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THE QUALITY OF MILK DURING ITS SEPARATION AND OIL PRODUCTION

ANNOTATION

The article presents the technological properties of milk during its separation and production of butter. For the study under farm conditions, five groups of animals of 12 heads each were formed from among first-calf cows on the principle of analogue groups, taking into account origin, live weight, and physiological state. in each: I – black-and-white (purebred); II – Holsteins of German selection (purebred); III – Holsteins of Dutch selection (purebred); IV – ½ Holstein of German selection × ½ black-and-white; V – ½ Holstein of Dutch selection × ½ black-and-white. The data obtained indicate that the milk of crossbred first-calf heifers of groups IV and V was distinguished by a higher mass fraction of fat. First-calf heifers of the black-and-white breed of group I were inferior to them in terms of fat content in milk. The data obtained and their analysis indicate the absence of any significant intergroup differences in the weight of cream and skim milk obtained from 10 kg of milk. The data obtained indicate that crosses of groups IV and V were distinguished by more efficient use of milk fat in the production of cream. The influence of genotype on the mass fraction of oil components was also noted. At the same time, the leading position of crossbred first-calf heifers of groups IV and V in terms of the mass fraction of fat, protein and SNF was noted. They were superior to their purebred peers of the black-and-white breed of group I and Holsteins of groups II and III in terms of fat content in cream. There was a tendency to increase the value of SNF in skim milk of crossbred heifers of groups IV and V. A comprehensive assessment of the results of butter production from cream obtained from first-calf cows of experimental groups indicates the influence of the genotype on both its quality and the physicochemical parameters of butter and buttermilk. At the same time, in terms of the mass of the resulting oil, the leading positions were occupied by Holstein crosses of groups IV and V. In terms of the value of the analyzed indicator, they were superior to purebred peers of the Black-and-White and Holstein breeds of groups I-III.

Key words: *milk, butter, cattle breeding, first-calf heifers, black-and-white breed, Holsteins of German and Dutch selection*

Introduction. The nutritional properties of milk depend on its chemical composition and the high digestibility of all organic substances (95-98%). Milk contains more than 200 chemically complex components, most of which are not found in nature in any product [1-9].

The composition and quality of milk are crucial in the production of products for further processing. The composition of milk varies greatly depending on the growing and feeding conditions, herd management strategy, lactation period and season.

Butter is a product made from cow's milk with a fat content of 50 to 85%. The size of the fat grains affects the cooking time of the cream when cooking the butter. As the concentration of fat granules increases, their diameter increases, so fat granules form faster. One of the main factors in obtaining butter is the fat content of milk [10].

The main indicators of the technological properties of milk as a raw material for buttermaking include the number of fat balls in 1 ml of milk and their average diameter. The size of the fat balls has

a significant effect on the process of oil formation and on the degree of use of fat during churning. Studies have shown that the number of small fat globules increases with an increase in blood pressure along the holsteins, while the number of large ones decreases. Thus, the largest diameter of fat globules (3.20 microns) is observed in the milk of purebred Simmental animals. This indicator is significantly (P>0.95) higher than that of purebred Holsteins by 0.50 microns. The obtained results of the evaluation of the physico-chemical and technological properties of cow milk of different genotypes allow us to conclude that the milk of cows of all studied groups is suitable for the production of good quality butter and high-quality cheese. Research shows that there are differences in the technological properties of milk depending on the genotype of the individual, which determine the biological value and properties of the produced oil. The milk of purebred cows had higher properties. In the process of producing butter from the milk of Holstein x Simmental cows, more fat was transferred into butter compared to Simmental cows. In skim milk of purebred animals, a higher mass fraction of protein was recorded in comparison with crossbred animals. In the process of separating milk from cows, which, when compared with the process of separating milk from crossbred cows, more fat passed into cream. During the production of butter, a similar pattern was observed in the degree of use of milk fat and its separation in the milk of cows of different genotypes, as in the process of producing cream. In the skim milk of the studied individuals, the mass fraction of protein in cows was noted to be greater than in crossbreds. A similar pattern was noted when studying the mass of cottage cheese obtained from 10 kg of milk. During the organoleptic assessment, it was established that in all respects the low-fat cottage cheese met the required parameters: consistency (soft, homogeneous, crumbly), taste and smell, color (uniform, white) [11-20].

