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ВЕСТНИК

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

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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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D. A. Baimukanov[1], S. K. Abugaliyev[1], N. B. Seidaliyev[1], V. G. Semenov[2], A. E. Chindaliyev[1], E. K. Dalibayev[1], B. S. Zhamalov[1], Sh. B. Muka[1]

[1]Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan,
[2]Chuvash state agricultural academy, Cheboksary, Chuvash Republic, Russia.
E-mail: dbaimukanov@mail.ru, baimukanov.dastanbek@bk.ru, ask1959@mail.ru,
s.nurzhan_b@mail.ru, semenov_v.g@list.ru, achindaliyev@rambler.ru, erdal62@mail.ru,
bakbergen.zhamalov@mail.ru, chika-1718@mail.ru

PRODUCTIVITY AND ESTIMATED BREEDING VALUE OF THE DAIRY CATTLE GENE POOL IN THE REPUBLIC OF KAZAKHSTAN

Abstract. With a linear estimation of the physique of first-calf heifers, it is established that in cows of domestic breeds, the parameters correspond to the optimal points of the species and the indicators of the extremities, but the parameters of the udder differ sharply. All the data on productive and exteriors were entered into the program of the Information and Analytical System (IAS), where the estimated breeding value of the studied cows was automatically calculated. The average estimated breeding value (EBV) for all breeds was 81.4. Among all breeds, the highest EBV level was determined in Holstein cows (84.3) of imported selection.

The average milk yield of the studied herds per 1 cow was 5300± 30 kg of milk, with a mass fraction of fat of 3.74±0.02%, the mass fraction of protein of 3.16±0.01%, with a content of 324.7±23.8 thous. of somatic cells. The most productive were the cows of the Holstein breed, their productivity over the Alatau breed was 694 kg (P>0.99), over the black-and-motley breed it was1446 kg (P>0.999), over the Simmental breed it was 1982 kg (P>0.999), over the red steppe - 2038 kg (P>0.999), no significant difference was found in the content of fat and protein of cow. Somatic cells were within normal limits. When studying the dynamics of milk yields according to lactation, it is established that the milk productivity of the Alatau breed is characterized by growth (4844... 5679... 5458 kg) by the second-third lactation and gradual decrease (4716... 4017 kg) by the fifth. On average, for all lactations, cows of this breed brought 5123±275.4 kg. The dairy productivity of Holstein cows is increased by the fifth lactation, without recessions. On average, for cows of black and motley breed for all lactations, the milk yield was 4671±190 kg. Dynamics of milk yield of the Simmental breed increases from the first to the second lactation (3917... 4035 kg), in the third it decreases (4035... 3334 kg), from the fourth to the sixth lactation the sequence increases.

Keywords: selection, selection, assortment, breeding value of cows, linear estimation of the exterior, milk yield, milk composition.

Introduction. In the domestic dairy cattle industry, the actual problem remains monitoring of traditional management systems of breeding processes in production. In modern dairy cattle breeding in our country, the main task of zootechnical science and practice is further intensification of the industry, aimed at increasing the genetic potential of the productive qualities of domestic animals and the extent of its implementation. The advancement of molecular biology, population genetics, biotechnology, the development and implementation of large-scale breeding, the use of computer programs for the analysis of breeding information enriched the arsenal of tools for studying biological patterns and management of animals heredity, and breed formation processes

The use of marker genes is especially important for the evaluation of traits, the phenotypic manifestation of which occurs relatively late or is limited to the sex, as well as for traits that are strongly influenced by non-genetic factors (for example, environmental factors) [1].

Because of the considerable variability of environmental conditions and nonadditive inheritance of dairy productivity, according to some researchers, the productivity of ancestors is not a reliable criterion for the value of their offspring. One of the ways to improve the accuracy of cows' estimation is to take into

account many environmental factors if possible, fluctuations in the dairy production by lactation, heritability, standard deviations, repeatability, etc. [2, 3].

In the world practice, an index estimate is used with the use of information systems, which allow to obtain an objective idea of individual animals and herds as a whole [4].

When determining the breeding (genetic) value of cows, the following phenotypic and genotypic characteristics are taken into account: productivity, exterior, udder health, reproductive qualities and duration of economic use [5].

The duration of economic use of cows is an important economic trait, since the quantity of products obtained depends on it, the volume and intensity of herd repair, as well as the level of recoupment of costs in dairy cattle breeding [6].

With the annual introduction of more valuable animals into the herd, the value of the selection differential increases, as a result of which the genetic improvement of the herd and the increase in its productivity are more successful. Long-term economic use of cows makes it possible to conduct breeding and selective work on farms at a higher level [7].

The development of domestic dairy cattle breeding is impossible without the diversity of the domestic gene pool of breeds, the solution of the problem of using valuable genetic resources on the basis of its own breeding base and the imported gene pool. In this connection, one of the most important factors in accelerating selection work is the widespread introduction of world and domestic achievements in the field of genetics and breeding into production.

At present, the process of approbation of the method of linear estimation of the exteriors and the determination of genetically determined interrelationships between the exterior characteristics with indicators such as the duration of economic use are underway. The appearance of the best genotypes of animals in the shortest possible time and their subsequent use for selective and breeding work with the herd is the basis of genetic progress in modern cattle breeding. It is important to take into account the data on the exteriors, lifelong productivity and the health status of the estimated livestock. The cornerstone of achieving the identified breeding priorities is the accuracy of the evaluation of genetically determined economic traits of animals. In this regard, there is a need to accumulate the information obtained by creating electronic databases and their corresponding software. The use of linear statistical models using computer modeling of the breeding process in dairy herds in the accelerated mode will help to provide an objective estimation of the breeding value of dairy cattle and the selection of animals with a high genetic potential of productivity. The use of pedigree servicing bulls with high estimated breeding value in generations will allow to increase the productivity of dairy cattle [8, 9].

With the annual introduction of more valuable animals into the herd, the value of the selection differential increases, as a result of which the genetic improvement of the herd and the increase in its productivity are more successful. Long-term economic use of cows makes it possible to conduct breeding and selection work on farms at a higher level (повторяется абзац) [6].

Thus, the new methods for estimation of the breeding value, taking into account the linear profile and genetic analysis data of cows will contribute to the intensification of selective and breeding work with dairy herds.

The aim of the research. Conducting a linear estimation of the productivity of the domestic dairy cattle gene pool.

Material and methods. Objects of the research were broodstocks, as well as servicing bulls. Materials of the research were the documents of primary zootechnical and pedigree accounting (from the IAS system), as well as the results of experimental studies, visual assessment, weighing, measurements, control milking of animals. In addition, biochemical studies of milk were carried out. For the analysis of dairy productivity, live weight and genealogy, the data of pedigree and zootechnical accounting of the economy were used. All animals were in the same conditions of feeding and maintenance. Cows were fed the fodder from the farm.

The calculation of the estimated breeding value was carried out according to the methodology developed by the researcher of Kazakh Scientific Research Institute of Animal Breeding and Fodder Production LLP [10].

To study the effect of the level of indices of breeding value on dairy productivity, the class intervals of indices were calculated according to the formula proposed by G.F. Lakin:

$$\lambda = \frac{x_{max} - x_{\min}}{K},$$

where λ – class interval value; x_{max} and x_{min} – maximum and minimum populations; K – number of classes.

