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ECONOMIC AND BIOLOGICAL PECULIARITIES OF GOLSHCHINSKY BREED COWS OF DIFFERENT ECOLOGICAL-GENETIC TYPES

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ABSTRACT

The purpose of the study was to establish the adaptive and economic-biological characteristics of the Holstein cattle of different ecological-genetic types and the efficiency of the use of new feed additives "Stimul" and "Bischosulfur" in rations of lactating cows. The experimental part of the research was carried out in the period from 2006 to 2015 in the Volgograd region of the Russian Federation. The object of the study was the Holstein cattle imported from the USA, Denmark, Germany, and Australia. The results of the study showed that animals of American and German breeding possessed a higher level of natural resistance and adaptability to specific features of the natural and climatic conditions of the region. However, while providing conditions conducive to an increase in the timing of economic use of Holsteins of different breeding, preference should be given to cows of Danish breeding. By the level of economic efficiency of milk production on average for five lactations, the cows of this selection exceed the United States, Germany and Australia selection peers by 8.4%, 3.7% and 10.8% respectively. To increase the economic efficiency of dairy production on the complexes, it is advisable to introduce innovative feed additives "Stimul" and "Bischosulfur" from the calculation of 100 g per head per day into the ration of feeding lactating heifers, which will increase the productivity of animals by 4.72% and 3.14% for lactation, an increase in the fat content in milk - by 6.54% and 4.41%, protein - by 5.97% and 3.75%. At the same time, the profitability of dairy production will be more by 6.4% and 4.1%, respectively.

Keywords: Holstein cattle, adaptability, feed additive, milk productivity, efficiency.

INTRODUCTION

Increasing milk production is an important, priority issue in the livestock sector. Its solution is related to the improvement of the genetic resources of cattle breeds, the increase in their dairy productivity and productive longevity. The use for this purpose of the global gene pool of animals of different genetic selection entails certain problems of adaptation to the nature of the different climatic conditions (StrekozovN.I.*et al.*, 2009; Sycheva O.V., 2008; Harvey J.W., 2012; DuninI. *et al.*, 2013; GorlovI.F.*et al.*, 2014).

The natural and climatic conditions and the microclimate of the premises have a significant influence on the formation and development of the organism. It is known that in animals with approximately the same heredity under the influence of different environmental conditions (feeding, care and maintenance, use, etc.), the formation of symptoms is not the same. Phenotypic diversity of traits in animals is determined by a complex interaction of heredity and life conditions (Roche J.R.*et al.*, 2006; Pareek N. *et al.*, 2007; BaumgardL.H.*et al.*, 2011; Berman A., 2011; GorlovI.F.*et al.*, 2014, 2015; Lopez S. *et al.*, 2015).

In the economy of the Russian Federation, the dairy cattle population totals more than 40 breeds and types. In the structure of dairy breeds of cattle the leading place is occupied by the black-and-white Holstein, which accounts for up to 60%.

Animals of Holstein-Frisian breed, bred in Russia, have very close genetic characteristics with the world's population of similar cattle. However, the animals of this breed need to further improve them according to the constitution, the exterior and the productive qualities, as well as their adaptation taking into account the natural and climatic conditions. The study of the acclimatization abilities of various breeds makes it possible to significantly expand the range of their distribution in the rational distribution of animals in different natural climatic zones (Bam E., 1987; Krus, G.N.*et al.*, 2000; Voronin E.S. *et al.*, 2002; El-Tarabany and El-Bayoumi, 2015).

In industrial conditions it is impossible to achieve high productivity of cows without the use of various compensating ingredients (Shurygina A., 2013; Gorlov I.F., 2014). Increased adaptive ability, productivity and quality indicators of milk due to the use of new biologically active and feed additives in rations of lactating cows are described in the works of TommeM.F.*et al.*(1969), Kalashnikov A.P. *et al.*(2003),Dunin I.M. (2005),Gorlov I.F. (2005),Gorlov I.F. *et al.*(2017). In this regard, in Volga Region Research Institute of Manufacture and Processing of Meat-and-Milk Production premixes "Stimul" and "Bischosulfur" for lactating cows were developed.

Dietary supplement "Stimul" contains in its composition vitamins (A (retinol) - 1500 thousand IU, D_3 (holikaltseferol) - 150 thousand IU, E (tocopherol) - 1200 mg), trace elements (manganese sulfate pentahydrate - 4090.5 mg, zinc sulfate heptahydrate - 8035.2 mg, copper sulphatepentahydrate - 1144.0 mg, potassium iodide - 159.4 mg, cobalt chloride hexahydrate - 362.8 mg), selenium in the form of selenium-containing preparation

DAFS-25, feed sulfur and glycine. As filler used pumpkin milk thistle in a ratio of 1:1.