Materials and methods. For the study under farm conditions, five groups of animals of 12 heads each were formed from among first-calf cows on the principle of analogue groups, taking into account origin, live weight, and physiological state. in each: I – black-and-white (purebred); II – Holsteins of German selection (purebred); III – Holsteins of Dutch selection (purebred); IV – ½ Holstein of German selection × ½ black-and-white; V – ½ Holstein of Dutch selection × ½ black-and-white. For the production of dairy products, precast milk was used, selected from 5 cows from each group, located at 5 months. lactation. The production of dairy products was carried out in the laboratory. Oil production was carried out by the method of periodic churning of cream according to the technological instructions for the production of butter. The mass fraction of cream fat is 40-42%, pasteurization is instant, cooling and maturation of cream within 8 hours. In cream and butter, organoleptic properties were determined by the method of F.A.Vyshemirsky (2000), the mass fraction of fat – according to GOST 5867, acidity – according to GOST 3624, moisture - according to GOST 3626, organoleptic parameters – according to GOST 28283.

Research results. In a comprehensive assessment of the technological properties of milk in the production of butter, not only the number and size of fat balls are evaluated, but also the composition of milk fractions obtained as a result of its separation, in particular, cream, is taken into account.

It is known that the technological features and quality of cream and butter are largely determined by the amount of raw materials (milk). The data obtained indicate that the milk of first-calf crossbreeds of groups IV and V was characterized by a higher mass fraction of fat. The first-calf cows of the black-and-white breed of group I were inferior to them in terms of fat content in milk by 0.04% and 0.06%, respectively, holsteins of the German selection of group II – by 0.14% and 0.16%, holsteins of the Dutch selection of group III – by 0.07% and 0.09% (Table 1).

Table 1 – Cream production results (X±Sx)

Indicator	Group				
	I	II	III	IV	V
1	2	3	4	5	6
Physico-chemical parameters of cream					
Mass fraction of fat, %	39,90±0,37	39,30±0,43	39,60±0,43	41,50±0,21	41,60±0,14
Mass fraction of protein,%	2,57±0,01	2,54±0,02	2,55±0,03	2,59±0,01	2,60±0,01
dry skimmed milk residue,	5,83±0,06	5,79±0,15	5,82±0,12	5,85±0,02	5,87±0,03

%					
1	2	3	4	5	6
Acidity, ^{0}T	15,82±0,12	15,73±0,11	15,80±0,07	15,90±0,07	15,93±0,02
Density, kg/m^3	978,67±1,08	977,00±0,71	978,33± 1,08	981,00±0,71	981,33±1,47
Physico-chemical parameters of skimmed milk					
Mass fraction of protein,%	3,18±0,01	3,17±0,01	3,18±0,01	3,19±0,01	3,19±0,01
dry skimmed milk residue, %	8,76±0,03	8,74±0,03	8,75±0,04	8,85±0,03	8,86±0,05
Acidity, ^{0}T	16,87±0,11	16,70±0,14	16,89±0,02	16,92±0,05	16,92±0,05
Density, kg/m^3	1032,60±0,28	1031,97±0,67	1032,40±0,62	1032,87± 0,57	1033,03± 0,39

It is known that cream is a multicomponent, heterogeneous system, similar to milk, but distinguished by a different ratio between the constituent phases-fat and plasma. This causes significant differences in the physico-chemical properties of milk and cream.

The influence of the genotype on the mass fraction of cream components was also noted. At the same time, the leading position of crossbred heifer cows of groups IV and V in terms of the mass fraction of fat, protein and SOMO was noted. They outperformed purebred peers of the black mottled breed of group I and Holsteins of groups II and III in terms of fat content in cream by 1.60-2.30%, protein – by 0.02-0.06, SOMO – by 0.02-0.08%. It is characteristic that the cream obtained from the milk of Holstein cows of German and Dutch breeding groups II and III differed in the minimum concentration of the main components. When monitoring the acidity and density of cream, no significant intergroup differences were found. We came to a similar conclusion when evaluating the physico-chemical parameters of skimmed milk. At the same time, there was a tendency for a higher value of the SOMO of skimmed milk from crossbred cows of the first heifers of groups IV and V (Table 2). A comprehensive assessment of the results of the production of butter from cream obtained from the milk of the first–calf cows of the experimental groups indicates the influence of the genotype on both its quality and the physico-chemical parameters of butter and buttermilk.

At the same time, Holstein hybrids of groups IV and V occupied the leading position in terms of the mass of the oil obtained. They outperformed purebred peers of the black-and-White and Holstein breeds of groups I - III in terms of the analyzed index by 0.04-0.06 kg (9.30-14.63%).

