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NAS RK is pleased to announce that Bulletin of NAS RK scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of Bulletin of NAS RK in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential multidiscipline content to our community.

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НАН РК сообщает, что научный журнал «Вестник НАН РК» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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PRODUCTIVE LONGEVITY AND REPRODUCTIVE QUALITY OF HOLSTEIN COWS OF FOREIGN BREEDING

Abstract. The aim of this work is to determine the productive longevity of Holstein cows of different breedings.

The results of the research showed that Finnish animals were superior in life expectancy and productive longevity, exceeding German breeding cows by 74 days ($P < 0.05$) and Hungarian cows by 24 days, and by 0.06 and 0.12 lactations in the productive period respectively. At the same time, according to the level of average productivity per lactation and lifelong milk yield, the highest rates were established for the group of Hungarian cows. So, their average milk yield per lactation was higher: compared to other groups by 529.2 kg and 561.8 kg or 7.6 % and 8.1%; lifelong milk yield by 1305.5 kg and 996 kg (5.6 % and 4.2%); per one day of calving interval - by 0.64 kg and 0.8 kg (3.6 % and 4.6%) and per one day of life - by 0.56 kg and 0.60 kg or by 3.2 % and 5.6%. In the context of the group of cows of the German and Finnish breeding, no significant differences were noted by these indicators.

The duration of pregnancy in experimental cows ranged from 285-289 days.

The analysis of the obtained data indicates that the cellular protection indicators of Holstein cows are within the physiological norm. So, phagocytic activity, which expresses the percentage of active leukocytes participating in phagocytosis to the total number of counted neutrophilic leukocytes, is higher in animals of the German breeding compared with Hungarian animals - by 13.2% and with Finnish ones - by 13.4%. The phagocytic index is defined by the average number of phagocytosed microorganisms per active leukocyte and characterizes the intensity of phagocytosis. In our experiment, the intensity of phagocytosis was higher in the German cows and amounted to 8.42, which exceeds this indicator by 11.4% compared with animals of the Hungarian breeding and by 3.3% compared to the Finnish animals.

Keywords: cows, industrial technology, productive longevity, reproductive qualities, and adaptive plasticity.

Introduction. The transfer of dairy cattle breeding to industrial technology and the intensive use of animals leads to increased culling of the breeding stock for a variety of reasons [1, 2, 3, 4].

This reduces the breeding resources of livestock breeds and causes an objective necessity to improve the system of growing replacement heifers, which provides the formation of early ripening, high productive animals with a strong constitution, able to withstand high physiological stresses associated with lactation, reproduction, and conditions of long-term economic use [5, 6].

The quality of imported livestock does not always meet the requirements. Therefore, studies on the productive and reproductive qualities of cows of different genotypes within industrial technology are very relevant [7, 8, 9, 10, 11].

The aim of this work is to determine the productive longevity of Holstein cows of different breedings.

Materials and methods. Investigational studies were performed on purebred Holstein animals imported from Germany, Hungary, and Finland.

The feeding and keeping conditions of the experimental cows were equal to the technology adopted on the farm.

Following the aim and objectives of the study, out of 886 cows of the herd, three groups of 21 animals-analogs were formed taking into account age, breeding, and linear affiliation of 7 animals each (Montwik Chieftain 95679, Vis Beck Ideal 0933122, Reflection Sovering 198998).

Cows belonging to different lines and breeding, as well as reproductive qualities were determined based on an analysis of the genealogical structure of the herd using pedigree certificates, pedigree cards, artificial insemination records, and other documents of primary zootechnical registration.

The reasons for the withdrawal of animals were determined according to veterinary records with an analysis of cattle diseases and technological reasons for culling.

Lifetime productivity of dairy cattle was determined by the duration of the economic use of cows and annual milk yield.

The reproductive qualities of cows were investigated taking into account age, live weight of the first fruitful insemination, duration of pregnancy, calving interval, dry, and service periods.