The feed additive "Bishoshulfur", containing sulfur and magnesium (as part of bischofite), is a source of mineral substances capable of effectively influencing the restoration of its energy when introduced into the animal's body. Sulfur in the animal body is in bound form, preferably in amino acids (methionine, cystine, cysteine) included in the composition of vitamins (biotin, thiamine), and pancreatic hormone - insulin used to build protein. Natural bishofit is a complex of magnesium salts (90-96%) as well as carbonate, sulphate, calcium salts, trace elements (iron, copper, bismuth, boron, barium, aluminum, etc.). Magnesium participates in the intermediate metabolism as a specific activator of enzymes, enhances the formation of antibodies by the body, increases the absorption of carbohydrates and is necessary for the normal functioning of the cicatricialmicroflora(Gorlov, 2014).

The purpose of the study was to establish the adaptive and economic-biological characteristics of the Holstein cattle of different ecological-genetic types and the efficiency of the use of new feed additives "Stimul" and "Bischosulfur" in rations of lactating cows.

MATERIALS AND METHODS

The experimental part of the research was carried out in the period from 2006 to 2015 in the conditions of the tribal plant "Donskoe", located in the Volgograd region of the Russian Federation. The object of the study was the Holstein cattle imported from the USA (245 heads of heifers), Denmark (245 heads of heifers), Germany (386 heads of heifers), Australia (250 heads of heifers).

For the comparative assessment of economically useful traits Holsteins different eco-genetic types of 4 groups heifers were formed at 16 months of 20 heads each on the principle analogs: I group - heifers of American selection, II group - Danish, III group - German and IV group - Australian. Conditions for feeding and keeping imported animals from different countries were the same. Experimental animals received a balanced diet in accordance with the detailed standards of the All-Russian Research Institute of Livestock named after academician L.K. Ernst (ViktorovP.I.*et al.*, 1991; Kalashnikov A.P.*et al.*, 2003). When feeding the fodder, the experimental animals were observed to have a calcium-phosphorus and a sugar-protein ratio due to appropriate feeding.

To study the effect of biologically active feed additives "Stimul" and "Bischosulfur" on dairy productivity and the quality of milk of cows of Danish breeding, 3 groups of cows with 10 heads each were formed. The animals of the control group received the general health diet (GHD), the I experimental group in addition to the GHD feed additive "Stimul" in the amount of 100 grams per head per day, the second test group - fodder supplement "Bischosulfur" in a similar dosage. The duration of the experiment is 150 days. The scheme of the research is shown in Figure-1.

