

Original article

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FEEDING PRODUCTIVITY OF NARROW-LEAVED LUPINE DEPENDING ON PRE-SOWING SEED TREATMENT AND SEEDING RATE

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Abstract. Grain legume crops are of great significance in obtaining feeds of high quality with high protein content. It is also very important that approximately 40–45 % of the crude protein of lupine seeds are amino acids, and their composition and quantity provide high biological value and protein quality. The total amount of essential amino acids is 35–55 % of the lupine seed protein. The aim of the work is to evaluate the effectiveness of pre-sowing seed treatment and seeding rates for the feeding productivity of narrow-leaved lupine. The research was carried out in the Educational Scientific and Industrial Complex (Agrotechnopark) of Udmurt SAU on the sod-podzolic middle loamy soils. Before sowing the seeds were treated with the inoculant Rizotorfin (*Rhizobium lupine*) (1 l/t), the plant growth regulator Melafen (5 ml/t), the complex fertilizer Agree's Forsazh (2 l/t), the fungicide Maksim XL (0.4 l/t. m), the complex fertilizer Agree's Forsazh together with the plant growth regulator Melafen, the fungicide Maksim XL together with the plant growth regulator Melafen, the fungicide Maksim XL together with complex fertilizer Agree's Forsazh. The control variant was without any treatment. The seeding rate was 1.0 million, 1.2 million, 1.4 million pcs/ha of germinating seeds. A three year study has proven an increase in feeding productivity of narrow-leaved lupine when applying the inoculant Rizotorfin, the complex fertilizer Agree's Forsazh, the plant growth regulator Melafen, the fungicide Maksim XL and their tank mixtures. The highest yield of metabolic energy of 23.1 GJ/ha and crude protein harvest of 0.57 t/ha are ensured by pre-sowing seed treatment with Agree's Forsazh complex fertilizer and sowing at a rate of 1.2 million pcs/ha of germinating seeds.

Key words: narrow-leaved lupine, crude protein, metabolic energy, pre-sowing seed treatment, seeding rate.

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COMPARATIVE ASSESSMENT OF SEED PRODUCTIVITY OF VARIEGATED ALFALFA VARIETIES IN NORTHERN KAZAKHSTAN

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Abstract. Alfalfa has an important function in solving the problems of forage production since it is nearly the only crop that increases soil fertility and is successfully grown both on rain-fed and irrigated lands. The purpose of the research is to determine the varietal features of the formation of seed productivity of alfalfa varieties under the arid conditions of Northern Kazakhstan. The research was carried out on the basis of stationary field experiments laid down in A. I. Barayev Research and Production Centre for Grain Farming in the Republic of Kazakhstan. The soil of the experimental site was a low-humus southern carbonate black soil, which is characterized by a high content of carbonates. 32 varieties of variegated alfalfa of different ecological and geographical origin were studied, including 10 varieties of Kazakhstan breeding, 18 varieties of Russian breeding, 3 varieties of Canadian breeding and 1 variety of Ukrainian breeding. It has been found that the varieties Shortandinskaya 2, Karagandinskaya 1, Karabalykskaya 18, Karabalykskaya raduga, Karabalykskaya pearl, Lucia 14, Kokshe, Lazurnaya of Kazakhstan selective breeding, varieties Uralochka, Nakhodka, Sarga of Russian selective breeding were distinguished by the highest seed productivity of 2.31–2.48 dt/ha. It has been established that the harvesting of alfalfa varieties for seeds can be started already in the first year of use, while the density of the herbage and their productivity in subsequent years of use do not decrease. The varietal reaction of variegated alfalfa used for seed purposes was revealed. The fourth year of use showed that varieties Muslim, Tatar pasture, Flora 7, Flora 4 and Ferax reduced seed productivity by 20–29 % relatively to productivity in the third year of use, varieties Zarya, Guzel, Voronezhskaya 6 and Rhizoma – by 34–37 %, varieties Blagodat and Nadezhda – by 40–44 %, Rangelander – by 50 %, which indicates the inexpediency of using grass stands of the 4th use for seeds.

Key words: variegated alfalfa, seed productivity, structure of crop yield, weight of 1000 seeds.