The number of classes was determined by the Sturges formula:

$$K=1+3.32 \lg_n [11].$$

The reliability of the difference in the indicators (P) was determined according to Student. The results of the studies were processed on a PC by statistical programs "Excel" according to the generally accepted methodology of variational statistics [12].

Results of the research. After processing the data of the IAS program (taking into account the exclusion of cows with incomplete data), the data for lactation of cows were analyzed (table 1).

Table 1 – Productivity of cows of domestic dairy cattle gene pool

Breed	Productivity for finished lactation							
	Milk yield, l		Fat, %		Protein,%		Somatic cells. thous.	
	X±m	Cv	X±m	Cv	X±m	Cv	X±m	Cv
Alatau (n=534)	5259±71	28	3.84±0.02	12	3.28±0.01	10	756.0±67	207.7
Simmental (n=796)	5654±60	32	3.96±0.01	10	3.37±0.01	7	356.9±20	156.8
Black-and-motley (n=812)	5548±63	32	3.74±0.01	9	3.24±0.01	7	240.6±15	173.2
Holstein b/m (n=505)	6380±67	36	3.80±0.01	11	3.24±0.01	8	217.6±11	176.1
For 305 days of lactation	5712±97		3.83±0.02		3.28±0.01		339.6±54	

It was found that the average milk yield per cow amounted to 5987±97 kg of milk, with an average fat content of 3.83±0.02%, protein content of 3.28±0.01%, with a content of 339.6±54 thousand somatic cells. The highest yield, as expected, was in the cows of the Holstein breed (6380±67 kg). The difference between the yield of Holstein cows and Alatau cows was 1121 kg (P>0.999), with black-and-motley cows 832 kg (P>0.999), Simmental - 726 kg (P>0.999), the highest content of fat was in the Simmental breed (3.96±0,01%), exceeding the Alatau by 0.12% (P>0.999), black-an-motley by 0.22% (P>0.999), Holstein - by 0.16% (P>0.999). In terms of protein content, the Simmental cows were superior to Alatau by 0.09% (P>0.999), black-and-motley and Holstein - by 0.16% (P>0.999). Somatic cells are within normal limits.

Since 2016, monthly trips have been organized to the basic farms to conduct control milking of cows, with the sampling of milk, and the determination of its quality in laboratory conditions. All data on the productivity and quality of milk (yield, fat and protein content, the number of somatic cells) were then added to the IAS program. The reliability of the results of these studies is ensured by the fact that the milk quality analysis was carried out in independent dairy laboratories, the productive data were selected monthly by researchers in the process of control milking, the control of the work was carried out by the Republican Chamber of Dairy Cattle.

The productive indicators of dairy cows in the context of breeds are presented in table 2.

Table 2 – Dairy productivity of cows in the context of breeds

Breed	n	Milk yield, l		Fat, %		Protein, %		Somatic cells, thous.	
		$X±m_x$	C_v	$X±m_x$	C_v	$X±m_x$	C_v	X±m	C_v
Alatau	220	5100±273	33.4	3.78±0.05	8.4	3.22±0.05	8.6	648.0±93.8	87.1
Holstein	2671	5794±93.0	37.0	3.72±0.02	15.6	3.17±0.02	14.7	285.2±8.9	75.1
Black-and-motley	674	4348±166	43.8	3.72±0.04	12.9	3.05±0.05	20.4	336.5±45.6	131
Simmental	403	3812±207	47.6	3.91±0.05	9.2	3.23±0.05	14.7	378.5±37.8	70.9
Red steppe	23	3756±571	40.9	3.53±0.13	9.6	2.84±0.11	10.9	530.7±195	72.6
Total/average	3991	5300±130	40.7	3.74±0.03	14.1	3.16±0.03	15.3	324.7±23.8	84.8

It was found that in the program of the information analytical system (IAS), on average, the dairy productivity of cows was 5300±129.6 kg. The most productive cows were, as expected, cows of the Holstein breed, the excess of their productivity over the Alatau cows was 694 kg (P>0.99), over the black-and-motley cows - 1446 kg (P>0.999), over the Simmental cows - 1982 kg (P>0.999), over the red steppe - 2038 kg (P>0.999).

Domestic and world experience proves that the decisive conditions for solving the problem of providing the population with products are the presence of breeds and herds of animals with a high genetic potential of productivity. In the solution of the tasks in hand, it is of great importance to improve the productive qualities of the animals of herds of the basic farms. The tendency, productivity of cows of Holstein breed prevails over the productivity of domestic breeds, but this difference is insignificant and unreliable (table 3).

Table 3 – Indicators of dairy productivity of first-calf heifers of the basic farms

Breeds	Number of cows, heads	Milk yield, kg		Fat, %		Protein, %		Somatic cells thous.	
		$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv
Alatau	37	4301±206.0	29	3.89±0.03	4.3	3.27±0.03	6.0	625.7±77.4	75
Holstein	480	5214±61.6	25	3.78±0.03	14	3.20±0.02	13	288.4±7.6	57
Black-and motley	49	4463±135.2	21	3.85±0.04	7.3	3.29±0.03	5.8	282.6±13.1	32
Simmental	68	4624±161.2	28	3.95±0.02	3.7	3.39±0.02	3.7	421.5±29.4	57
On average	634	4739±86.4	26	3.81±0.03	12	3.23±0.02	11	321.9±14.4	56

Thus, the domestic breeds of dairy cattle of the basic farms, where three intra-breed types are predominantly bred: "Ak-Yrys" of Alatau, "Sairam" of black-and-motley and "Ertis" of Simmental breeds - are already approaching to productivity of the dairy breed of import selection - Holstein, which predetermines the effectiveness of breeding work carried out by researchers of the department of breeding and selection of dairy cattle of the Kazakh Scientific Research Institute of Animal Breeding and Fodder Production LLP.

The duration of economic use of cows is one of the important indicators in the system of reproduction of the herd - a complex production process, including a set of organizational, economic, veterinary, and technological measures. Productivity and reproductive abilities of animals are the most important components of economic екфшеs, according to which breeding should be carried out. The works of scientists are dedicated to this [13, 14].

On average, for all lactations, cows of the Alatau breed milked 5123±275.4 kg (table 4).

