Original article
DOI 10.48012/1817-5457_2023_2_4-11

GROWTH AND DEVELOPMENT OF HEREFORD BULL CALVES IN UDMURTIA

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Abstract. The main task of the agro-industrial complex is ensuring the country's food security. Beef is a strategic product, and therefore, the development of beef cattle breeding is of particular relevance. The purpose of the work is to study the growth and development of Hereford bull calves obtained from cows of the Udmurt and Permian generations. The research was carried out on the basis of OOO Vostok in the Seltinsky district of the Udmurt Republic on Hereford bull calves of various origins. Monitoring for the growth and development of animals was carried out by individual weighing. On the basis of it, the absolute and average daily gain and the relative gain according to the Brody formula were calculated. Exterior features, growth and development of young cattle of meat productivity were studied at birth, at 8, 12 months and before slaughtering by taking measurements from the corresponding parts of the body according to the generally accepted methods. The live weight of bull calves at birth was in the range of 28–40 kg, on average in groups (31.7–32.6 kg). By the age of 205 days, the bull calves obtained from Udmurt cows outperformed their herd mates by 2.5 kg, by 8 months the difference increased to 4.5 kg, and the live weight exceeded the minimum requirements of the superior stock by 13.0 kg and 8.5 kg, reaching 258.0 and 253.7 kg, respectively. By 12 months, bull calves of the Udmurt generation outperformed their herd mates obtained from Perm cows by 11.9 kg in live weight, by 14 months – by 17.3 kg and reached 445.6 kg. The largest average daily increase was recorded in the period from 12 to 14 months – 1033–1121 grams. During the growing period the average daily increase in groups averaged 931 g in bull calves obtained from cows of Perm breeding, and 969 grams in their herd mates. The relative growth data indicate that in the period from birth to 205 days of age, the bull calves obtained from cows of the Perm selection slightly exceeded their herd mates – by 0.72 % in terms of growth intensity, but by the end of the suckling period they were inferior to the bull calves of the Udmurt generation by 0.67 % in this indicator, which is explained by the higher milk productivity of cows of the Udmurt selection. The revealed trend continued in subsequent periods. The assessment of the exterior by the time of slaughter revealed the advantage of bull calves obtained from cows of the Perm selection in latitudinal measurements and the development of the hindquarter, which makes it possible to predict their better meat qualities than those of herd mates of the Udmurt selection.

Key words: Hereford breed, bull calves, growth, development, live weight, absolute gain, average daily gain, measurements.

For citation: Dedyukin A. M., Sannikova N. A., Vorobyeva S. L., Kokonov S. I. Growth and development of Hereford bull calves in Udmurtia. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 4-11. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_4-11.

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Original article

DOI 10.48012/1817-5457_2023_2_11-17

REALIZATION OF THE GENETIC POTENTIAL OF COWS ACCORDING TO THE MILK QUALITY INDICATORS IN DIFFERENT TECHNOLOGICAL CONDITIONS

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Abstract. Many factors influence the dairy productivity of cattle, including the technology of dairy cattle production. To obtain large volumes of high-quality dairy products, it is necessary to choose a technology that will fully contribute to the development of the genetic potential of cow productivity. In this regard, the purpose of our research was to analyze the impact of milk production technology on the realization of cows' potential in terms of milk quality indicators. The studies were conducted in 2018–2022 on the basis of AO Voskhod of the Sharkansky district of the Udmurt Republic. The focus of the research was the group of cows born in 2016 kept in conditions of different milk production technologies: the first is loose-housing technology with milking in a milking parlor of the Karusel type, the second is tie-up housing with milking in a milk pipeline. Seven groups of cows were formed for each technology, depending on the level of genetic potential of productivity by milk yield. The study revealed that cows with a high level of genetic productivity potential for milk yield realized it better when using automated milking technology in the Karusel milking parlor. In cows with a level of genetic productivity potential for milk yield over 9,500 kg, the degree of its realization was higher by 8.6–25.2 % in terms of the amount of milk fat, and also higher by 11.0–21.2 % in terms of the amount of milk protein when milking in the milking parlor than when milking in the milk pipeline. The degree of realization of the genetic potential in terms of quality indicators in these cows was also higher when using loose-housing technology with milk-

ing robot system. The difference in this indicator between the technologies was 4.0–20.1 % in the amount of fat in milk and 4.3–12.3 % in the amount of protein.