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Original article

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POSTEMBRYONIC DEVELOPMENT OF YOUNG ANIMALS AND MILK PRODUCTIVITY OF KAZAKH BACTRIAN FEMALE CAMELS (*CAMELUS BACTRIANUS*)

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Abstract. Kazakh Bactrian camels do well in natural pastures and develop their productive and reproductive qualities at the highest possible level. The aim of the study was to analyze the biological features of the postembryonic development of young camels and to establish the main patterns of formation of milk productivity of female camels of the Kazakh Bactrian breed (*Camelus bactrianus*). The research target was the young and breeding stock of Kazakh Bactrian camels bred in the conditions of the Balkhash zone of Kazakhstan. During the period from the birth to 18 months of age, males are superior to females in the development according to both in body measurements and in live weight. The increase in the quantitative parameters of the body is determined by the intensity of growth. In our studies, the average daily gains during the accounting period in young animals ranged from 220.4 g to 977.1 g in males, and in females from 217.1 g to 907.9 g, respectively. Over 18 months, the average daily weight gain in males was 472.4 g, which is 6.8 % more than in females (442.2 g). The analysis of the milk productivity of the breeding stock of camels of different origins showed that the female camels of the Temir Bura line surpassed their herd mates of the Aport Bura line in milk yield for 6 months of lactation by 14.7 kg (1.9 %), and in the amount of milk fat by 1.1 kg (2.2 %). The data obtained in ontogenesis of the dynamics of body measurements and live weight of young camels are recommended to be used as criteria for assessing the development of purebred Kazakh Bactrian. Milk yield of Kazakh Bactrian female camels with twice-a-day milking significantly increases from April to July, followed by a decrease in milk productivity

Key words: *Camelus bactrianus*, young camels, growth and development, female camel, milk yield, milk fat.

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EFFECT OF THE “ACTIVE MIX” VMG 500/600 FEED ADDITIVE ON THE CONTENT OF MICROELEMENTS AND VITAMINS IN THE BLOOD OF FIRST-CALF HEIFERS

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Abstract. The article presents the results of using the new liquid feed additive “Active Mix” VMG 500/600, which was given to heifers of the Holsteinized Kholmogorsky breed in the period of 2 weeks before and 2 weeks after calving. When creating this feed additive, new approaches were applied aimed at increasing the digestibility of vitamins and microelements, as well as reducing the signs of their antagonism. The dynamics of changes in the content of microelements in the animal blood was studied: copper, zinc, cobalt, iron and selenium, as well as vitamins A, C, E. It was established that there were changes that could be explained by such physiological processes as calving, production of colostrum and milk. The levels of these vitamins and microelements in the blood of animals that received the liquid feed additive turned out to be higher compared to the animals of

the control group, which were not given it. The general state of the animals, the process of calving, colostrum and milk production were also assessed. Before the beginning of the experiment all heifers had signs of microelement and vitamin deficiency. During the study the state of the animals of the experimental group returned to normal, calving was easier, and the production of colostrum and milk turned out to be higher compared to the animals of the control group (in which the signs of vitamin and microelement deficiency persisted). The protein and fat content in the milk of cows of the experimental group increased. In addition, the content of trace metals in the blood of animals of the experimental group was higher than in the control group. Thus, the high efficiency of using the feed additive “Active Mix” VMG 500/600 was shown.

Key words: feed additive, chelate complex compounds of microelements, vitamins, bioavailability, first-calf heifers.

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Original article

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REALIZATION OF THE GENETIC POTENTIAL OF COWS DEPENDING ON THE SELECTION AND MANAGEMENT METHODS

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Abstract. The realization of the genetic potential of cows with different selection methods depending on the cattle management methods has been studied. The studies were carried out in the breeding plant of the agricultural complex “Kolos” of the Vavozhsky district of the Udmurt Republic. Two groups were formed depending on the management method: group I – loose and cubicle housing, group II – tie-up housing. Each group included cows of all ages, the average age of cows was 2.4 lactation. The milk productivity of cows of each group was studied according to the highest

lactation, depending on the linear features and the method of selection: in-line and interline selection. The genetic potential of cows was determined based on the productivity of female ancestors (parental cow index) and the degree of realization of genetic potential. The research results revealed that the realization of the genetic potential of cows bred by different selection methods had a certain difference depending on the keeping method. The realization of the genetic potential for milk yield for 305 days of maximum lactation with in-line selection using a loose and cubicle housing was the greatest in the Vis Back Ideal breeding line and amounted to 101.2 %, the lowest – with the breeding of the Reflexion Sovering line – 97.1 %. The degree of realization of the genetic potential of milk yield of cows with the tie-up housing was higher in the Montvik Chieftain and Reflection Sovering breeding lines – 103.1 %. The fullest realization of the genetic potential of the milk yield of cows bred with the interline selection of the Vis Back Ideal and Ceiling Tridejune Rocket lines was with the loose and cubicle housing – 103.2 %, and with the tie-up housing with the selection of the Montvik Chieftain and Reflection Sovering breeding lines – 103.1 %.