Table 4 – Indicators of dairy productivity and milk composition of the Alatau breed

Age, in lactation	Number of cows, heads	Milk yield, kg		Fat, %		Protein, %		Somatic cells thous./cm^3	
		$X \pm m_x$	C_v	$X \pm m_x$	C_v	$X \pm m_x$	C_v	$X \pm m_x$	C_v
1 lactation	62	4844±189	30.8	3.74±0.04	8.6	3.19±0.03	8.6	542.2 ± 57	83.1
2 lactation	58	5679±221	29.7	3.77±0.04	8.5	3.22±0.03	8.1	490.6 ± 57	89.3
3 lactation	36	5458±313	34.4	3.76±0.04	6.8	3.22±0.04	7.3	802.0±155	116.2
4 lactation	34	4716±275	34.0	3.79±0.05	8.3	3.23±0.05	8.6	785.3±89	66.2
5 lactation	12	4017±641	55.3	3.93±0.11	10.0	3.29±0.10	10.3	673.6±181	93.2
6 lactation	14	4421±468	39.7	3.92±0.12	11.8	3.20±0.11	12.8	1045 ± 206	74.0
Total/ on average	216	5077±275,4	33.6	3.78±0.05	8.5	3.21±0.05	8.6	649.8 ± 95	87.6

The dairy productivity of the Alatau breed is characterized by growth (4844... 5679... 5458 kg) by the second-third lactations and gradual decrease (4716 ... 4017 kg) by the fifth, i.e. for this breed, it is characterized by a constant level of milk yields, which confirms its high stress resistance. The uniformity of the lactation flow of the Alatau breed by age is clearly confirmed in the diagram (figure 1). As can be

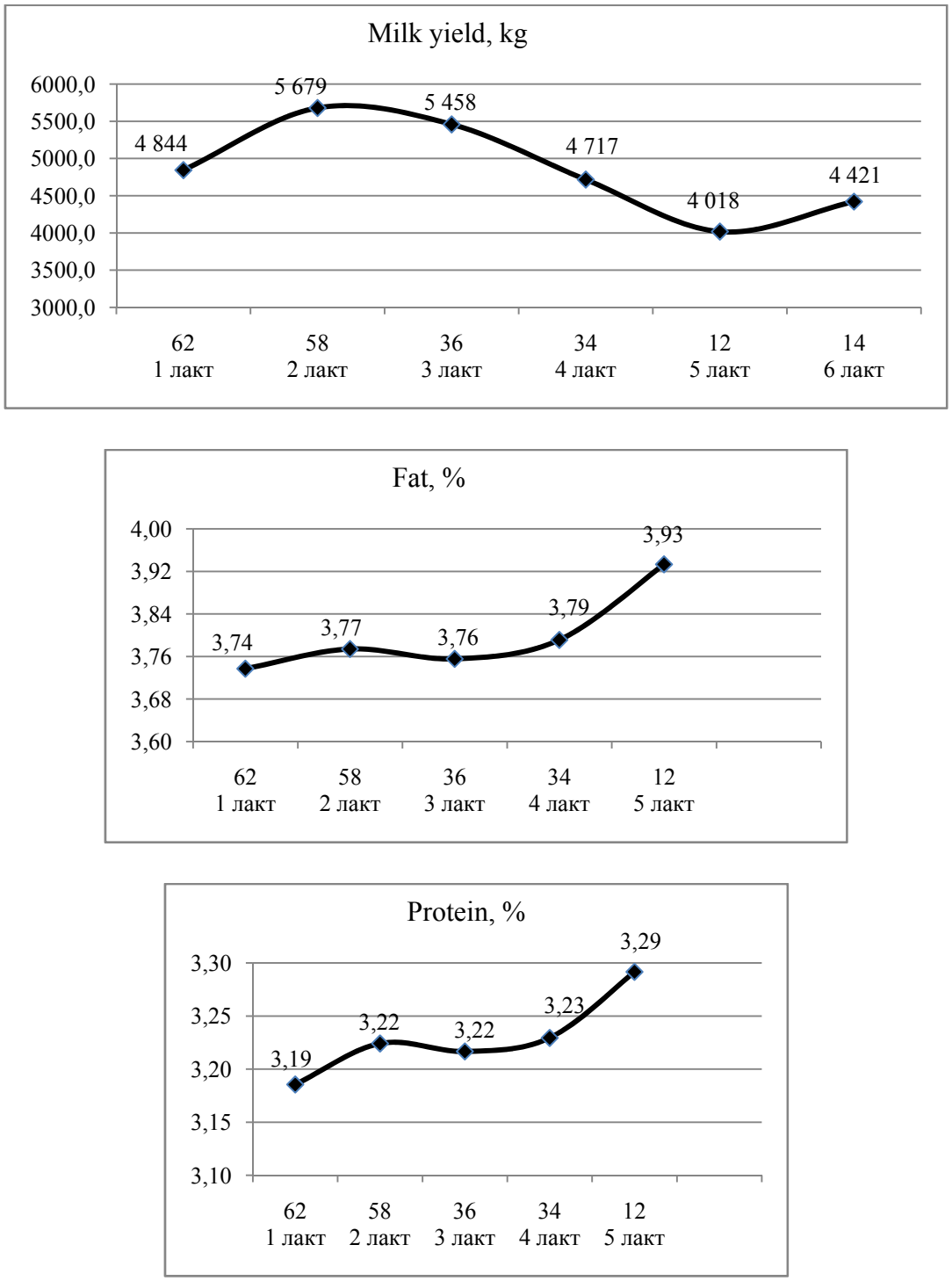


Figure 1 – Diagram of the productivity of the Alatau cows in the context of calving

seen from the graph, the milk yield of Alatau cows from the second lactation is gradually decreasing, while the decline in dairy productivity is gradual. According to the chemical composition, the milk of the Alatau cows does not have any noticeable differences. It has been established that the number of somatic cells increases with cows of the Alatau breed with age.

It has been established that the dairy productivity of Holstein cows increases by the fifth lactation (table 5), without recessions, which is typical for this, the youngest breed, as can be clearly seen from the diagram (figure 2). The chemical composition by age is stable.

Table 5 – Indicators of dairy productivity and milk composition of the Holstein breed

Age, in lactation	Number of cows, heads	Milk yield, kg		Fat, %		Protein, %		Somatic cells thous./cm^3	
		X ±m_x	C_v	X±m_x	C_v	X±m_x	C_v	X±m_x	C_v
1 lactation	722	5280±67.6	34	3.73±0.02	14	3.18±0.02	13	302.2±7.3	65
2 lactation	583	5502±85.4	37	3.78±0.02	11	3.22±0.02	12	274.2±5.3	47
3 lactation	356	5598±98.1	33	3.76±0.02	9	3.21±0.01	8	313.4±14.9	89
4 lactation	158	5650±159.3	35	3.74±0.04	12	3.21±0.03	11	297.2±16.4	69
5 lactation	91	6139±213.1	33	3.79±0.03	8	3.25±0.03	7	256.7±15.4	57
6 lactation	50	5648 ± 281.6	35	3.73±0.05	9	3.25 ±0.03	8	287.3 ±18.3	44
Total	1960	5479±93.3	35	3.75±0.02	12	3.20±0.02	11	293.0±9.5	63