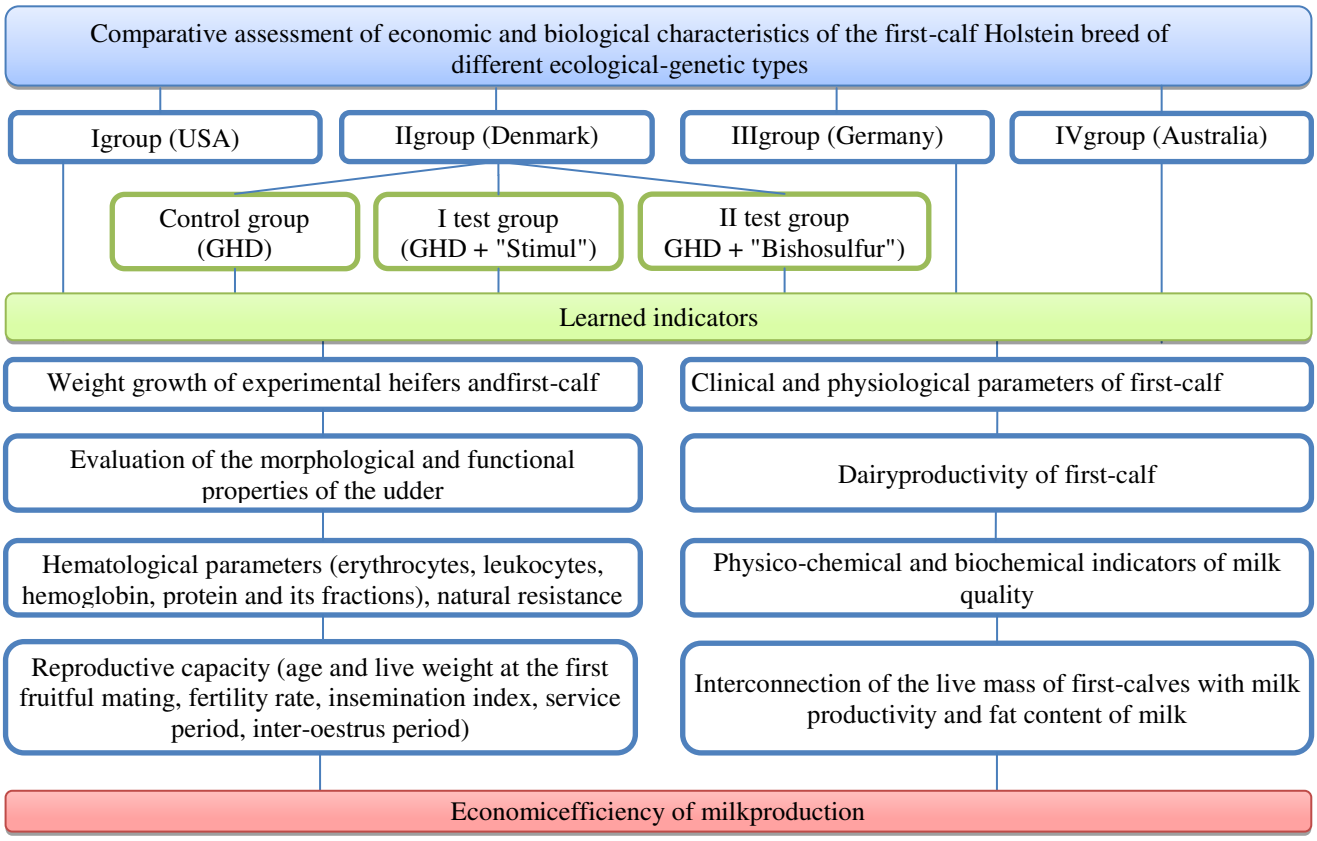

Figure-1. Scheme of the study.

During scientific and economic experiments, the following was studied: feed intake for each group of experimental cows by weighing the given feed and their remains every ten days for two adjacent days; digestibility of nutrients of rations, balance and use of nitrogen, calcium and phosphorus in the body of lactating cows according to the methods of Simon E.I. (1956),TommeM.F. (1968), Ovsyannikov A.I. (1976); dynamics of live weight of experimental young animals by growth periods when calculating the relative growth rate of animals; morphological and functional properties of the udder of the experimental cows at the end of the period of expansion according to the methodological instructions and bonitizing of cattle of dairy breeds; reproductive ability of heifers and cows according to zootechnical records. The reproductive capacity was determined by the method of Wilkoh C.J. (1969), the calculation of milk productivity - based on the data of monthly control docks. The nature of lactation curves and lactation constancy rates was studied by the method of V.B. Veselovsky (1971).

Milk samples were taken in accordance with Government Standard (GOST) 26809-86 "Milk and dairy products". The content of fat in milk was determined by the Gerber method in accordance with GOST R ISO 2446-2011. Analysis of the mass fraction of total and non-protein nitrogen, the mass fraction of whey proteins and total protein in milk was performed according to the Kjeldahl method (GOST R 53951-2010, GOST 23327-98, GOST R 54756-2011).

Quantitative analysis of amino acids in the milk were determined by high performance liquid chromatography (HPLC) using a chromatograph LC-10 (Shimadzu company) with fluorimetric detector and precolumnderivatization according to the manufacturer's recommendations. Density and acidity of milk was determined in accordance with GOST 3625-84 and GOST 3624-67. Qualitative indicators of milk were studied in II-III months of lactation from 5 cows of each group.

Hematologic parameters were determined by standard methods: the content of hemoglobin - according to the Sahli-Hellige method, the number of erythrocytes and leucocytes - counting in a Goryaev's chamber, total protein in blood serum - refractometrically by method of McCord, protein fractions - by electrophoresis in modifications of Yudelovich, calcium - by method of De-Waard, inorganic phosphorus - bymethod of Briggs, serum selenium and in milk was determined by atomic adsorption spectrometer QUANTUM-2A (GOST P ISO 5725-2002), alkaline reserve of blood – by method of Nevodov in modification of P.T. Lebedev and P.V. Kovaleva.

Natural resistance of the organism and immune status of the animals was evaluated by serum bactericidal activity (method of O.V.Smirnova and T.A. Kuzmina in modification of O.V. Bukharin and A.V. Sozykin (1979), blood lysozyme activity (by Grant), phagocytic index.