Key words: cattle, genetic potential, milk productivity, in-line selection, interline selection.

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DETERMINATION OF SOME MICRO- AND MACRO-ELEMENTS IN THE BODY OF BEES WHEN USING A FEED ADDITIVE

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Abstract. The formulations of modern feed additives for bees are often compiled without taking into account the chemical interaction of the components, their possible antagonism and synergy, which reduces the effectiveness of their application. The purpose of the study was to evaluate the

effectiveness of using new approaches to the formulating feed additives for bees. The feed additive composition was divided into two parts. One part was dry and contained salts of some micro and macro elements, as well as soy flour. The second part was liquid and was an aqueous solution of vitamins C, B₂ and B₆, as well as chelate complex compounds of some microelements. In addition, it included emulsified fat-soluble vitamins A, D₃, E. The studies were carried out on bees from one bee colony. Three groups of bees of 40 g in cages were formed. The first group received a feed additive prepared in the usual way (mixed with sugar syrup); the second group of bees received a new feed additive; the third group of bees – sugar syrup without feed additives. As a result, the dose of vitamins and microelements received by the bees of the 2nd group was 4 times less compared to the 1st group. During the study a comparison was made of the efficiency of uptake of some elements (Cu, Fe, Mn, Ca, Zn) when using a new feed additive. The bees of the 2nd group turned out to have the calcium content in the body higher than in the bees of the 1st group by 0.09 %, which may indicate a supposed decrease in the biochemical (physiological) antagonism of the components of the feed additive when they are fed separately. The average content of zinc and manganese in the 2nd group was only slightly lower than in the 1st group (by 2.0 and 4 mg/kg, respectively), copper was 1 mg/kg more, and the iron content was the same (70 mg/kg). The calcium content in the 3rd group was higher than in the 1st group (by 0.6 %) and lower than in the 2nd group (by 0.03 %). This may be due to the antagonistic effect of other substances (given together) on the absorption of calcium when using a feed additive prepared in the usual way.

Key words: beekeeping, feed additive, chelate complex compounds, micro-elements, macro-elements, vitamins.

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Original article

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ON THE BEARING CAPACITY OF THE BPC-12 CULTIVATOR FRAME

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Abstract. Increasing the bearing capacity of the structural elements of the tillage machine frame is an urgent problem of agricultural production engineering. The purpose of the work is a theoretical study of the strength of the most loaded structural elements of the cultivator frame. To achieve this goal, the operational loads on the frame due to the resistance to the movement of the cultivator were calculated; the structural elements that lost their bearing capacity in the form of significant residual deformation and viscous destruction were calculated for strength; an assessment of the reliability of the design under various operating conditions of the cultivator was given. One of the most effective numerical methods for calculating machine parts is the finite elements method. However, the adequacy of the solution of this method significantly depends on the correctness of setting the boundary conditions, based on experiments or an intuitive approach. Incorrect selection of boundary conditions leads to a significant deviation of the theoretical solution from the real stress-strain state of the structural element. Analytical methods are still widely used, however, in the case of statically indeterminate constructions, they can also be solved as systems of algebraic equations, which can be solved using any analytical software package. Thus, the refinement of the existing methods of calculating units is an urgent task in the design and modernization of agricultural machines. All the calculated beams, crossbars and half-frames of the cultivator are statically indeterminate structures. To reveal the static uncertainty the following energy methods were used: the equation of three moments for adjacent spans of beams and the Castellano method for supporting half-frame sections. Calculations have shown that under normal operating conditions of the cultivator, the dimensions of the cross-sections of the frame elements ensure its operation with a margin of safety exceeding the standard by 1.1...1.3 times. The destruction of the frame elements and their interfaces is associated with the redistribution of external forces between them due to the loss of the bearing capacity of the main transverse beam of the half-frame because of intensive dynamic loading, as well as improper transportation of the cultivator.

Key words: cultivator, frame, destruction, load-bearing capacity, reliability, strength calculation.