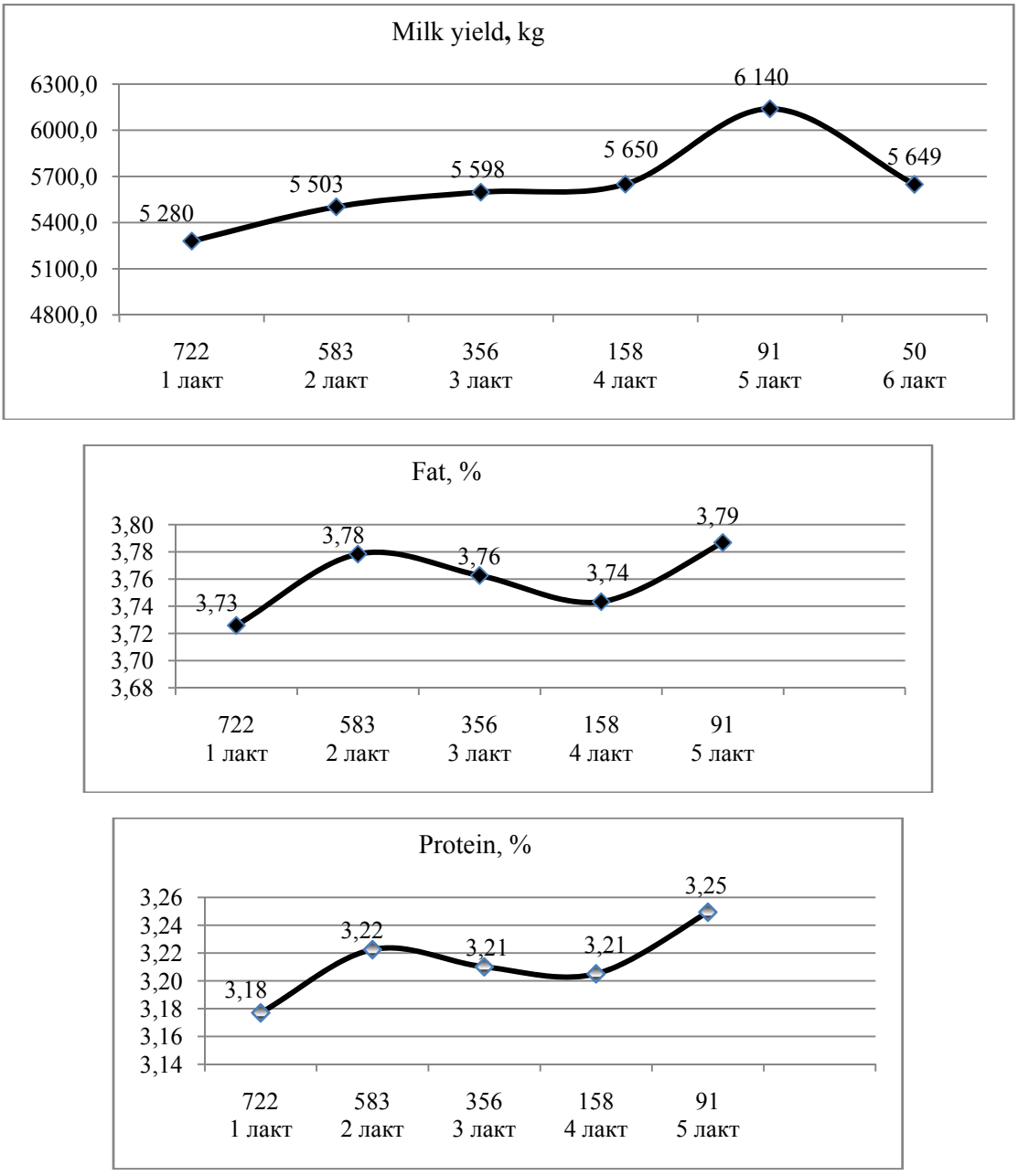


Figure 2 – Diagram of the productivity of the Holstein cows in the context of calving

It is known that the high lifetime productivity of cows is a consequence of the good development and functioning of all organs and systems of vital activity of the animal body during the whole period of its use [15].

It has been established that in black-and-motley cattle from the first lactation, when the maximum milk yield is observed (4936±231 kg), a gradual decrease by the fifth lactation occurs, which confirms the increased reaction of this breed to stress factors of the external environment (table 6).

Table 6 – Indicators of dairy productivity and milk composition of the black-and-motley breed

Age, in lactation	Number of cows, heads	Milk yield, kg		Fat, %		Protein, %		Somatic cells thous./cm^3	
		$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv
1 lactation	117	4936±231	50	3.65±0.05	15	3.05 ± 0.05	19	444.1 ± 101.7	247
2 lactation	121	4692±191	44	3.77±0.03	9	2.97 ± 0.06	23	293.5 ± 26.6	99
3 lactation	108	4811±157	34	3.75±0.04	10	3.14 ± 0.05	18	408.1 ± 64.5	164
4 lactation	68	4493±174	32	3.81±0.03	6	2.97 ± 0.10	26	289.1 ± 27.2	77
5 lactation	54	3989±180	33	3.85±0.03	5	3.23 ± 0.04	8	241.7 ± 8.9	26
6 lactation	22	4391±243	26	3.84±0.07	7	3.21 ± 0.05	6	722.3 ± 273.0	177
Total	490	4658±192	40	3.75±0.04	10	3.07 ± 0.06	19	367.7 ± 62.1	141

On average, for all lactations, the yield of the black-and-motley cattle was 4671±190 kg, i.e. the potential of this breed is available, as evidenced by the variability of this selective feature (32.0... 50.7%), which is clearly visible in the diagram (figure 3).

When working with the black-and-motley breed, it is necessary to strengthen the selection by dairy productivity and milk composition.

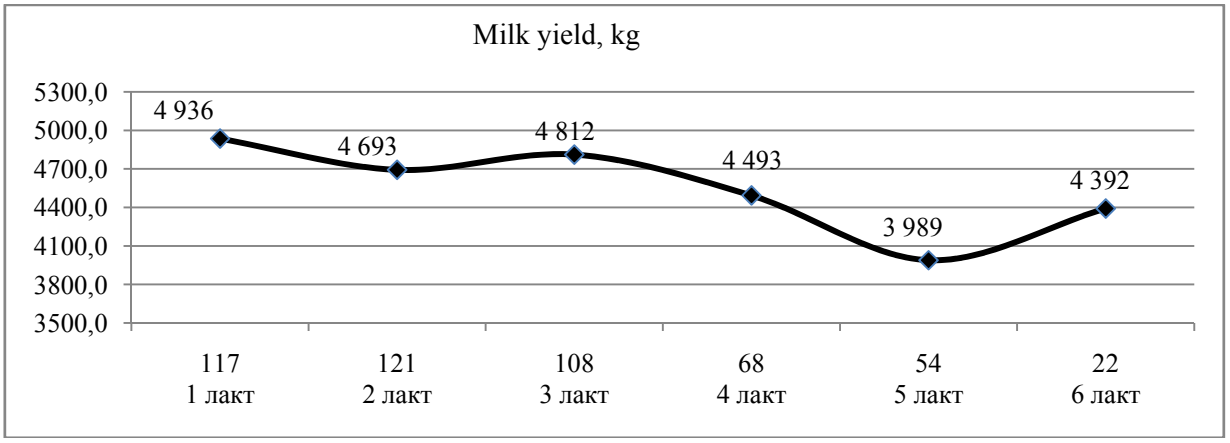
The average productivity of the Simmental cows was only 3809 kg (table 7).