Key words: cattle, milk fat, milk protein, realization of genetic potential, milk production technology.

For citation: Kislyakova E. M., Vladykina E. L. Realization of the genetic potential of cows according to the milk quality indicators in different technological conditions. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 11-17. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_11-17.

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Original article

DOI 10.48012/1817-5457_2023_2_17-27

EFFECT OF LIQUID FEED SUPPLEMENT "ACTIVE MIX" VMG 500/600 ON BIOCHEMICAL AND HEMATOLOGICAL INDICATORS OF FIRST-CALF HEIFERS

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Abstract. The article provides the results of the application of a high-calorie liquid feed supplement «Active Mix» VMG 500/600, which was developed by means of new approaches to increase the digestibility of vitamins and microelements. The feed supplement consists of two liquids varied in composition «Active Mix» VMG 500 and «Active Mix» VMG 600. They are given to animals separately with an interval of 1 day. This makes it possible to achieve a reduction in antagonism between microelement compounds, vitamins and other substances, as well as to prevent undesirable chemical reactions. The composition of the feed supplement includes moderately resistant chelate complex compounds of microelements – metals. Diacetophenonenonyl selenide (DAFS) and fat-soluble vitamins (A, D_3, E) are contained in the feed supplement in the form of a stable microemulsion (with an average micelle size of less than 1 μm). At the same time, the composition of micelles includes substances that significantly enhance their digestion in the gastrointestinal tract of animals. The research was carried out in a pedigree-cattle breeding plant for Kholmogorsky cows breeding. Feed supplement was given to heifers 2 weeks before calving and 2 weeks after calving. Before the start of the experiment, the animals had signs of deficiency of vitamins and microelements, which were reversed by the end of the study. In addition, the heifers of the experimental group had easier calving, and their production of colostrum and milk increased in comparison with the animals that

did not receive this feed supplement. The dynamics of changes in hematological and biochemical parameters of blood revealed the significant increase in the content of erythrocytes, hemoglobin and hematocrit in animals receiving the feed supplement. The content of glucose and total protein in their blood increased significantly. There was a significant increase in the value of the alkaline reserve, as well as a decrease in the content of total bilirubin and alanine aminotransferase activity.

Key words: liquid feed supplement, heifers, first-calf heifers, vitamins, microelements, bioavailability, milk productivity.

For citation: Kulikov A. N., Shishkin A. V., Vasiliev Yu. G., Sannikova N. A., Kulikova M. S. Effect of liquid feed supplement «Active Mix» VMG 500/600 on the biochemical and hematological indicators of first-calf heifers. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 17-27. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_17-27.

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Original article

DOI 10.48012/1817-5457_2023_2_27-33

BIOCHEMICAL PARAMETERS OF BLOOD AND MEAT PRODUCTIVITY OF BULL CALVES WHEN USING A BIOSTIMULATOR OF PLANT ORIGIN IN FEEDING DIETS

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Abstract. Many scientists and practitioners are interested in the use of biologically active feed additives in cattle breeding to stimulate the immunity of animals, normalize metabolic processes, increase and improve productive qualities. The research was carried out in the pedigree-cattle breeding farm Zarya of Mozhginsky district in the Udmurt Republic in the period from 2019 to 2022. The purpose of the research was to study the state of metabolism in the body of bull calves and their meat productivity when using a biostimulator of plant origin in animal feeding diets. The objectives of the study were to assess the state of animal health based on the study of the biochemi-

cal composition of blood serum and the analysis of quantitative indicators of meat productivity of bull calves. The control group and two experimental groups of 10 heads each were formed (Black-and-White bull calves at the age of 3 days), the animals were kept in the same conditions. The control group was on a general economic diet, and experimental groups received a daily biostimulator of plant origin in the amount of 0.15 g and 0.3 g per 1 kg of live weight in the general economic diet. The biostimulator included in its composition: common yarrow, dioecious nettle, blueberry leaves, garden sage, St. John's wort, common tansy, spruce resin. The biostimulator was used from the age of 3 days to 6 months. The conducted studies revealed that the indicators of alkaline phosphotase in the blood, the enzymatic activity of aspartate aminotransferase and alanine aminotransferase were within the physiological norm in all age periods, the most intensive processes of accumulation of protein substances occurred in animals of experimental group 2, consuming a biostimulator of plant origin at a dosage of 0.3 g/kg of live weight. The use of a biostimulator of plant origin in an amount of 0.3 g/kg of live weight in experimental group 2 contributed to the production of heavier carcasses of 251.5 kg, the slaughter weight was 266 kg with the highest slaughter yield of 55.5 %.