Adaptation to environmental conditions of cows was studied in winter (February) and summer (July) periods. The mass of hair per unit of area (1 cm²), their length and structure of hair coat, as well as potassium and phosphorus contents in the studied samples were determined by the method of VASKhNIL.

Research results. The live weight of cows is one of the most important breeding traits, as an indicator of the overall development of the animal significantly affecting the level of dairy products. This is because large animals have not only well-developed muscles, but also organs of the blood circulatory system, respiration, and digestion. Our research has established that no significant differences in the live weight of cows depending on their origin have been identified. At the same time, in the first two lactations, some advantage was observed in the group of cows of the German breeding, and later the Hungarian.

With an increase in the live weight of the Holstein cows, their relative milk yield or milking capacity increases. The highest milking capacity coefficient was for Reflection Sovering cows of the Hungarian breeding for the third lactation (1399.0 kg), while in cows of the German breeding this indicator was 137 kg less, in the Finnish cows - 123 kg. Relatively high indicators of milking capacity indicate the level of their productivity and expressiveness of the dairy type.

To identify the relationship between indicators of protein metabolism, dairy productivity, and its main components, the correlation coefficients were determined. There is a negative relation between the level of milk yield and the mass fraction of fat in milk in all experimental cows, and a positive relation in terms of the mass fraction of protein. Approximately the same phenotypic variation was established between live weight and milking capacity coefficient, and in almost all groups of experimental animals it is positive. The relations between the level of milk yield and live weight in all experimental groups of animals are positive.

It was found that with an increase in lifetime productivity, the share of the revenue from milk sales grows and the share of costs for growing replacement heifers decreases (table 1).

Table 1 – Productive longevity parameters of cows of different breedings, (M±m)

Parameters	Breeding		
	German	Finnish	Hungarian
Lifetime, days	2106±36.2	2180±41.9	2156±44.7
Productive period, lactation	3.32±0.11	3.38±0.16	3.26±0.13
Productivity, kg			
average per 1 lactation	6995.1±139	6962.5±127	7524.3±153*
lifetime	23223.7±785	23533.2±734	24529.2±897*
per one day of calving interval	17.68±0.19	17.52±0.28	18.32±0.41
per one day of life	11.02±0.14	10.77±0.15	11.38±0.17
*P < 0.05.			

The results of the research showed that Finnish animals were superior in life expectancy and productive longevity, exceeding German breeding cows by 74 days (P<0.05) and Hungarian cows by 24 days, and by 0.06 and 0.12 lactations in the productive period respectively. At the same time, according to the level of average productivity per lactation and lifelong milk yield, the highest rates were established for the group of Hungarian cows. So, their average milk yield per lactation was higher: compared to other groups by 529.2 kg and 561.8 kg or 7.6 % and 8.1%; lifelong milk yield by 1305.5 kg and 996 kg (5.6 % and 4.2%); per one day of calving interval - by 0.64 kg and 0.8 kg (3.6 % and 4.6%) and per one day of life - by 0.56 kg and 0.60 kg or by 3.2 % and 5.6%. In the context of the group of cows of the German and Finnish breeding, no significant differences were noted by these indicators.

In such a way, these data indicate a higher genetic potential of productivity of the group of Hungarian cows, which is primarily due to the greater number of animals belonging to the Reflection Sovering line.

When studying the adaptive process of imported livestock, a specific criterion is a reason for the premature withdrawal of imported animals [10]. In our studies, the main reasons for the premature withdrawal of cows were: gynecological diseases, which on average accounted for 4.2%; various forms of metabolic disorders - 3.6%; diseases of the extremities - 1.56%; mastitis - 1.28% and low productivity - 0.76%. In the group of the German cows, the largest percentage of culling occurred because of the impaired reproductive functions (4.72%) and diseases of the extremities (1.8%), in the Hungarian cows - metabolic disorders (4.46%) and gynecological diseases (4.0%).

Thus, long-used cows are especially valuable for the breeder, as their high productivity and fecundity are reliable indicators of constitutional strength, disease resistance, and such cows are often the founders of valuable families.

