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### **EVALUATION OF THE CHEESE SUITABILITY OF GOAT AND COW'S MILK**

It seems expedient and reasonable to use goat's milk for producing semi-hard cheeses, as well as its compound with cow's milk. The studies were carried out within the period of 2018–2020. For researches, 5 samples were compounded: sample 1 – cow milk; sample 2 – goat milk; sample 3 – a compound of goat and cow milk in a 1 : 1 ratio; sample 4 – a mixture of goat and cow milk in a ratio of 3 : 1; sample 5 – a mixture of goat and cow milk in a ratio of 1 : 3. Evaluation of milk and cheese qualities was carried out according to commonly accepted methods. In goat milk, compared to cow milk, the SNF content showed by 0.52 % higher ( $P \geq 0.95$ ) and reached 8.49 %. In a compound of goat and cow milk, in a ratio of 3 : 1, the content of SNF was 8.39 % which was higher than in a mixture in a ratio of 1 : 1 by 0.29 %, and 1 : 3 by 0.31 % ( $P \geq 0.95$ ) respectively. In terms of organoleptic, physicochemical and microbiological indicators, cow milk fully meets the requirements of GOST R 52054-2003 and GOST 32940-2014. In cow milk, the content of somatic cells was 186.4 thousand/cm<sup>3</sup> which is by 498.1 thsd / cm<sup>3</sup> ( $P \geq 0.999$ ) less than in goat milk. Goat milk has a high calcium content – 209.4 mg% which is by 58.5 % or 77.3 mg% ( $P \geq 0.99$ ) higher than cow's milk. The same trend can be traced in a compound of the goat and cow milk, in a ratio of 3 : 1. The duration of rennet coagulation was 18.3 minutes for the cow milk, which is 7.2 minutes longer than in the goat milk. According to the results of the tasting assessment of cheese, all samples can be qualified as of the highest grade. The highest number of points had been awarded to the cheese of a compound of goat's and cow's milk, in a ratio of 3 : 1. To produce 1 kg of cheese from goat milk, 6.86 kg of raw milk is needed which is 5.08 kg, or 74.1 % less compared to cow milk. The least expenditure of milk had been observed in a compound of goat and cow milk, in a ratio of 3 : 1. Readymade cheese can be packed in triangular segments of MGS in a rigid film on a thermoformer. Packaging and labeling must comply with the regulatory documentation for the type of a product.

**Key words:** cow's milk; goat's milk; a compound of goat and cow milk; cheese suitability; semi-hard cheese; cheese yield; packaging; labeling.

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## **AGROECOLOGICAL ASSESSMENT OF AGRO-SOD-PODZOLIC REGRADED SOILS (*ALBIC GLOSSIC RETISOLS (LOAMIC, CUTANIC, OCHRIC)*) OF FALLOW LANDS IN THE UDMURT REPUBLIC**

In the article, an agroecological assessment is given over agro-sod-podzolic regraded soils (Albic Glossic Retisols (Loamic, Cutanic, Ochric) of different overgrowth periods of loamy and sandy loamy granulometric composition located over transit and accumulative landscape elements. The study was carried out by the method of expeditionary soil-ecological surveys of the territory of regions in the Udmurt Republic. It was found out that in loamy soils of fallow lands located on the elements of the agricultural landscape's slopes of the transit direction there a change in physicochemical and chemical properties takes place, the intensity of which depends on the initial level of soil fertility in key areas – the higher the initial fertility of arable land turning into fallow, the higher the value deviations of the trait from the arable analogue: a significant shift in the environment reaction of the soil layers 0–10 and 10–20 cm to the acidic side; an increase in the amount of absorbed bases in the 0–10 cm soil layer and a decrease in it in the 10–20 cm layer; a decrease in the saturation degree of the bases both in the 0–10 cm soil layer and in the 10–20 cm layer. The humus content in loamy soils of fallow lands located on the elements of the agro-landscape's slopes of the transit direction has increased by 19.3...36.6 rel.% in the 0–10 cm layer and decreased in the 10–20 cm layer by 9.4...17.8 rel.%. The soil acidity of the fallows located on the accumulative elements of agricultural landscapes decreases less pronounced, in contrast to the soils located on the transit slopes, and usually affects the upper layer of the humus horizon, which is caused by greater moisture, in comparison with the soils of the transit slopes.