Key words: bull calves, Black-and-White breed, biostimulator, biochemical parameters of blood, meat productivity.

For citation: Lazareva K. V., Krasnova O. A. Biochemical parameters of blood and meat productivity of bull calves when using a biostimulator of plant origin in feeding diets. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 27-33. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_27-33.

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Original article

DOI 10.48012/1817-5457_2023_2_33-40

INFLUENCE OF METEOROLOGICAL FACTORS ON HONEY PRODUCTIVITY OF BEE FAMILIES UNDER THE CONDITIONS OF THE UDMURT REPUBLIC

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Abstract. The growth, development and efficiency of bee families have a direct interrelation with natural and climatic conditions and depend on the temperature background of the environment and the amount of precipitation. The research was conducted to study the influence of the environment during the main honey harvest on the honey productivity of bee colonies in the conditions of the Udmurt Republic from 2017 to 2021. The study involved a group of 10 bee colonies, which were similar in strength, in the number of sealed brood and feed in the spring period, with the queens of

the same age, in which one control hive was placed on commodity scales VT 8908-500. The research was carried out according to the "Methods of conducting scientific research in beekeeping" (2006). The collection and analysis of climatic and weather conditions were carried out using archival data from the weather log www.gismeteo.ru and apiary records of our own and of the beekeepers' observations. The air temperature (°C), the amount of precipitation (mm) and the number of days with precipitation were analyzed. The dynamics of the weight gain of the control hive was measured using commodity scales during the summer period at the time of the main honey harvest. It was revealed that with an increase in the temperature above +25 °C in 2018, the maximum increase in the weight gain of the control hive was recorded to 8.6 kg per day. The analysis of the dynamics of weight gain for 2019 showed that at a low temperature background, the maximum weight gain was at a temperature of +16.1 °C and reached 3.7 kg. Weight gain charts for 2020 and 2021 clearly demonstrated that at temperatures above +25.1 °C and with the absence of precipitation, the weight gain of the control hive during the main honey harvest increased to 7.0 kg. The analysis of the dynamics of the weights of the control hive proves the relation of the meteorological regime with the productivity of bee colonies.

Key words: climate change, air temperature, honey productivity, amount of precipitation, control hive, flight activity.

For citation: Tronina A. S., Vorobyeva S. L., Yudin V. M. Influence of meteorological factors on honey productivity of bee families under the conditions of the Udmurt Republic. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 33-40. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_33-40.

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Original article

DOI 10.48012/1817-5457_2023_2_41-48

AUDIT OF THE BEEF PRODUCTIVITY OF THE HEREFORD BULL CALVES ON THE BASIS OF THE ANALYSIS OF THE CARCASSES INDICATORS

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Abstract. The article analyzes the beef productivity of fattening Hereford bull-calves bred on the collective farm Druzhba, Uvinsky district of the Udmurt Republic, followed by an assessment of the compliance of the obtained beef with the requirements of the standard GOST 33818-2016.

The study involved fattening bull calves at the age of 11–13 months, intended for slaughtering and primary processing at Uva Meat Processing Plant. The determination of the fatness category of the obtained beef, as well as the shape and meat yield of the carcasses, was carried out on the basis of GOST 33818-2016. The slaughter qualities were assessed based on the results of the control slaughter of animals under the conditions of Uva Meat Processing Plant. To determine the morphological composition of the carcass, the carcass was divided along the spinal column, with the isolation of cuts, followed by meat boning and trimming. The quality of meat was established on the basis of the analysis of the chemical composition of the average sample of the muscle tissue of the longest back muscle. The mass fraction of protein, fat, total ash was determined according to the current state standards. The studies revealed that carcasses obtained from fattening Hereford bull calves were compliant with the category K and quality class III, since the thickness of subcutaneous fat was 1.98 cm, the loin eye area was 112.2 cm^2, the color of muscle tissue was dark-red, and the color of subcutaneous fat is milky white. These facts indicate the possibility of producing high-quality beef from fattening Hereford bull calves bred in this farm.