Quantitative determination of immunoglobulins in serum of cattle blood conducted in triplicate by single radial immunodiffusion (according to Mancini) using monospecific antisera and monoclonal antibodies to specific isotypes of immunoglobulins (IgG, IgM, IgA) and a reference standard serum cattle blood with a known content of immunoglobulins of each isotype.

Economic efficiency of the use of animals of different ecological and genetic groups was established on the basis of actual and intraeconomic annual economic effect using the following formulas:

$$Milkofstandartfatcontent(3.4\%), kg == \frac{Milkreceived(forecastonaverageforfivelactations), kg \times Fatcontentinmilk, \%}{3.4\%};$$

Milk sales proceeds, $ = Milk of standard fat content (3.4%), kg × Market value of milk 1 kg, $;

Profit, $ = Milk sales proceeds, $ - Farm input, $;

$$Profitabilitylevel, \% = \frac{Profit, \$}{Farminput, \$} \times 100\%.$$

The digital material of the research was processed by methods of variation statistics on a PC using the program "Statistika 10.0", the "Microsoft Office" software package and the determination of the reliability criterion for the difference by Student-Fisher at three levels of probability. Potential productivity was determined by R. Schiller *et al.* (1989).

RESULTS AND DISCUSSIONS

Comparative evaluation of economically useful signs of Holstein cows of different ecological and genetic types as a result of the study of the features of growth and development of first-calf cows imported from different countries, it was found that with similar feeding technologies and the corresponding zoogeographical requirements, the live weight of heifers of German breeding surpassed the live weight of analogs from the USA, Denmark and Australia in all age periods (Table-1).

Table-1. Dynamics of live weight of heifers and first-calf cows, kg.

Age, months	Live weight, kg			
	I (USA)	II (Denmark)	III (Germany)	IV (Australia)
16	425.5±4.5	412.4±4.0	461.7±4.5	421.0±3.8
18	465.5±5.1	452.4±4.4	501.7±4.1	461.0±4.9
24	514.3±4.0	504.0±3.8	562.3±5.1	528.5±2.9
36	607.4±3.9	598.5±4.1	635.0±3.1	622.8±2.9

Thus, cows of German breeding showed more intensive growth compared with analogues from other countries. By the age of 36 months, the live weight of heifers of German breeding was 635.0 kg, which is by 12.2 kg or 1.9% (P <0.05) higher than for first-calves imported from Australia, by 27.6 kg or 4.5% (P <0.001) higher than the analogues of American breeding and by 36.5 kg or 5.7% (P <0.001) higher than that of Danish peers.

Studies of the morphological and functional properties of the udder have shown that in all the experimental cows, the udder had a cup-shaped and bath-like shape. In the I group 35.0% of the cows had a bath-shaped udder, which is by 10.0% higher than in the II and III groups and by 5.0% higher than in the IV group. Animals that have an undesirable udder shape are not recorded.

In the studied groups, most of the cows had a cylindrical nipple: I and IV group - 75.0%, II group - 90.0% and III group - 80.0%.

The measurements of the udders of the experimental cows did not differ significantly. However, the length and width of the udder before milking in the cows of I group exceeded those for the analogues from II group by 4.44%, III group - by 2.17% and IV group - by 6.8% (P <0.05). The maximum girth of the udder was possessed by animals of German breeding, the value of which was 141.0 cm, which is higher than that of American selection cows by 0.70%; Danish breeding - by 2.90% and Australian breeding - by 3.68%.

The highest index of the udder was found in the cows of I group, which was 48.1%, which is by 1.6% higher than in II group, by 2.1% - III group, and by 2.5% - IV group.

In studying the morphological and functional properties of the udder, it was found that the udder of all animals studied met the basic requirements of industrial milk production technology. On the basis of the data obtained, it can be concluded that in the process of operation under optimal feeding and maintenance conditions, animals of American and German breeding are most suitable for machine milking.

When studying the milk production of first-calves, imported from the USA, Denmark, Germany and Australia, we found that milk yields were higher for peers from the United States and Germany (Table-2).

Table-2. Indicators of productivity of experimental first-calf.

Indicator	Group			
	I (USA)	II (Denmark)	III (Germany)	IV (Australia)
Milk yield for 305 days of lactation, kg	8200 ± 110.5	7600 ± 106.0	8130 ± 113.0	7630 ± 103.5
Fat content in milk,%	3.95 ± 0.02	3.92 ± 0.05	4.00 ± 0.05	3.91 ± 0.02
The amount of milk fat, kg	323.9 ± 0.02	297.3 ± 0.05	325.2 ± 0.05	298.3 ± 0.02

Dairy productivity of American cows (Group I) for 305 days of lactation was 8200 kg, which is more than Danish (group II) - by 600 kg, German (group III) - by 70 kg, Australian (group IV) - by 570 kg. The highest fat content in milk was in German animals and was 4.00%, which is by 0.05% higher than that of American breeding cows, by 0.08% for Danish breeding, by 0.09% for Australian breeding. However, the difference between the experimental groups was unreliable.