The effectiveness of breeding dairy cattle largely depends on the reproductive qualities of cows. It was established that the age of the first fruitful insemination of heifers and calving of cows on the farm is 18.2 and 27.5 months, respectively. The live weight at the first insemination varies from 386 kg to 398 kg (table 2).

Table 2 – Indicators of reproductive qualities of cows

Indicator	Breeding					
	German		Finnish		Hungarian	
	M±m	Cv, %	M±m	Cv, %	M±m	Cv, %
Age at first insemination, months	17.82±0.3	3.3	18.35±0.33	3.2	18.1±0.5	5.6
Live weight of heifers at the 1st insemination, kg	386.9±14.5	2.0	398.0±13.1	1.6	390.6±12.7	2.1
Age at first calving, months	27.2±0.33	2.2	27.7±0.39	2.1	27.6±0.58*	3.7
The average duration of subsequent lactations, days						
service period	108.1±3.88	2.4	112.3±3.72	2.8	121.5±4.16	1.8
pregnancy	287.4±3.9	1.8	285.1±2.08*	1.8	289.3±2.9	1.8
calving interval	385.5±4.5	0.7	397.4±4.33	0.6	410.8±5.21*	0.5
CRA (Coefficient of reproductive ability)	0.95±0.003	0.6	0.92±0.003	0.6	0.89±0.003	0.6
*P < 0.05.						

The duration of pregnancy in experimental cows ranged from 285-289 days. The largest duration of the service period and, as a result, the calving interval was revealed for the group of the Hungarian cows - 410 days, which was significantly (P<0.05) longer than that of the analogs of the German breeding for 25 days and the Finnish ones for 13 days. In our opinion, this is because of a higher level of their productivity, which somewhat restrains the restoration of sexual functions due to the increased removal of nutrients with milk during the milking.

Thus, industrial technology necessitates the introduction of such a herd reproduction system that would facilitate the rapid creation of a new type of high productive cows adapted to intensive use in industrial farms.

The hair cover of cattle performs heat-protective functions and varies according to the seasons of the year. The obtained data and their analysis indicate a significant effect of the season on its indicators.

When studying the condition of the hair covering, it was found that in the summer period compared with winter, a decrease in the hair mass of the cows of German breeding is observed - by 65.8 mg, in Hungarian cows - by 64.2 mg, and in Finnish cows - by 63.6 mg; the hair lengths - by 19.3 mm, 22.0 mm and 20.6 mm; the hair density in 1 cm² - by 659 pcs., 704 pcs. and 663 pcs., respectively. In winter, it was revealed that the German cows have a higher hair mass index by 1.6 mg (2%) and a density by 4 pcs. in 1 cm² (0.3%) compared with cows of Hungarian breeding. The Hungarian cows have a greater hair mass by 0.9 mg (1.08%, P<0.05) and the hair density by 30 pcs. per 1 cm² (2.1%) compared with the German cows. The hair density is largely determined by the genotype of animals, regardless of the season of the year.

Meanwhile, in imported animals, during the acclimatization, depending on their breeding, the composition of the mineral substances of the coat was slightly different.

The German cow hair coat had the highest potassium content (4700 mg/kg), the Hungarian one had the highest phosphorus (1300 mg/kg) with the lowest phosphorus content in Germans (900 mg/kg) and potassium in Hungarian cows (3700 mg/kg).

Thus, the obtained data indicate some features of the adaptive plasticity of Holstein cattle, depending on their origin.

The content of red blood cells, leukocytes and hemoglobin in the blood of full-grown animals in all genotypes generally was within the physiological norm with some fluctuations depending on the breeding and the intensity of metabolic processes in the body. So, the content of hemoglobin in the blood of animals of Hungarian breeding was higher by 2.3-5.6% and the red blood cells content higher by 5.0-4.6% compared with cows of the German and the Finnish breedings. The highest leukocyte count was observed in German cows and the lowest - in Finnish ones. However, intergroup differences in the morphological composition of the blood were not significant and not statistically significant.