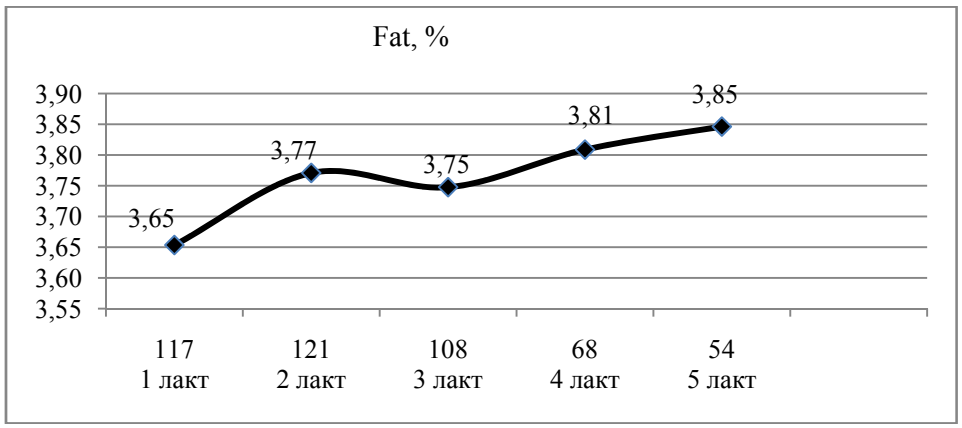
Table 7 – Indicators of dairy productivity and milk composition of the Simmental breed

Age, in lactation	Number of cows, heads	Milk yield, kg		Fat, %		Protein, %		Somatic cells thous./cm^3	
		$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv
1 lactation	134	3917±138.0	40	3.96± 0.02	5.4	3.30±0.03	9.9	387 ± 17.1	50
2 lactation	100	4035±220.1	54	3.88± 0.03	7.8	3.18±0.05	16.2	352 ± 18.2	51
3 lactation	68	3334±200.5	49	3.80± 0.07	15.7	3.22±0.08	20.3	329 ± 17.1	42
4 lactation	56	4391±301.9	51	3.91± 0.04	7.6	2.97±0.09	21.4	418 ± 82.7	148
5 lactation	21	3058±328.8	49	3.81± 0.12	14.2	3.31±0.06	8.6	513 ± 197.4	176
6 lactation	23	2879±246.4	41.0	4.23± 0.16	17.7	3.64±0.06	8.4	365.4± 51.5	67
Total	402	3809±208.0	47.6	3.91± 0.05	9.2	3.23±0.05	14.7	378.7± 37.9	70

Dynamics of milk yields of the Simmental breed of cattle is of a curvilinear nature.

In particular, with the increase in productivity by the second lactation (3917... 4035 kg), in the third, on the contrary, it decreases (4035... 3334 kg), then this sequence is repeated. Therefore, the average productivity of cows of this breed is only 3809 kg, which is clearly visible from the graph (figure 4).





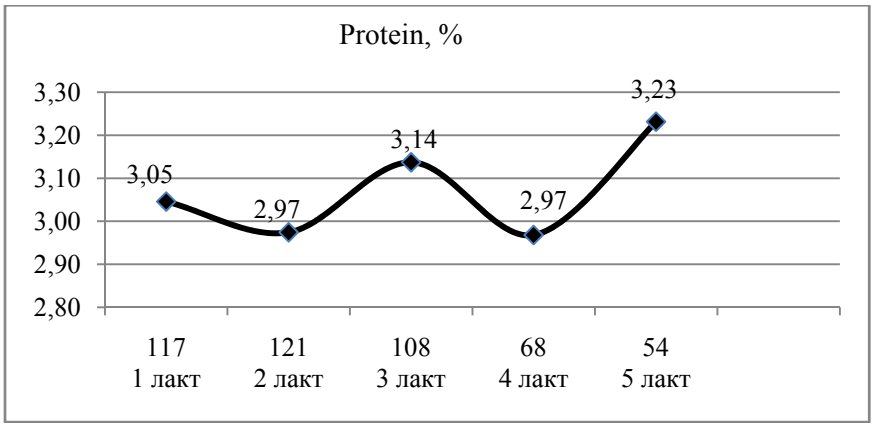


Figure 3 – Diagram of the productivity of the black-and-motley cows in the context of calving

According to the milk composition, a relative stability is set, which is clearly visible in the diagrams.

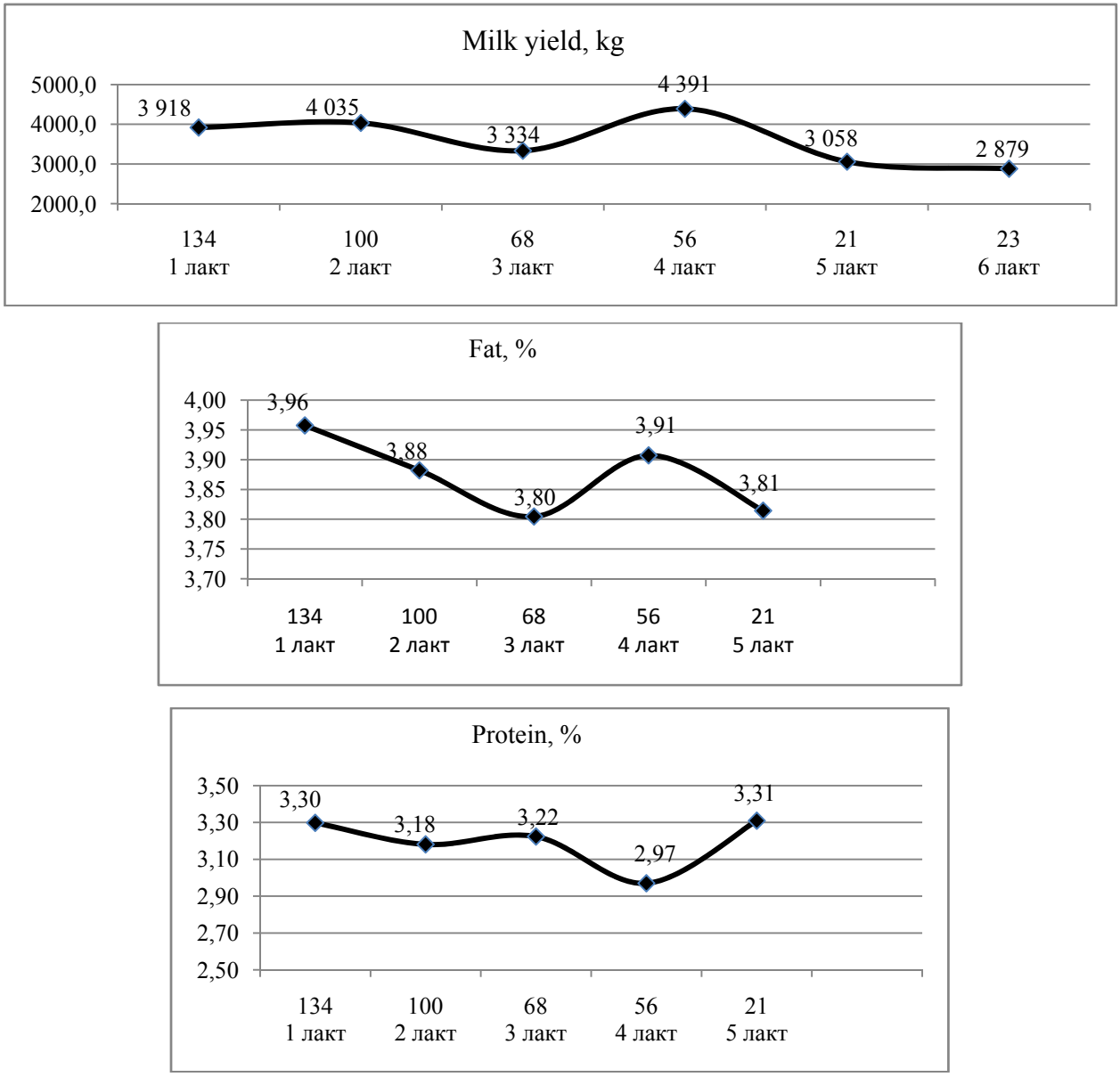


Figure 4 – Diagram of the productivity of the Simmental cows in the context of calving

For the effective management of the selection process, complete, qualitative and reliable information is needed, both about the individual animal and the breed as a whole. In countries with developed livestock breeding, the selection process is closely related to management. One of the tasks of modern animal husbandry is to improve the selection management system, both in general and in individual sectors.