The highest coefficient of constancy of lactation was found in group II first-calves (Denmark), which was 78.6%; versus 75.3% in group I (USA); 76.2% in group III (Germany) and 76.5% in group IV (Australia).

For the first three months, 2557 kg were received from the animals of group I, 2394 kg of group II, 2680 kg of group III and group 4-2424 kg of milk, which is 31.18%; 31.50%; 32.96% and 31.77% of milk yield for 305 days of lactation, respectively, to groups.

The higher daily yield (4 month of lactation) was found in the cows of group I and amounted to 33.2 kg, which is greater than by 8.8%(P <0.05),by 5.4% and by 6.7%, than in animals of II, III and IV groups. We also found that the maximum value of the milk yield rate was in the cows of group I (2.01 kg/min), which is higher than in the cows of group II - by 6.9%; group III - by 3.1% and group IV - by 11.0%.

The maximum milk yield for the three lactations was obtained in the I group (USA), which amounted to 25220 kg of milk, which is more than in Group II (Denmark) - by 1554 kg (P <0.001), in Group III (Germany) - by 360 kg and in the IV group (Australia) - by 1430 kg (P <0.01).

Analysis of the nature of the lactational curves of the monthly milk yields of the first-aiders of the experimental groups showed that in animals of the third group (Germany) the lactation curve top was in the second month of lactation, and groups I, II and IV - in the third. However, it should be noted that lactational curves of milk yields of all groups of first-calves decrease smoothly during lactation (Figure-2).

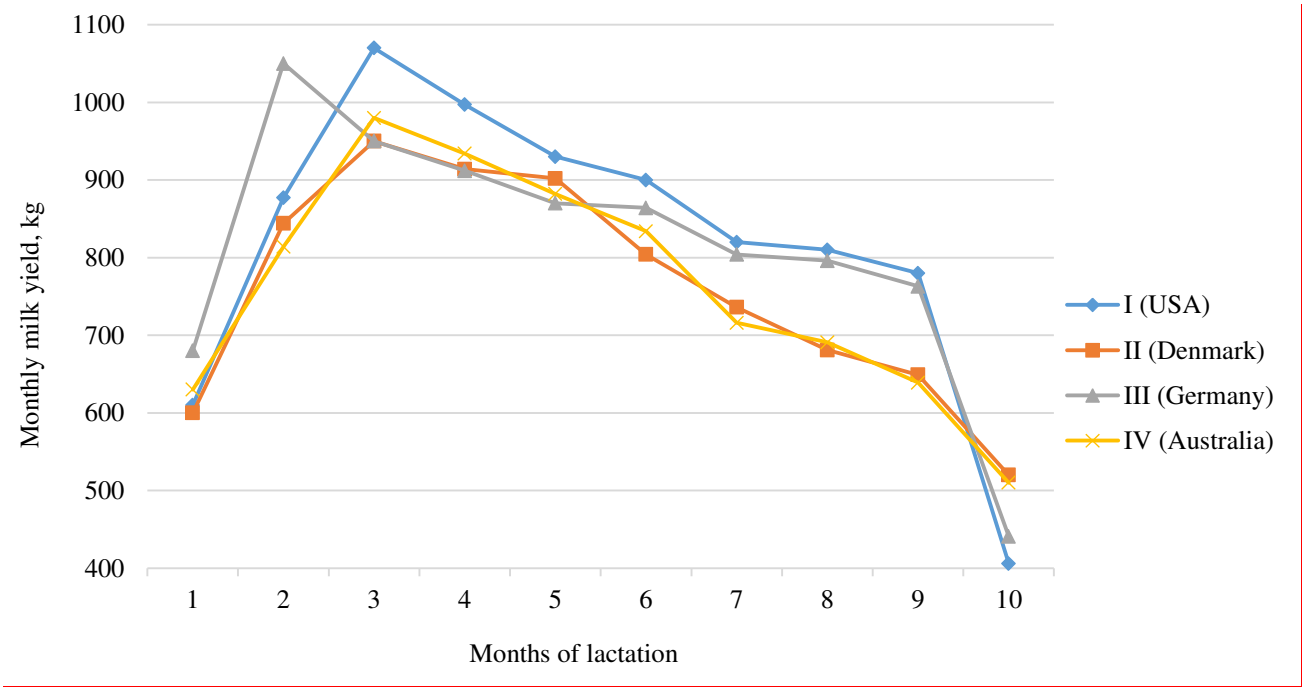

Figure-2. Lactation curves of monthly milk yields.