Removal of lands from active agricultural use, even for a long period, doesn't have a negative effect on the humus state of sod-podzolic loamy soils. On the contrary, the humus content and its reserves in fallow lands increase the labile carbon content in the soil increases. The labile part of organic matter in the humus layer of fallow lands increases, as a rule, in proportion to the period of natural overgrowth. The composition of humic acids is dominated by fulvic acids, both in the upper part of the humus layer 0–10 cm, and in its lower part 10–20 cm.

**Key words:** lands excluded from active agricultural use; the period of overgrowth; elements of agricultural landscapes; agrochemical properties; granulometric composition; Albic Retisol.

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## **LANDSCAPE AND FORESTRY CHARACTERISTICS OF PINE PLANTATIONS IN RECREATIONAL ZONES OF SPECIALLY PROTECTED NATURAL TERRITORIES OF THE UDMURT REPUBLIC**

Specially protected natural territories serve as an important element of recreational forest management. With constantly growing urbanization, it is important to preserve the environmental, water protection, protective, sanitary-hygienic and health-improving functions of forests. A tendency of increasing recreational use of forests leads to the appearance of negative changes in forest ecosystems.

The purpose of the work is to determine the recreational potential of pine plantations in the recreational zone of specially protected natural territories of National Park Nechkinsky and Nature Park Ust'-Bel'sk.

The results of eye-measuring and landscape taxation of pine forest plots on 21 laid testing area are presented. According to the results of correlation and regression analysis, a close relationship between the stages of digression and recreational load has been revealed. The equations of dependence of recreational attendance of forests on the stage of digression have been compiled.

It is established that the territory of the recreational zone of the studied objects is dominated by stable pine plantations, with a high recreational rating. These plantings play a significant role in ensuring the conditions for conservation of natural complexes and the implementation of recreational use of forests of the Udmurt Republic.

**Key words:** specially protected natural territories; recreational loading; recreational assessment; type of spatial structure; digression; forest type.

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## **MICRONUTRIENT STIMULATING ADDITIVES WITH CONTROLLED REDOX POTENTIAL**

The application of innovative technologies when cultivating crops ensures a high yield, reduces material costs and increases the ren-service capacity of production. One such a direction is the development and application of nanoelements for crop production with optimal particle parameters for maximum absorption of macro- and microelements. These metals cannot directly interact with the plant. As an alternative, the paper proposes a nanosolutions technology to be used and based on colloidal systems. Such microelements are more accessible to plants. Therefore, influence of trace elements of oxidation-reduction potential (ORP) of colloidal solutions on barley yield was studied. Studies carried out in the field conditions on sod-podzolic medium-glutinous medium-occult soil have confirmed the assumption of the effect of the sign of particle charge in solution when soaking seeds. The aim of the study was to develop the use of nanoelements for a plant with optimal particle parameters for maximum absorption of macro- and microelements. The task is to study the influence of redox potential (ORP) of colloidal solutions of trace elements on barley yield. The two-year studies proved that in versions with pre-treatment of barley seeds with solutions of had negative ORP ( $\text{Cu}^-$  and  $\text{Co}^-$ ), the yield of barley grains significantly exceeded the control version being devoid of treatment by 11,1–13,2 g/m<sup>2</sup>. Treatment of seeds with colloidal solutions with positive ORP ( $\text{Cu}^+$  and  $\text{Co}^+$ ) had affected the crop negatively. As a result, the yield of barley had decreased by 8,4–27,5 g/m<sup>2</sup> with the  $\text{SSD}_{05} - 6,3$  g/m<sup>2</sup>.