The selective-genetic approach to stock breeding was also undertaken not in many works. In the selection of animals, the need arose to strengthen the mathematical apparatus and to introduce more precise, modern methods of genetics in stock breeding, including DNA analysis and polymorphic protein systems, the analysis of hidden genetic defects. Until now, an exhaustive management system of biological and genetic-statistical parameters of selection has not been created. The situation is complicated by the low organization of stock breeding with herds of dairy cattle. It should be noted that the farms do not give much attention to the conduction of a linear estimation of the exteriors of cows.

One of the most acute problems in the cattle breeding is the lack of servicing bulls of their own selection. Modern selection needs a detailed study of all breeding genetic processes in populations and a consideration of populations as complex biological systems, which in the future, undoubtedly, will make both theoretical and practical significances in cattle breeding and biology [13-16].

At present, the research institutions based on the experience of countries with developed dairy cattle breeding have developed a methodology for index estimation of the breeding value of milking cows. This technique is embedded in the program of the information and analytical system (IAS), which, in the presence of data on productivity (milk yield, fat and protein content in milk, the number of somatic cells) and the exterior, calculates the estimated breeding value of the animal in terms of productivity.

During 2016-2017 and now monthly we carry out control milking of cows with sampling of milk. Then samples are transferred to the dairy laboratory of KazSRIAB&FP LLP for carrying out its biochemical composition, especially interested in the content of fat, protein and the number of somatic cells. These indicators, together with the results of the linear estimation of the exteriors of cows, are entered into the IAS program, which automatically calculates the estimated breeding value of cows by the method developed by the employees of KazSRIAB&FP LLP. The results of the calculations are given in table 8.

Table 8 – Results of calculation of the estimated breeding value of cows in a cut of breeds

Breed	Number of cows, heads	EBV of milk yield for 305 days, kg		EBV of fat for 305 days, %		EBV of protein for 305 days, %	
		$X \pm m_x$	C_v	$X \pm m_x$	C_v	$X \pm m_x$	C_v
1	2	3	4	5	6	7	8
Holstein	1960	100±0.3	12	99.9±0.1	4.1	99.9±0.1	3.9
Black-and-motley	490	100±0.6	14	99.4±0.4	8.1	91±1.3	31.3
Alatau	216	100±0.9	13	100±0.1	1.6	100±0.1	1.3
Simmental	402	100±0.8	16	100±0.1	2.6	100±0.1	2.8
Total/on average	3091	100±0.5	13	99.8±0.1	4.3	98±0.3	7.9

Continuation of table 8

Breed	Number of cows, heads	Dairy productivity index		Udder health index		The total estimated breeding value	
		$X \pm m_x$	C_v	$X \pm m_x$	C_v	$X \pm m_x$	C_v
1	2	9	10	11	12	13	14
Holstein	1960	100±0.2	7.6	100±0.01	0.4	84±0.3	15.7
Black-and-motley	490	98±0.5	11.0	99.4±0.3	7.9	77±0.5	14.1
Alatau	216	100±0.5	7.7	100±0.04	0.6	75±0.4	7.8
Simmental	402	100±0.5	9.6	100±0.02	0.5	75±0.3	7.7
Total/on average	3091	99.7±0.3	8.4	99.9±0.1	1.6	81±0.3	13.8

It was found that the aggregate figure of the total estimated breeding value (EBV) for all breeds was 81.4. Among all breeds, the highest EBV level was determined in the Holstein cows (84.3) of imported selection. The EBV level of cows of other breeds does not have a significant difference.

The main task for the selection of the necessary genotypes is to estimate the breeding value of animals that can contribute to the enhancement of the genetic potential of the next generation. Determination of the breeding value of dairy cattle is the main criterion for increasing the genetic potential of animals and their productive indicators.

One of the reasons for the low efficiency of selection work with dairy cattle in Kazakhstan is the use of low-quality pedigree material. Very rarely farmers use high-quality breeding material from leading manufacturers. The regulatory acts adopted in Kazakhstan in the field of cattle breeding have created real prerequisites for the conservation and expansion of the livestock gene pool [13].

Currently, a lot of data have been accumulated that allow to carry out effective selective and breeding work with animals of dairy breeds of cattle. Studies should be conducted taking into account genetically isolated populations, adapted to the climatic conditions of their breeding [14, 15]. At the same time, it is necessary to trace the indicators of economic traits in pedigrees [16-20].

The individual indices of the studied dairy cattle gene pool are in the limit of 100, so we studied the EBV (estimated breeding value), previously dividing them into classes according to the generally accepted methodology.

The dependence of the indices and the level of dairy productivity is determined depending on the class distribution according to the dairy productivity index (table 9).

Table 9 – Distribution of total estimated breeding value by class gap

Total estimated breeding value (lim)	n	Milk yield for 305 days, kg		EBV of milk yield for 305 days, kg		EBV of fat for 305 days, %	
		$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv
1	2	3	4	5	6	7	8
413 – 47.4	3	1799.3 ± 358.1	34.5	76.8 ± 2.13	4.8		
47.5 – 53.6	2	1796.0 ± 505.0	39.8	77.9 ± 3.79	6.9	94.0 ± 3.6	5.4
53.7 – 59.8	15	1406.9 ± 105.0	28.9	75.3 ± 1.05	5.4	100.5 ± 0.4	1.4
59.9 – 66.0	56	2368.3 ± 178.0	56.2	81.7 ± 1.39	12.7	98.4 ± 0.7	4.9
66.1 – 72.2	501	2855.9 ± 39.9	31.2	85.7 ± 0.23	6.1	99.6 ± 0.2	5.6
72.3 – 78.4	1345	5188.3 ± 25.5	18.0	100.5 ± 0.12	4.5	100.2 ± 0.1	3.3
78.5 – 84.6	300	6951.8 ± 67.6	16.8	116.2 ± 0.27	4.1	99.4 ± 0.1	1.9
84.7 – 90.8	85	6944.2 ± 407.4	54.1	116.5 ± 2.89	22.9	99.0 ± 0.3	2.3
90.9 – 97.0	227	3179.3 ± 101.1	47.9	86.5 ± 0.87	15.1	100.0 ± 0.2	2.7
97.1 – 103.2	341	5621.7 ± 48.7	16.0	101.2 ± 0.28	5.2	100.3 ± 0.1	2.3
103.3 – 109.4	172	8041.6 ± 70.1	11.4	116.5 ± 0.39	4.4	100.0 ± 0.1	1.8
109.5 <	48	10255.0 ± 140.5	9.5	132.2 ± 0.73	3.8	99.8 ± 0.1	0.8