For the prediction of milk yield of cows imported from different countries, the following nonlinear regression equations were applied: $Y_X = 7940 + 280X - 20X^2$ (USA); $Y_X = 8202 - 936X + 334X^2$ (Denmark); $Y_X = 8200 - 155X + 85X^2$ (Germany); $Y_X = 7410 + 190X + 30X^2$ (Australia).

As a result of the regression analysis, it was revealed that the predicted yield of Danish selection for the fifth lactation is 11872 kg of milk, which is higher by 2522 kg compared to the yield of cows of German breeding; on 2762 kg - cows of Australian selection; on 3032 kg - cows of the American selection. Thus, the forecasting of production processes using regression analysis methods made it possible to reveal the fact that with the increase in the period of economic use of cows of different breeding, Holstein Danish breeding by milk yields far exceeds the selection cows of the USA, Germany and Australia.

Investigations of the organoleptic parameters of the milk of first-calves imported from the USA, Denmark, Germany, Australia, on the smell, taste and color of significant differences were not revealed in accordance with GOST R 52054-2003. Density and acidity of milk in all experimental groups were within the norm. The content of dry matter in milk of first group I (USA) was the highest and amounted to 12.62%, which is more than in Group II (Denmark) - by 0.11% (P <0.05); III group (Germany) - by 0.04% and Group IV (Australia) - by 0.02%. It was found that the milk of all experimental groups was suitable for use in cheese making. The time of rennet clotting of milk of American first-calf cows was 33.1 minutes, which is by 1.9 minutes or 5.74% (P <0.01) less, than the cows of Danish selection, by 2.1 minutes or 6.34% (P <0.01)less than the German and by 0.4 minutes or 1.21%less, than the Australian. The content of milk sugar in the milk of cows varied from 4.44 to 4.56%. There are no significant differences in the content of mineral substances in the milk of the experimental first-calf cows.

The rate of realization of genetic potential and the output of livestock production directly depend on the intensity of reproduction of the herd. It was found that cows of foreign breeding, imported from Germany and the USA, had a higher percentage of fertility: the advantage in this indicator in the first sexual hunting was 8-15%. A higher insemination index was also noted in cows from Germany and the United States. The longer first service period was for cows from Denmark and Australia in comparison with the service period for cows from the USA and Germany. The yield of calves from cows from the USA, Denmark, Germany and Australia was respectively 87%, 82%, 84% and 83%. The live weight of

calves at birth ranged from 37.5 to 39.9 kg on average, which corresponds to the figures for the Holstein cattle breed. Priority for live weight had calves, obtained from cows from Germany - by 1.6 kg; by 2.3 kg and by 1.8 kg more than calves received from cows imported from the USA, Denmark and Australia, respectively.

Thus, a comparative study of the economically useful traits of Holstein hutches of American, Danish, German and Australian breeding in the Lower Volga region showed that animals of American and German breeding possessed a higher resistance to changing environmental conditions and were characterized by higher rates of reproductive function in comparison With animals imported from Denmark and Australia.

Based on the conducted studies, it was established that the morphological indices of the blood of animals of all the compared groups were within the limits of the physiological norm. However, it should be noted that the erythrocyte content was higher in the cows of Groups II and IV, and was 6.81×10^{12}/l and 6.99×10^{12}/l, which is higher than in Group I animals by 0.46×10^{12}/land 0.64×10^{12}/l and III group - by 0.24×10^{12}/l and 0.42×10^{12}/l. The highest concentration of leukocytes in the blood was in the cows of group II - 7.82×10^{9}/l, which is by 8.46% higher than in the cows of group I; by 7.27% higher than in the cows of group III and by 4.41%higher than in the cows of group IV.

Biochemical indices of blood serum of animals of different ecological-genetic types were also within the physiological norm. The maximum concentration of the total protein in the blood serum was observed in the cows of group IV, which was 92.0 g/l, which is by 9.52% higher (P <0.001) compared to group I, by 1.55% - to group II and by 6.73% - to group III(P <0.01). However, the content of the albumin fraction was higher in the cows of group I by 30.58 g/l and group II by 32.07 g/l, and in terms of total protein by 36.4% and 35.4%, respectively. The parameters of erythrocyte sedimentation rate (ESR) and γ-globulins in the blood of animals of I and III groups significantly exceeded those in the cows of groups II and IV: ESR - 0.90 mm/h and 1.09 mm/h, against 0.54mm/h and 0.49 mm/h; and γ-globulins - 29.7% and 29.3% of the total protein, against 29.1% and 27.7%. Alkaline blood reserve was the highest in the cows of group III, and amounted to 561.5 mg%.