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STUDY OF ANTIFRICTION PROPERTIES OF CERAMIC RECOVERY COATINGS BASED ON IRON OXIDE

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Abstract. Modern repair production is developing in the direction of obtaining thin recovering coatings mainly from composite materials, based on the use of ceramic materials. However, the use of ceramic compositions in mass production is hindered by the lack of reliable data on their anti-friction properties. This work is devoted to the study of the tribotechnical properties of recovering coatings based on the FeO oxide matrix additionally doped with boron oxide B₂O₃. The coatings are obtained by highly concentrated short-pulse laser processing of powder compositions previously deposited on metal surfaces. The resulting coatings are subjected to wear tests under conditions of dry sliding friction with fixation of the friction coefficient, depending on the applied load and the formulation of the powder composition. The obtained research results confirm the high antifriction properties of ceramic coatings based on oxide compounds. Oxide structures have a positive impact on the antifriction properties of coatings, in particular, the introduction of boron oxide in the range from 2 to 4 % into the formulation of the ceramic composition reduces the friction coefficient to unique 0.09–0.1 under dry friction conditions. In this case, the formation of stable tribological structures between the contacting surfaces is observed.

Key words: ceramic coatings, iron oxide, tribolayer, coefficient of friction, short-pulse laser processing.

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IMPROVEMENT OF THE ELECTROSTATIC SMOKING UNIT FOR ENHANCING THE QUALITY OF COLD SMOKED FISH

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Abstract. The article shows the state of the fish products market in Russia in recent years. The analysis of the reasons hindering the development of the fish processing industry is given, and the conclusion about the need to introduce new energy-saving technologies for the production of smoked fish products is drawn. The aim of this work is to enhance the quality of cold-smoked fish by improving the design of the electrostatic smoking unit. The article substantiates the feasibility of using electrical technology in the production of cold smoked fish. The mechanism of fish production by this method is shown, the advantages and disadvantages of the electro-smoking technology are given. Based on the analysis of the existing electric smoking units, the UEC-1 unit was selected as the most suitable for the production of cold-smoked fish for companies with a small production volume. The smoking process revealed the disadvantages of UEC-1 consisting in the discrepancy between the temperature of the smoke fume to the required value and in the smoking inconsistency. The modernization of the mentioned unit has been carried out; for this purpose the existing smoke generator has been replaced with a new remote smoke generator. The work of the smoke pipe was investigated and its parameters were determined experimentally. The length of the smoke pipe should be at least 4000 mm for salmon fish and 2000 mm for all other fish. The paper proposes to introduce a device that provides automatic switching-on of the high voltage source as the smoke fills the smoking chamber, which makes the work of the smoker man easier and improves the quality of the finished product. The duration of smoke treatment of fish during electrostatic smoking is from 5 to 20 minutes, the ageing time is from 12 to 36 hours depending on the variety and weight of the fish.

Key words: automatic control, high-voltage source, smoke generator, smoke pipe, product quality, smoke fume, fish products, electric field, electric smoker, electric smoking.

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JUSTIFICATION OF THE DESIGN AND MAIN PARAMETERS OF THE MODULE FOR CLEANING THE SORTING SURFACE

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Abstract. Equipment cleaning for the food production and food processing is a complex production process that depends on many factors: design features and materials from which the equipment is made, cleaning methods, cleaning solutions and washing intervals. The Department of Food Engineering and Biotechnosphere Safety of UdGAU gains experience of servicing the technological equipment in order to obtain safe food products. The purpose of this work was to study and determine the design and technological parameters of the multifunctional control module of actuators in the production of quick-frozen semi-finished products from potatoes. During the work the studies of the sorting a heap of cut potatoes and contamination of the sorting surface, depending on the physical and chemical properties of the supplied raw materials were carried out. A scheme of interaction of the elements of a multifunctional module is proposed and four stages of the production and technological process are substantiated. To confirm the results of theoretical studies, experiments were carried out on a plant model for which the Arduino Mega 2560 platform built on the ATmega 2560 microcontroller was used at the control module of actuators. We succeeded in obtaining a regulated cleaning of the sorting surface under the following conditions: the fixed time of cleaning cycle is 10 min. which corresponds with the duration of technological interval, the pressure of cleaning solution is 5–5.5 MPa, the concentration is 5 %, temperature is 45–55 °C. The application of the design provides cleaning without dismantling the equipment, reduces the time spent on washing, improves the quality of the final product.

Key words: process, parameter, solution, surface, interval, washing, quality, torch, nozzle, potatoes.

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