Table 2 – Physico-chemical parameters of the oil

Indicator	Group				
	I	II	III	IV	V
Mass fraction of fat, %	81,60±0,07	81,40±0,28	81,53±0,11	81,93±0,52	82,03±0,59
Mass fraction of moisture, %	16,20±0,06	16,42±0,29	16,28±0,11	15,86±0,54	15,75±0,59
The acidity of the oil, ^{o}K	0,90±0,02	0,86±0,03	0,88±0,02	0,92±0,01	0,93±0,01

In turn, purebred first-born cows of the black-and-white breed of group I exceeded the purebred peers of the Holstein breed of German and Dutch breeding of groups II and III by 0.02 kg (4.88%) and 0.01 kg (2.38%), respectively, in terms of the mass of the produced oil. An important indicator characterizing the efficiency of oil production is the amount of milk spent on obtaining 1 kg of oil. The analysis of the data obtained indicates that Holstein hybrids of groups IV and V differed in the lowest milk costs for the production of 1 kg of butter. Thus, in the first-calf cows of the black-and-

white breed of group I, this indicator was higher than in the crossbreeds of groups IV and V, respectively, by 0.17 kg (0.81%) and 0.24 kg (1.15%), Holsteins of the German selection of group II – by 0.66 kg (3.16%) and 0.73 kg (3.51%), Holsteins of the Dutch breeding of group III – by 0.32 kg (1.53%) and 0.39 kg (1.87%). The established intergroup differences in the amount of milk consumed per 1 kg of butter are due to a higher mass fraction of fat in the milk of crossbred cows of the first heifers of groups IV and V. There were intergroup differences in the degree of use of cream fat. At the same time, cream obtained from the milk of Holstein cows of the German and Dutch breeding groups II and III differed in its greater value. Purebred animals of the black-and-white breed of group I were inferior to them in terms of the analyzed indicator by 0.28% and 0.19%, respectively, crossbreeds of group IV – by 0.69% and 0.60%, crossbreeds of group V – by 1.21% and 1.12%.

It is known that the nutritional value of milk, as well as its quality as a food product and raw materials for the production of dairy products, are largely determined by the mass fraction of protein. It should be borne in mind that its content in milk is significantly influenced by a complex of paratypical genotypic factors. When kept under similar technological conditions and the same feeding diet, the mass fraction of protein in the milk of lactating cows is determined solely by the animal genotype. This position has been confirmed in our studies, as evidenced by the results of monitoring the chemical composition of the milk of cows in the experimental groups. It should be borne in mind that the protein composition of cow's milk is represented by casein and whey proteins albumin and globulin. Moreover, casein is found only in milk proteins, albumin has certain differences in its structure and properties from serum albumins. In this case, casein and albumin are synthesized by the mammary gland of the lactating animal, whereas globulin is transformed from blood without significant changes. When evaluating the biotechnological properties of milk during its processing into dairy products, it should be borne in mind that they are dominated by the component of the protein casein. The analysis of the data obtained indicates that the leading position in terms of the mass fraction of casein was occupied by crossbreeds of groups IV and V (Table 33). purebred first-born cows of the black-and–white breed of group I were inferior to them in terms of the analyzed indicator by 0.06%, purebred animals of the Holstein breed of the German selection of group II - by 0.11%, Holsteins of the Dutch selection Group III – by 0.08%.

Thus, the minimum casein content in milk protein was distinguished by the first-calf cows of the Holstein breed of German and Dutch breeding of groups II and III. When analyzing the indicators characterizing the mass fraction of individual casein fractions, it was found that the crossbreeds of groups IV and V exceeded the alpha-casein content of purebred first-born cows of the black-and–white breed of group I by 0.03%, animals of the Holstein breed of the German selection of group II by 0.05%, Holsteins of the Dutch selection of group III by 0.03, and by the mass fraction of beta-casein, respectively, by 0.06%, 0.09% and 0.07%.

At the same time, crossbreeds of groups IV and V were inferior to purebred peers of groups I, II and III in terms of the mass fraction of γ-casein by 0.03%. It is known that high levels of albumins and globulins can have a negative effect on the quality of milk during its heat treatment.

The data obtained and their analysis indicate that the concentration of whey proteins in cow milk was dominated by crossbred cows of the first heifers of groups IV and V.

The technological properties of cow's milk in the production of dairy products are largely due to both the mass fraction of casein and the ratio of its individual fractions. Precipitation of γ –casein is carried out using rennet enzyme in the production of cottage cheese by the acid-rennet method and cheese. At the same time, γ –casein remains in the serum. In addition, the γ –casein fraction in casein micelles is the main barrier against calcium precipitation. This leads to a significant increase in the stability of proteins during technological operations of heat treatment of milk. The obtained data and their analysis indicate that the β-casein fraction was distinguished by the highest specific gravity in first-calf cows, the α-casein fraction was minimal, and the γ –casein fraction occupied an intermediate position. At the same time, the influence of the genotype of first-calf cows on the ratio of individual casein fractions was established (Table 34).

At the same time, the leading position of the crossbreeds of groups IV and V was noted in terms of the specific gravity of α-casein and β-casein, its minimum value was distinguished by purebred cows of the Holstein breed of German and Dutch breeding of groups II and III, purebred animals of the black-and-white breed of group I occupied an intermediate position. Suffice it to note that the crossbreeds of groups IV and V surpassed the purebred peers of the black-and-white breed of group I

in terms of α-casein content by 0.09% and 0.22%, respectively, β-casein by 1.11% and 1.17%, purebred first-born Holstein cows of the German breeding group by 0.42% and 0.45%, 1.17% and 1.23% of Dutch–bred holsteins - by 0.14% and 0.17%, 1.15% and 1.21%.