Key words: Hereford cattle breed, high-quality beef, meat productivity, slaughter yield, morphological composition of meat, chemical composition of meat, technological properties of meat.

For citation: Khardina E. V., Berezkina G. Yu., Shkarupa K. E., Vostrikova S. S., Yakimov D. V. Audit of the beef productivity of the hereford bull calves on the basis of the analysis of the carcasses indicators. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 41-48. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_41-48.

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Original article
DOI 10.48012/1817-5457_2023_2_49-55

PRODUCTIVE AND REPRODUCTIVE QUALITIES OF COWS DURING THE APPLICATION OF INBRED AND OUTBRED FORMS OF BULLS SELECTION

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Abstract. Regulated pedigree breeding today is the key and main method of selection and breeding work with cattle of the dairy productivity. A large choice of sires places certain limitations on their selection due to their common origin. The studies were carried out on a herd of Holstein breed cattle in the Michurin Agricultural Production Company of the Vavozhsky district of the Udmurt Republic based on the data analysis from the database of the information and analytical system Selex – Dairy Cattle, catalogs of sires. To analyze the selection of sires, groups were identified, including outbred and inbred cows, selected according to the type of daughters-halfsibs (half-sisters). 374 cases of inbreeding were identified in the herd with an average homozygosis coefficient of 1.6 %, while 69.7 % of inbred animals accounted for distant inbreeding, the average inbreeding coefficient being 0.26 %. The number of animals obtained with moderate inbreeding is 29.4 % of the total number of inbred animals with an inbreeding coefficient of 1.22 %. When selecting sires, there are significant differences in the number of inbred cases: when using one bull, inbred animals predominate, in others outbred ones, and when selecting individual bulls, their number is equal. Close inbreeding accounts for only 0.8 % of cases, with an average homozygosis rate of 3.32 %. Analyzing milk productivity on average for 305 days of lactation, inbred cows have the maximum milk productivity – 9116.8 kg, which is 281.7 kg (3.09 %) more than that of outbred half-siblings, by 0.03 % in terms of fat mass fraction. At the same time, according to various degrees of inbreeding, milk productivity differs slightly. When analyzing the selection of bulls, it was revealed that distant inbreeding had a different effect on the productivity of animals. In most cases inbred daughters have a higher productivity (from 6.1 to 13.8 %) than outbred half-sisters.

Key words: inbreeding, outbreeding, breeding selection, panmixia, sire, productive longevity, cattle, dairy productivity, reproduction.

For citation: Yudin V. M., Tronina A. S., Lubimov A. I., Manurov I. M., Khokhlov V. V. Productive and reproductive qualities of cows during the application of inbred and outbred forms of selection of bulls. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 49-55. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_49-55.

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Original article
DOI 10.48012/1817-5457_2023_2_56-64

PRODUCTION OF BIODEGRADABLE ECO-PACKAGE FOR FOOD STORAGE AND TRANSPORTATION FROM FLAX SHIVE BY VACUUM CASTING

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Abstract. The necessity to reduce the percentage of plastic in the package leads to the search for alternative organic environmentally friendly materials both of animal and plant origin. Flax shive can be used for this purpose. The shive is a waste of flax production which should be utilized. The chemical composition of the shive contains up to 77 % of cellulose, which with additional processing can be used as a material for the production of packaging and tableware. The purpose of the study is to provide the rationale for the main parameters and modes of the technological process of production of eco-friendly biodegradable package for transportation and storage of food products. The tasks of the work are to determine the quantitative ratio of the mixture components, to select the operating modes of the vacuum casting line for this mixture, to test control samples in the enterprise. Samples of cellular package were produced on the production line of vacuum paper casting Beston in the Izhevsk enterprise Sputnik named after Isaenko E.M. in the Udmurt Republic, laboratory tests were conducted in the laboratory of the Udmurt State Agricultural University, industrial tests were conducted in the Sarapul Poultry Farm, in Sarapul in the Udmurt Republic. The main research material was flax shive and waste paper. Methods of automatic and instrumental control were used to determine density, mass, humidity. Industrial samples were made from pulp of different composition, the amount of shives varied from 10 to 90 %. Analyzing these samples, testing them for strength, the optimal composition of the main raw material was revealed – 50 % of flax shives and 50 % of waste paper. With this ratio of components, the package weight is 60–70 grams, humidity is 8–12 %, the bearing load has a margin of safety of more than 15, the tensile strength has a margin of safety of 5. This package due to the unique properties of the shive provides antibacterial properties and its strength characteristics are as good as its prototype – paper packaging made of 100 % waste paper.

