as long as it occupies at least 10% of the surface area of the steel product. Reducing the area of the zinc coating leads to catastrophic corrosion failure of the coating.

Key words: corrosion; zinc; zinc coatings; meltwater; inhibitors.

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