Higher bactericidal and lysozyme activity was observed in animals I (USA) and III (Germany) groups. Thus, bactericidal activity in the cows of group I was 77.1%, which is by 11.8% higher than in group II (P <0.001); by 7.9% (P <0.01) - in group III and by 12.8% (P <0.001) - in group IV. Phagocytic activity in cows of groups I and III is somewhat lower than II and IV. The highest phagocytic activity was observed in the cows of group II, which amounted to 61.5%, and the phagocytic index - 14.8.

The results of studies of blood serum of cows of different genetic selection for the content of immunoglobulins of individual isotypes showed that higher values were established in cows of Danish and German breeding (Table-3).

Table-3. Immunoglobulin profile of blood serum of cows of different genetic selection (n = 5).

Indicator	Group of animals			
	I (USA)	II (Denmark)	III (Germany)	IV (Australia)
lgG,mg/ml	21.93 ± 0.67	22.77 ± 0.47	23.23 ± 0.05	23.53 ± 0.56
lgM, mg/ml	2.50 ± 0.05	2.47 ± 0.40	2.90 ± 0.22	1.95 ± 0.08
lgA, mg/ml	0.29 ± 0.01	0.35 ± 0.03	0.41 ± 0.03	0.31 ± 0.03

At the same time, animals of different breeding had a sufficiently high level of serum immunoglobulins in the cows of the first lactation, which in this case are inferior to the cows of subsequent lactations, while demonstrating potential adaptive possibilities.

Analysis of hematological parameters of experimental cows imported from different countries showed that the alkaline blood reserve, ESR, γ-globulin content, total protein, lysozyme activity of blood serum were lower in import animals from Denmark and Australia, and phagocytosis rates were higher. Imported heifers from the USA and Germany tend to have a higher content of immune proteins in the blood with a decrease in phagocytic activity compared to animals from other countries, which indicates the superiority of humoral immunity factors in animals of this selection. The increased content of proteins and erythrocytes in the blood, indices of phagocytic activity, alkaline reserve of blood and a decrease in the leukocyte count in animals from the USA and Germany testify to the peculiarities of the homeostasis of animals of this genetic selection under adaptation conditions.

During the research, we determined the kappa-casein genotype in Holstein cows of different ecology-genetic types (Table-4).

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Table-4. DNA diagnosis results for the kappa-casein gene.

Indicator	Country supplier			
	USA	Denmark	Germany	Australia
Number of heads	30	35	35	15
Genotype for kappa-casein:AA	30	35	35	15
AB	-	-	-	-
BB	-	-	-	-

A blood test made it possible to establish the polymorphism of the investigated cows for the kappa-casein gene. In all cases, genotypes of AA were found.

The calculation of the economic efficiency of milk production of Holstein cows showed that the lowest cost price is provided by the milk of Danish breeding animals ($30.05 per 100 kg of milk), which is lower by $1.86 compared to the cost of milk of American cows; by $1.56 - German breeding and by $2.36 - Australian selection. The level of profitability of milk production from cows in Denmark is 45.5% and exceeds by 8.4%, 7.3 and 10.8% profitability of milk cows from the USA, Germany and Australia respectively.

The data obtained as a result of studies of the effect of new biologically active feed additives "Stimul" and "Bischosulfur" on the milk productivity and quality of lactating cows of Holstein breed of Danish breeding testify to the better use of dry and organic substances, crude protein and fat by animals of experimental groups in comparison With a control group (Table-5).

Table-5. Indices of digestibility of nutrients in rations of experimental animals,% (n = 3).

Indicator	Group		
	Control	I experienced	II experienced
Dry matter	63.4 ± 0.52	67.5 ± 0.62	66.7 ± 0.44
Organic matter	64.2 ± 0.33	69.1 ± 0.41	68.6 ± 0.29
Crude protein	61.6 ± 0.37	64.9 ± 0.51	64.2 ± 0.43
Crude fat	63.7 ± 0.73	66.5 ± 0.84	66.1 ± 0.69
Crude fiber	57.9 ± 0.53	66.3 ± 0.49	65.7 ± 0.51
Non-nitrogenous extractive substances	67.5 ± 0.45	72.6 ± 0.52	71.9 ± 0.49

As follows from the data in Table-5, the cows of I and II experimental groups had an advantage in comparison with the control analogs for the dry matter digestibility coefficient by 4.00% (P <0.01) and by 3.60% (P <0.01), organic matter - by 4.90% (P <0.01) and 4.40% (P <0.01), crude protein by 3.30% (P <0.05) and 2.60% (P <0.05), raw fat - by 2.80% and 2.40%, crude fiber - by 8.40% (P <0.01) and 7.80% (P <0.01), nitrogen-free extractive substances - by 5.10% (P <0.05) and 4.40% (P <0.05), respectively.