Continuation of table 9

Total EBV (lim)	n	EBV of protein for 305 days, %		Dairy Productivity Index		Udder health index	
		$X \pm m_x$	Cv	$X \pm m_x$	Cv	$X \pm m_x$	Cv
1	2	9	10	11	12	13	14
41.3 – 47.4	3			46.1 ± 1.28	4.8	99.6 ± 0.33	0.6
47.5 – 53.6	2	97.7 ± 2.68	3.9	84.9 ± 3.58	6.0		
53.7 – 59.8	15	6.8 ± 6.77	387.3	71.3 ± 1.58	8.6	93.3 ± 6.67	277
59.9 – 66.0	.	63.1 ± 6.36	75.4	83.1 ± 0.25	2.2	100.2 ±0.11	0.8
66.1 – 72.2	501	98.2 ± 0.58	13.2	91.0 ± 0.15	3.7	100.0 ±0.02	0.5
72.3 – 78.4	1345	100.1 ± 0.05	2.0	100.4 ± 0.08	2.8	100.0 ±0.01	0.4
78,5 – 84.6	300	99.5 ± 0.16	2.7	109.5 ± 0.16	2.5	99.9 ± 0.03	0.6
84.7 – 90.8	85	99.3 ± 0.31	2.9	109.5 ± 1.75	14.7	99.9 ± 0.07	0.6
90.9 – 97.0	227	100.4 ± 0.18	2.6	91.9 ± 0.51	8.3	100.0 ±0.03	0.5
97.1 – 103.2	341	100.3 ± 0.10	1.8	100.8 ± 0.16	2.9	99.9 ± 0.03	0.5
103.3–109.4	172	100.2 ± 0.12	1.6	109.9 ± 0.23	2.7	100.0 ±0.04	0.6
109.5 <	48	100.1 ± 0.12	0.9	119.3 ± 0.43	2.5	100.0 ±0.07	0.5

It has been established that as the indices increase, the level of dairy productivity also increases, with the exception of the range of 90.9 - 97.0, when there is a decline in milk yields, which is quite explicable, since in this gradation the lowest dairy productivity index (91.9±0.51), i.e. now, in Kazakhstan, there is the most reliable quantitative trait of selection.

On the basis of complex investigations, groups of the desired type were formed by annual selection of the highly productive black-and-motley Holstein cows (table 10).

Table 10 – Productivity of the black-and-motley Holstein cows of the desired type of experimental farms

Name of the farm	n	Milk yield for 305 days of lactation, kg		Fat, %		Protein, %		Live weight, kg	
		$X \pm m_x$	C_v	$X \pm m_x$	C_v	$X \pm m_x$	C_v	$X \pm m_x$	C_v
Pervomaisky LLP	9	5817±62	3.2	3.67±0.04	2.9	3.31±0.05	4.9	496±5.7	3.4
Ice LLP	99	10116±80	7.9	3.69±0.01	3.5	3.30±0.01	3.1	679±5.3	7.9
Aidarbayev E.S. Farm	15	8048±214	10.3	3.83±0.02	2.3	3.22±0.01	1.3	595±8.9	5.8
Total/on average	123	9549±95	7.8	3.70±0.01	3.3	3.27±0.01	3.0	656±5.7	7.3

As can be seen from the data in table 10, in three experimental farms of different regions of Kazakhstan, out of 2,800 heads of total livestock, 123 heads of highly productive cows were formed by carrying out a complex of modern biotechnological, biochemical and molecular genetic studies. Their average dairy productivity was 9549±95 kg of milk, with a fat content of 3.70±0.01%, protein content of 3.27±0.01%. The breeding effect of using the offspring of these cows will be 96 kg of milk per year from each head, taking into account that the heritability coefficient for daily productivity is not more than 0.2 and the generation interval is 5 years, and the economic efficiency from the additional production will be more than 7500 tenges per 1 head of cattle.

Conclusion. In cows of the Alatau breed, the type parameters and parameters of the limbs correspond to the optimal indicators, but the parameters of the udder differ sharply. The same trend is observed in cows of the black-and-motley breed, which determines the direction of further selection work with the domestic breed of cows: it is necessary to conduct a corrective selection of servicing bulls, taking into account these shortcomings.

A methodology for assessing the physique of the Holstein cows and the algorithm for calculating the indices of the estimated breeding value of the Holstein cows in the content of somatic cells in milk, providing a logarithmic scale for estimating the number of somatic cells, were unified.

Approaches have been developed to determine the index of the duration of economic use and to determine the index of the reproductive ability of the Holstein cows in accordance with modern international requirements.

It was found that the average index of the total estimated breeding value (EBV) for all breeds was 81.4. Among all breeds, the highest EBV level was identified in the Holstein cows (84.3) of imported selection. The EBV level of cows of other breeds does not have a significant difference. When studying the EBV, previously divided into classes, it was found that with an increase in indices, the level of dairy productivity also increases, with the exception of the interval of 90.9 - 97.0, when there is a decline in milk yields, which is quite understandable, since in this gradation it is the lowest dairy productivity index (91.9 ± 0.51).

123 heads of the black-and-motley Holstein cows were formed. Their average dairy production was 9549±95 kg of milk, with a fat content of 3.70±0.01%, protein content of 3.27±0.01%. The breeding effect of using the offspring of these cows will amount to 96 kg of milk per year from each head, taking into account that the heritability estimate in dairy productivity is not more than 0.2 and the generation interval is 5 years, and the economic efficiency from the additional production will be more than 7500 tenges per head.

The research was carried out within the framework of the target scientific and technical program of the Ministry of Agriculture of the Republic of Kazakhstan in the Kazakh Scientific Research Institute of Animal Breeding and Fodder Production LLP in the period 2016-2018.

Д. А. Баймуканов[1], С. Қ. Абуғалиев[1], Н. Б. Сейдалиев[1], В. Г. Семенов[2], А. Е. Чиндалиев[1], Е. К. Далибаев[1], Б. С. Жамалов[1], Ш. Б. Муқа[1]

[1]«Қазақ мал шаруашылығы және жем шөп өндірісі ғылыми зерттеу институты» ЖШС,
Алматы, Қазақстан,
[2]Чуваш мемлекеттік ауыл шаруашылығы академиясы,
Чебоксар, Чуваш Республикасы, Ресей

ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ СҮТТІ ІРІ ҚАРА МАЛДЫ ӨСІРЕТІН ТЕКТІК ҚОРЫНЫҢ АСЫЛТҰҚЫМДЫҚ ҚҰНДЫЛЫҒЫНЫҢ ИНДЕКСІ МЕН СҮТІНІҢ ӨНІМДІЛІГІ

Аннотация. Бірінші тума сиырларының дене пішімін сызықтық бағалауда, отандық тұқым сиырларын оңтайлы баллы сыртқы түрлердің көрсеткіштері мен аяқтың көрсеткіштеріне сәйкес келетіндігі анықталды, бірақ желіннің параметрлері күрт ерекшеленеді. Өнімділік пен сыртқы пішінінің көрсеткіштері бойынша барлық деректер ақпараттық-талдау жүйесі (АТЖ) бағдарламасына енгізіледі және сиырдың асыл тұқымды құнының индексі автоматты түрде есептелініп анықталады. Асыл тұқымдық құндылықтарының орташа көрсеткіші (АТҚИ) 81,4 болды. Импорттық асылдандыруда голштин сиырларының асыл тұқымдық құндылықтарының индексінің (84,3) деңгейі барлық тұқымдардың арасында ең жоғарысы.