**Key words:** colloidal solutions; redox potential; pretreatment; yield.

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## **COMPARATIVE ANALYSIS OF THE INFLUENCE OF HONEY PLANTS ON THE PRODUCTIVITY OF THE CENTRAL RUSSIAN HONEY BEE**

In apiaries, a system of keeping bee colonies in 12 frame or 16 frame hives-loungers is used. To hold hives during the period of autumn and winter dormancy, they are placed in specialized winter-loungers. The Kalinovka apiary, the advantage is 25 141.25 kg per season possesses the largest stock of available honey resources. In summer, within the radius of summer period the dominant crops

for the bees of “Krasniy Yar” and “Kalinovka” are meadow clover – 13 440 and 12 885 kg and alfalfa – 46 665 and 114,750 kg, respectively. Winter survival of bee colonies Kalinovka is 1 street higher, the amount of brood also exceeds the indicators of Krasniy Yar by 1 unit. This can be explained by the location and the presence of a more protected area from the winds. The purity of the hives is average, the difference between the two apiaries makes 0.6 points. Overall, it determines winter resistance at an average level. The amount of commercial honey between apiaries differs by 25 kg in favour of the Kalinovka apiary, the amount of fodder honey is also 15 kg higher. Marketable honey per colony in the Krasnoyarsk apiary is 25 % lower. The resulting difference is due to the presence of a greater variety of melliferous crops during the main honey harvest period. The apiary Kalinovka is characterized by greater economic efficiency, the volume of production per one bee colony is 2.6 conventional units higher than at Krasny Yar – the total profit of the apiary is 41 % lower. Despite this, the profit per 1 conventional honey unit from apiaries differs by 12 rubles. The profitability level is 8.4% higher at the Kalinovka apiary.

**Key words:** bees; beekeeping; fodder; honey; honey productivity.

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### **ANALYSIS OF EXISTING TECHNOLOGIES FOR FERTILIZING CROPS WITH CARBON DIOXIDE AT THE PROTECTED SOILS**

The issue of plant nutrition in vegetable and flower growing farms in the Russian Federation is of great importance today. There is an acute issue of fertilizing plants with carbon dioxide in protected ground structures. Low concentration of carbon dioxide when growing plants is a factor limiting the yield. As you know, plants need a large amount of air for photosynthesis, since the content of carbon dioxide in the atmospheric air is only 0.03 % which is insufficient for optimal growth and development of plants. With insufficient air exchange, the content of CO<sub>2</sub> in greenhouses being intensively absorbed by plants, carbon dioxide content can fall down below 0.01 % and photosynthesis practically falls to zero. The study of existing technologies for feeding crops of protected soils with carbon dioxide, and along with the increase of the efficiency of electrical equipment feeding plants with CO<sub>2</sub>, and calculating the reduction of costs entailed by growing greenhouse crops with the use of installations for generating carbon dioxide is a priority for the study.

**Key words:** carbon dioxide; plant fertilizing.

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## **OPTIMIZATION OF THE MODES OF FORMATION OF PROTECTIVE AND RESTORATIVE CERAMIC COATINGS BASED ON MULTIFACTORIAL PLANNING OF THE EXPERIMENT**

This paper is devoted to the issues of optimization of technological modes of the restorative and hardening coating on the working surface of the valve chamfer. It is known that modern mashinebuilding, when turning to gas engine fuel, runs through the difficulties over durability of the valve mechanisms. One of the solutions to the problem is ceramic coating on the surfaces of the working part of the valves. However, there is some difficulty in the application, namely the difficulty of obtaining non-porous and dense coating. Therefore, the issues of optimization of the application modes are relevant and require additional researches. The problem having been solved it is possible to obtain high-quality and durable protective and restorative coatings. To optimize the modes of application and data processing the software products STATISTICA 10, KOMPAS-3D were used. Laboratory studies also were carried out using a friction machine SMT-2070, a stationary Vickers hardness tester PMT-3 and an UPOI-6 optical microscope. The research results have proved our expectations. In particular, it has been proved that the kinematic and energy modes of laser treatment have a decisive influence on physical and mechanical properties of the coatings created. Obtained regressive models of the investigated parameters made it possible to obtain a graphic reflection of the dependence of the investigated parameters on the characteristics of laser processing and thereby optimize the processing parameters through the extrema of the response surfaces.