The results of biochemical studies indicate that the total protein content in the blood serum of all experimental groups was relatively high and ranged from 79.5 - 83.9 g/l. Its greatest number was observed in animals of the Hungarian and German breedings, mainly due to the increased content of globulins by 3.8-5.9%.

In our opinion, a kind of increased activity of aminotransferases in cows of Hungarian and German breedings is due to the peculiarities of the processes of transamination and the intensity of metabolic processes in the body of these animal groups.

The analysis of the obtained data indicates that the cellular protection indicators of Holstein cows are within the physiological norm. So, phagocytic activity, which expresses the percentage of active leukocytes participating in phagocytosis to the total number of counted neutrophilic leukocytes, is higher in animals of the German breeding compared with Hungarian animals - by 13.2% and with Finnish ones - by 13.4%. The phagocytic index is defined by the average number of phagocytosed microorganisms per active leukocyte and characterizes the intensity of phagocytosis. In our experiment, the intensity of phagocytosis was higher in the German cows and amounted to 8.42, which exceeds this indicator by 11.4% compared with animals of the Hungarian breeding and by 3.3% compared to the Finnish animals.

Disturbance in neutrophil activation is a pathogenetic link in many diseases. Cytochemical methods for studying the spontaneous NBT test allow us to identify the state of nonspecific reactivity of the body at the cellular level. Thus, the content of NMT spontaneous under basal conditions is greater in cows of Hungarian and Finnish breeding by 12.12 ($P < 0.05$) and 34.09% than in cows of the German breeding, whereas after adding zymosan to blood samples from cows of Hungarian and Finnish breedings, the indicator decreased compared to analogs by 7.05 and 5.13%, respectively.

The neutrophil activation index (NAI) of blood under both basal conditions and after adding zymosan blood samples was higher in Hungarian cows compared to German cows by 35.71 and 8.33%, and to Finnish cows by 28.57 and 4.17% respectively.

In general, data on the activity and state of immunocompetent blood cells, activation of NAI indicate, on the one hand, the high activity of the main phagocytes of the cow body - neutrophils. On the other hand, this set of neutrophil characteristics in combination with economically useful traits indicates the normal physiological state of the experimental animals and their high adaptive potential.

The crucial condition for conducting the livestock industry is the payback of the costs of milk production through the rational use of the genetic resources of livestock. The amount of milk in terms of the basic indicator of fat and protein for lactation in the group of the Hungarian cows was greater than that of the German and Finnish ones by 254.2 kg and 514.9 kg or 3.1 % and 6.5% respectively. At the same time, despite higher production costs for this group of cows, the proceeds from the sale of milk were 5.8 thousand and 11.7 thousand rubles more and, as a result of this, the profit and profitability level in comparison with other groups were 1.9 % and 5.7% higher.

Suggestions for production. To increase the production volume and the profitability of dairy cattle breeding, it is economically feasible to give preference to the use of the Holstein cows of the Hungarian breeding, as being better adapted to the climatic and feeding conditions.

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ШЕТЕЛДІК СЕЛЕКЦИЯДАҒЫ ГОЛЬШТЕЙН ТҰҚЫМДЫ СИЫРЛАРДЫҢ ӨНІМДІ ҰЗАҚ ӨМІР СҮРҮІ ЖӘНЕ ӨСІМІН МОЛАЙТУ ҚАСИЕТІ

Аннотация. Бұл жұмыстың мақсаты-әр түрлі селекция жағдайында өсірілген голштейн сиыр тұқымдарының өнімділік өміршеңдігін анықтау.

Зерттеу нәтижелері неміс селекциясының артықшылығы - 74 күн ($P < 0,05$) және венгр селекциясы – 24 күн, сәйкесінше өнімділік мерзімі бойынша 0,06 және 0,12 лактациялар. Өмірлік сауым және лактаация уақытында орташа өнімділіктің жоғары көрсеткішіне венгрлік селекция сиырлары ие болды. Басқа топтармен салыстырғанда, лактация кезіндегі орташа сауым жоғары болды: 529,2 және 561,8 кг немесе 7,6 және 8,1 %; өмірлік көрсеткіш 1305,5 және 996 кг (5,6 және 4,2%); 1 күнде БАМ – 0,64 және 0,8 кг (3,6 және 4,6%) және на 1 күн өмірде – 0,56 және 0,60 кг немесе 3,2 және 5,6 %. Фин және неміс селекциясы арасында көрсеткіштер мәліметтері бойынша айырмашылықтар анықталған жоқ.