When calculating the utilization factor of the adopted nitrogen, the superiority of the experimental group cows was established by 4.2% and 3.2%, and from digested nitrogen - by 4.8% and 3.6%, respectively, relative to the control.

The indicators of phosphorus utilization in I and II experimental groups exceeded those for the control group analogs by 5.01% and 3.84%, respectively. Consequently, the use of "Stimul" premix and "Bischosulfur" fodder supplement in the diets of feeding experimental lactating heifers contributed to a higher deposition and use of nitrogen elements, mineral elements (calcium, phosphorus) in the body, which ultimately influenced the increase in milk productivity of cows.

Introduction of biologically active feed additives "Stimul" and "Bischosulfur" in the diet of lactating cows had a positive effect on the level of their milk yield and the quality of the milk received. Thus, it was established that the lactating animals of I and II experimental groups differed from the analogues from the control group by the average daily productivity (Table-6).

Table-6. Daily average milk yield of experimental cows, fat and protein content in milk (n = 10).

Indicator	Group		
	Control	I experienced	II experienced
Average daily milk yield, kg	28.01 ± 0.14	29.31 ± 0.17	28.89 ± 0.16
The average fat content in milk,%	4.03 ± 0.03	4.10 ± 0.02	4.08 ± 0.01
The average protein content in milk,%	3.37 ± 0.01	3.41 ± 0.02	3.39 ± 0.02

The average daily milk yield of the cows of the experimental groups exceeded the control group by 1.3 kg or 4.64% (P <0.001) and 0.88 kg or 3.14% (P <0.01), respectively.

The fat content of milk in the cows of the I and II experienced groups increased in comparison with the control group by 0.07% and by 0.05%, the protein content - by 0.04% and 0.02%.

When studying the indicators of the mineral composition of milk from experimental first-calves, it was established that the level of calcium concentration in the I experienced group was higher than in the control group by 1.82 mmol/l or 5.79% (P <0.01), II experienced group by 1.65 mmol/l or 5.25% (P <0.05), phosphorus - 1.71 mmol/l or 9.13% (P < 0.01) and 1.65 mmol/l or 8.81% (P <0.01), respectively. We also noted that the milk of experimental groups had higher density values in comparison with the control by 0.33 kg/m and 0.19 kg/m and less prolonged rennet clotting - by 7.20% and 5.90%, respectively.

Calculations of economic efficiency showed that the use of the studied feed additives "Stimul" and "Bischosulfur" in the diets of feeding lactating first-caliber experimental groups contributed to an increase in milk yields for the whole experiment by 248.1 kg or 4.72% and 164.7 kg (3.14%), respectively, in comparison with the control group. The profit from the sale of milk with the use of feed additives "Stimulus" and "Bischosulfur" increased by 17.6% and 11.4%, and the level of profitability of production - by 6.4% and 4.1%, respectively.

CONCLUSIONS

The study of the economically useful features of Holsteins originators imported from the USA, Denmark, Germany and Australia in the conditions of the Lower Volga region showed that animals of American and German breeding possessed a higher level of natural resistance and adaptability to specific features of the natural and climatic conditions of the region, on indicators of productive and reproductive function in comparison with contemporaries of the Danish and Australian selections.

However, while providing conditions conducive to an increase in the timing of economic use of Holsteins of different breeding, preference should be given to cows of Danish breeding. By the level of economic efficiency of milk production on average for five lactations, the cows of this selection exceed the United States, Germany and Australia selection peers by 8.4%, 3.7% and 10.8% respectively.

To increase the economic efficiency of dairy production on the complexes, it is advisable to introduce innovative feed additives "Stimul" and "Bischosulfur" from the calculation of 100 g per head per day into the ration of feeding lactating heifers, which will increase the productivity of animals by 4.72% and 3.14% for lactation, an increase in the fat content in milk - by 6.54% and 4.41%, protein - by 5.97% and 3.75%. At the same time, the profitability of dairy production will be more by 6.4% and 4.1%, respectively.

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