**Key words:** protective and restorative ceramic coating; planning of the experiment; porosity of the coating.

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## **DETERMINATION OF STARTING CHARACTERISTICS OF AN ASYNCHRONIC MOTOR WITH A COMBINED WINDING**

One of the ways to improve the energy characteristics of asynchronous motors is to use a combined stator winding instead of its standard one. This leads to a decrease in the relative content of higher spatial harmonics in the distribution curve of the magnetomotive force generated by the stator current. Besides, active resistance of such a winding with certain motor dimensions may be lower than that of a standard one. All this can affect not only the improvement of the energy characteristics of the motor, but also affect its starting properties. The paper implies to show the dependences of current, active power and the torque from the voltage supplied to the motor with a locked rotor. The tests carried out had been performed on the two rewound АИР71В4 motors, with

a rated power of 0.75 kW, whereas in one of the motors a standard winding was laid, and in the other one – combined winding. At each given voltage value, the measurements of the readings of the devices were recorded several times. The processing of the results obtained was carried out in the Excel Programme. Tests have shown that at the rated mains voltage, an experimental motor with the combined winding has a larger starting current by 3.38 %, active power consumption by 5.84 % and the developing starting torque by 14.11 % compared to a similar motor with standard winding

**Key words:** induction motor; combined winding; higher harmonics; starting characteristics..

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## **EFFICIENCY ANALYSIS OF THE HARDENED KNIVES FOR THE ROTARY MOWER KRONE EASYCUT B 870 CV**

The paper analyzes the feasibility of the efficiency rise of the Krone EASYCUT B 870 CV rotary mower by increasing the cutting properties of the knives when applying ceramic coatings to the cutting edge. The coating technology provides for laser synthesis of thin coatings based on nickel-based ceramic compounds. The thickness of the synthesized coatings is 10–15 microns, with an initial roughness of Rz 40, the hardness of the coatings is 9800 HV. To assess the effectiveness of the decisions made, production tests were carried out in the conditions of AO “Put' Ilyicha” in the Zavyalovsky district, Udmurt Republic. To determine the cutting properties of hardened knives at the Department of Operation and Repair of Machines at the Izhevsk State Agricultural Academy, a technique and device for determining the cutting force had been developed. The research results have confirmed arguments referring to the possibility of increasing the cutting properties of the knives for the Krone EASYCUT B 870 CV rotary mower. In the run of operation, a decrease in the wear rate of hardened cutting edges by 10–14 % has been observed. The maximum wear reduction is observed with an operating time of 800 hectares, which confirms the high resistance of the cutting edge under conditions of intense fatigue and shock loads. Besides, the reduction of cutting power losses has been analyzed and it is noted that the hardening of the knife reduces cutting losses by 10–14 %.

**Key words:** hardening coating; knife; mower; wear resistance; cutting power.

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## **THEORETICAL STUDIES OF THE PROCESS OF GRASS MOWING BY A SEGMENT-FINGER MOWER**

The article provides a kinematic analysis of existing cutting units and determines their main parameters. The substantiation of the operational drawbacks of the knife drive mechanism of the existing segment-finger mowers and their elimination by using a non-deaxial knife drive in the segment-finger mower has been carried out. As a result of theoretical studies, it was found out that with a connecting rod length of  $L = 1200$  mm, an eccentricity of 38.1 mm, when the angle of inclination of the connecting rod changes from  $0^\circ$  to  $30^\circ$ , the  $S + \Delta S$  knife stroke changes to 12.8 mm, and its maximum value reaches 89 mm. The increase in the knife stroke, first of all, increases the energy consumption for the knife drive due to the increase in speed of its movement. In addition, with the increase in energy consumption during the formation of desaxial  $\zeta$  the following disadvantages occur: the friction forces of the knife head along the guides increase, and as a result, they lead to heating of rubbing surfaces, tear-and-wear and the appearance of gaps; to beating, vibration and additional noise; power consumption increases to overcome frictional forces; heating and tear-and-wear of rubbing parts increases; gaps between conjugating parts, vibration and noise of the unit increase; there appears a case of unloading of the mown mass in front of the cutter bar.

**Key words:** segment-finger mower; disaxial; crank mechanism (CM); cutting device; balancing device.

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