Key words: shive, eco-friendly package, waste paper, vacuum casting, cellulose, antibacterial properties, tensile strength, bearing strength, moisture absorption capacity.

For citation: Badretdinova I. V., Kasatkin V. V. Production of biodegradable eco-package for food storage and transportation from flax shive by vacuum casting. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 56-64. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_56-64.

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Original article
DOI 10.48012/1817-5457_2023_2_64-70

JUSTIFICATION OF AIR CHARGE PARAMETERS AT DIESEL START-UP UNDER LOW TEMPERATURES

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Abstract. Diesel engines have a significant drawback – a difficult start-up when operating them in the winter season. The aim of the work was to create a fuel-air mixture in the cylinders of a diesel engine with indicators that ensure its guaranteed start-up at low temperatures. To ensure the accuracy of theoretical calculations of the temperature of the fuel-air mixture, it is proposed to introduce a correction factor "K", taking into account the reduced value of the actual compression during the diesel start-up process. A series of tests was carried out to study the effectiveness of the use of the developed thermal accumulator for pre-launch preparation of the D-243 engine on the basis of the open area stand. The paper presents the results of experimental studies of changes in compression in the cylinders of a diesel engine during start-up depending on its temperature, a change in the pre-start temperature parameters of a diesel engine as a result of heating the coolant, engine oil and fuel by using the energy of a thermal accumulator. The proposed design of the heat accumulator showed a fairly high efficiency during the inter-shift storage of equipment. The temperature of storage of working fluids in a thermal accumulator decreased from +90 ℃ to +54 ℃ within 15 hours. With an initial starting temperature of the engine of -15 ℃ and the supply of coolant and engine oil from the heat accumulator to its systems, after 3 minutes the temperature of the cylinder head is +18 ℃, and the temperature of the engine oil is +45 ℃, which fully ensures the guaranteed process of starting the diesel engine. Installing a starting turbine in the air supply system of a diesel engine will make it possible to compensate for the decrease in air charge pressure during start-up. The turbine must be powered from the on-board network of the tractor.

Key words: diesel, compression, air-fuel mixture, temperature, start-up process.

For citation: Vakhrameev D. A., Deryushev I. A., Potapov E. A., Martyushev A. A., Arslanov F. R. Justification of air charge parameters at diesel start-up under low temperatures. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 64-70. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_64-70.

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Original article
DOI 10.48012/1817-5457_2023_2_71-75

THE IMPACT OF ANTIFRICTION CERAMIC COATINGS IN BEARING COUPLINGS ON THE PERFORMANCE EFFICIENCY OF THE TURBOCHARGER

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Abstract. The article analyzes the main urgent problems of bearing couplings of turbochargers of internal combustion engines and the existing methods for their solution. A technology for modifying the bearing coupling with a ceramic antifriction coating with a low coefficient of friction is proposed. The laboratory test bench has been developed for a comparative analysis of the performance of a turbocharger with modified bearing couplings. It makes it possible to evaluate and analyze the acceleration time of the turbocharger shaft and the degree of pressure ratio in the compressor manifold on the input air flow rate. The conducted studies confirmed the positive effect of the antifriction ceramic coating on the performance efficiency of the turbocharger, in particular, the acceleration time of the turbocharger shaft decreased by 34% in unsteady operating modes of the turbocharger. More intensive untwisting of the turbocharger shaft increases the dynamics of engine acceleration and reduces the turbo lag effect. Reducing the breaking force in bearing couplings also has a positive effect on the degree of pressure ratio. Even at low speeds of the input air flow, a stable degree of pressure increase and, thus a stable operation of the engine and acceleration dynamics are achieved. The results obtained have a high practical significance and can be used in repair technologies.

Key words: turbocharger, friction coefficient, inertance, acceleration time, ceramic antifriction coating, test bench, pressure ratio.

For citation: Malinin A. V., Ipatov A. G., Shmykov S. N. The impact of antifriction ceramic coatings in bearing couplings on the performance efficiency of the turbocharger. The Bulletin of Izhevsk State Agricultural Academy. 2023; 2(74): 71-75. (In Russ.). https://doi.org/10.48012/1817-5457_2023_2_71-75.

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