Тәжірбиелі сиырлардағы буаздық ұзақтығы шамамен 285-289 күн.

Алынған мәліметтерге талдау Голштейн сиырларының жасушалық қорғаныс көрсеткіштері физиологиялық норма шегінде екенін көрсетеді. Сонымен, фагоцитозға қатысатын белсенді лейкоциттердің пайыздық санының нейтрофилді лейкоциттердің жалпы санына пайыздық қатынасын білдіретін фагоцитарлық белсенділігі неміс селекциясы жануарларында венгрлермен салыстырғанда - 13,2% және фин селекциясында - 13,4% жоғары. Фагоцитарлық көрсеткіш белсенді лейкоцитке фагоциттелген микроорганизмдердің орташа санымен анықталады және фагоцитоздың қарқындылығын сипаттайды. Біздің тәжірибемізде фагоцитоздың қарқындылығы неміс селекциясының сиырларында жоғары болды және 8,42 құрады, бұл венгр селекциясы жануарларымен салыстырғанда 11,4% және финдік селекциямен салыстырғанда 3,3% жоғарыкөрсеткішке ие болды.

Түйін сөздер: сиырлар, өндірістік технология, өнімділіктің өміршеңдігі, репродуктивті қасиеттер және бейімделгіштігі.

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ПРОДУКТИВНОЕ ДОЛГОЛЕТИЕ И ВОСПРОИЗВОДИТЕЛЬНОЕ КАЧЕСТВО КОРОВ ГОЛШТИНСКОЙ ПОРОДЫ ЗАРУБЕЖНОЙ СЕЛЕКЦИИ

Аннотация. Цель настоящей работы – определение продуктивного долголетия коров голштинской породы разных селекций при разведении.

Результаты исследований показали, что наибольшей продолжительностью жизни и продуктивным долголетием характеризовались животные финской селекции, превосходившие коров немецкой селекции на 74 дня ($P < 0,05$) и венгерской селекции – на 24 дней, а по продуктивному периоду на 0,06 и 0,12 лактаций соответственно. В тоже время по уровню средней продуктивности за лактацию и пожизненного удоя наиболее высокие показатели установлены по группе коров венгерской селекции. Так, средний удои за лактацию у них был выше: по сравнению с другими группами на 529,2 и 561,8 кг или 7,6 и 8,1 %; пожизненный на 1305,5 и 996 кг (5,6 и 4,2%); на 1 день МОП – на 0,64 и 0,8 кг (3,6 и 4,6%) и на 1 день жизни – на 0,56 и 0,60 кг или на 3,2 и 5,6 %. В разрезе групп коров немецкой и финской селекции по данным показателям достоверных различий не установлено.

Продолжительность стельности у подопытных коров колебалась в пределах 285-289 дней.

Анализ полученных данных свидетельствует, что показатели клеточной защиты коров голштинской породы находятся в пределах физиологической нормы. Так, фагоцитарная активность, выражающая процентное отношение активных, участвующих в фагоцитозе лейкоцитов к общему числу подсчитанных нейтрофильных лейкоцитов больше у животных немецкой селекции по сравнению с венгерской – на 13,2% и финской – на 13,4%. Фагоцитарный индекс определяется средним числом фагоцитированных микроорганизмов, приходящихся на один активный

лейкоцит и характеризует интенсивность фагоцитоза. В нашем опыте интенсивность фагоцитоза была больше у коров немецкой селекции и составила 8,42, что превышает данный показатель на 11,4% по сравнению с животными венгерской селекции и на 3,3% по сравнению с финской селекцией.

Ключевые слова: коровы, промышленная технология, продуктивное долголетие, воспроизводительные качества и адаптационная пластичность.

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