Табындағы бір сиырдың орташа сүт өнімділігі 5300 ± 130 кг сүтті құрады, майдың массалық үлесі 3,74 ± 0,02%, ақуыздың массалық үлесі 3,16 ± 0,01%, құрамында 324,7 ± 23,8 мың соматикалық клеткалар бар. Ең көп өнімді голштин тұқымды сиырлар болды, олардың өнімділігі алатау сиырынан 694 кг (P> 0.99), қара ала сиырынан - 1446 кг (P> 0.999), Симментал сиырынан - 1982 кг (P> 0.999), қырдың қызыл сиырынан - 2038 кг (P> 0.999) жоғары, сиыр майының және ақуыздың құрамы бойынша айтарлықтай айырмашылықтар жоқ. Соматикалық клеткалар қалыпты деңгейде. Сүт өнімділігінің динамикасын лактация бойынша зерттегенде, алатау тұқымының сүт өнімділігінің өсуі (4844 ... 5679 ... 5458 кг) екінші немесе үшінші лактация кезеңінде жоғарлап және бірте-бірте (4716 ... 4017 кг) бесіншіге лактация кезеңіне қарай төмендегені анықталды. Осы тұқымды сиырлардың барлық лактация кезеңінде, орташа алғанда, 5123 ± 275,4 кг-ға дейін жеткізілді. Гольштиндік сиырдың сүт өнімділігі бесінші лактацияға дейін құлдыраусыз өседі. Орташа алғанда, қара ала сиырлары барлық лактацияда 4671 ± 190 кг сүт өнімі құрады. Симментал тұқымының сүт өнімділігінің динамикасы бірінші лактациядан екінші лактацияда (3917 ... 4035 кг) артып, үшінші лактациялық кезеңде (4035 ... 3334 кг) төмендеп, төртінші лактациядан алтыншы лактациялық кезең бойынша дәйектілік артады.

Түйін сөздер: асылдандыру,сиырларды іріктеу, сұрыптау, сиырдың асыл тұқымдық құндылығы, сыртқы пішінін сызықты бағалау, сүт өнімділігі, сүт құрамы.

Д. А. Баймуканов[1], С. К. Абугалиев[1], Н. Б. Сейдалиев[1], В. Г. Семенов[2], А. Е. Чиндалиев[1], Е. К. Далибаев[1], Б. С. Жамалов[1], Ш. Б. Муқа[1]

[1]ТОО «Казахский научно-исследовательский институт животноводства и кормопроизводства»,
Алматы, Казахстан,
[2]Чувашская государственная сельскохозяйственная академия,
Чебоксары, Чувашская Республика, Россия

ПРОДУКТИВНОСТЬ И ИНДЕКС ПЛЕМЕННОЙ ЦЕННОСТИ РАЗВОДИМОГО ГЕНОФОНДА МОЛОЧНОГО СКОТА В РЕСПУБЛИКЕ КАЗАХСТАН

Аннотация. При линейной оценке телосложения коров-первотелок установлено, что у коров отечественных пород оптимальным баллам соответствуют параметры вида и показатели конечностей, но резко отличаются параметры вымени. Все данные по продуктивным и экстерьерным показателям были занесены в программу информационно-аналитической системы (ИАС), где автоматически был рассчитан индекс племенной ценности изученных коров. Средний индекс племенной ценности (ИПЦ) по всем породам составил 81,4. Среди всех пород наивысший уровень ИПЦ определен у коров голштинской породы (84,3) импортной селекции.

Средний удой изученных стад на 1 корову составил 5300±130 кг молока, с массовой долей жира 3,74±0,02%, массовой долей белка 3,16±0,01%, с содержанием 324,7±23,8 тысяч соматических клеток. Наиболее продуктивными оказались коровы голштинской породы, превышение их продуктивности над

алатауской составило 694 кг (P>0,99), над черно-пестрой – 1446 кг (P>0,999), над симментальской – 1982 кг (P>0,999), над красной степной – 2038 кг (P>0,999), по содержанию жира и белка коровы достоверной разницы не обнаружено. Соматические клетки в пределах нормы. При изучении динамики удоев по лактациям установлено, что, молочная продуктивность алатауской породы характеризуется ростом (4844…5679…5458 кг) до второй-третьей лактациям и постепенным снижением (4716…4017 кг) к пятой. В среднем за все лактации коровы этой породы надоили 5123±275,4 кг. Молочная продуктивность коров голштинской породы увеличивается до пятой лактации, без спадов. В среднем у коров черно-пестрой породы за все лактации удой составил 4671±190 кг. Динамика удоев симментальской породы возрастает с первой ко второй лактации (3917…4035 кг), в третьей происходит ее снижение (4035…3334 кг), с четвертой по шестую лактации последовательность увеличивается.

Ключевые слова: селекция, отбор, подбор, племенная ценность коров, линейная оценка экстерьера, удой, состав молока.

Information about authors:

Baimukanov Dastanbek Asylbekovich, Doctor of Agricultural Sciences, Professor, Corresponding Member of the National Academy of Sciences of the Republic of Kazakhstan, Chief Researcher of the Department of breeding and selection of dairy cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; dbaimukanov@mail.ru, baimukanov.dastanbek@bk.ru; https://orcid.org/0000-0002-4684-7114

Abugaliyev Serimbek Kurmanbaiuly, Candidate of Agricultural Sciences, Head of the Department of breeding and selection of dairy cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; ask1959@mail.ru; ORCID/Researcher ID 0000-0003-2316-5214; https://orcid.org/0000-0003-2316-5214

Seidaliyev Nurzhan Beskempirovich, Candidate of Agricultural Sciences, Senior Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; s.nurzhan_b@mail.ru; https://orcid.org/0000-0002-2985-6967

Semenov Vladimir Grigoryevich, Doctor of Biological Science, professor, honored worker of science of the Chuvash Republic, professor of Department of morphology, obstetrics and therapy of the Chuvash state agricultural academy, Cheboksary, Chuvash Republic, Russia; semenov_v.g@list.ru; https://orcid.org/0000-0002-0349-5825

Chindaliyev Askhat Erbosynovich, Master of Agricultural Sciences, Senior Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; achindaliyev@rambler.ru; https://orcid.org/0000-0002-2468-3809

Dalibayev Ermek Kurmanbaevich, Senior Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; erdal62@mail.ru; https://orcid.org/0000-0002-2712-7445

Zhamalov Bakbergen Seydakhanuly, Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; bakbergen.zhamalov@mail.ru

Muka Shynar Bakytkyzy, Master of Biological Sciences, Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; chika-1718@mail.ru

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