Thus, in terms of the mass of the oil actually obtained, the advantage was on the side of the crossbred cows-the first heifers of groups IV and V. They outperformed purebred peers of the black-and-White and Holstein breeds in terms of the analyzed index by 0.04-0.06 kg (9.52-15.00%). According to the consumption of cream per 1 kg of butter, the opposite rank of distribution of the first-calf cows of the experimental groups was noted. At the same time, the crossbreed cows of the first heifers of groups IV and V differed in the minimum cost of cream for obtaining 1 kg of oil. In purebred animals of the black-and-White and Holstein breeds of groups I and III, the value of the analyzed indicator was higher by 0.07 kg (3.52%) and 0.09-0.10 kg (4.52-5.02%), respectively. When analyzing the physico-chemical parameters of the oil, the leading position of cross-bred cows of the first heifers of groups IV and V in terms of the mass fraction of fat was established. Purebred heifer cows of the black-mottled and Holstein breeds of groups I - III were inferior to them in terms of the analyzed indicator by 0.33-0.63%. At the same time, purebred first-born cows of the black-and-white breed of group I surpassed purebred peers of the Holstein breed of German and Dutch breeding of groups II and III in terms of the mass fraction of fat in oil by 0.20% and 0.07%. It is known that the moisture content in different types of oil has different values. In our case, butter from milk of mixed cows of groups IV and V differed by a slightly lower mass fraction of moisture with a slightly higher acidity. In general, judging by the mass fraction of fat and moisture, butter from the milk of first-calf cows of all experimental groups met the requirements of GOST R 52253-2004. When analyzing the physico-chemical parameters of buttermilk, it was found that the buttermilk obtained during the production of butter from the milk of cross-bred cows of the first heifers of groups IV and V differed in the smallest mass fraction of fat. Purebred animals of the black-and-White and Holstein breeds of groups I and III exceeded them in terms of the analyzed index by 0.07-0.10% and 0.08-0.13%, respectively. Buttermilk obtained from the milk of purebred first-calf cows of the Holstein breed of groups II and III differed in the maximum fat content. Similar intergroup differences were observed in the mass fraction of protein in buttermilk and milk itself.

The tendency of lower acidity and density of buttermilk obtained in the production of butter from the milk of purebred Holstein cows of German and Dutch breeding groups II and III has been established. When evaluating the organoleptic properties of buttermilk obtained in the production of butter from the milk of first-calf cows of different genotypes, their compliance with the requirements was established. It was characterized by a white color and the presence of a protein precipitate without flakes, it had a milky smell. In a comprehensive assessment of oil quality, much attention is paid to determining the organoleptic characteristics of the product. In this case, the requirements of GOST R 52969-2008 "Butter. Technical specifications" (date of introduction 01.01.2010). The evaluation results were carried out in points on a 20-point scale by summation. The analysis of the data obtained indicates the influence of the genotype of first-calf cows on the organoleptic parameters of butter. The evaluation results were given in points on a 20-point scale by summation (Table 3). At the same time, the maximum complex score (without taking into account the evaluation of packaging and labeling) was distinguished by oil produced from the milk of crossbred first-calf cows of groups IV and V, purebred animals of the black-and-white breed of group I were inferior to them in terms of the analyzed indicator, respectively, by 0.6 points (3.80%) and 0.7 points (4.43%), German holsteins the selections of group II – by 1.4 points (9.33%) and 1.5 points (10.00%), the holsteins of the Dutch selection of group III – by 0.7 points (4.46%) and 0.8 points (5.10%).

Table 3 – Organoleptic evaluation of butter, score

Indicator	Group				
	I	II	III	IV	V
Taste and smell (10)	9,1	8,4	9,0	9,6	9,7
Consistency and appearance (5)	4,7	4,6	4,7	4,8	4,8
Colour (2)	2,0	2,0	2,0	2,0	2,0
Packaging and labeling (3)	-	-	-	-	-

Total (20)	15,8	15,0	15,7	16,4	16,5

In turn, purebred first-born cows of the black-and-white breed of group I surpassed the purebred animals of the Holstein breed of German and Dutch breeding of groups II and III by 0.8 points (5.33%) and 0.1 points (0.64%), respectively, in terms of the complex score obtained during the organoleptic evaluation of the oil. At the same time, a sensory assessment of the oil obtained from the milk of first-calf cows of all genotypes ind icates that all samples were characterized by a homogeneous, dense, plastic consistency, characterized by a shiny surface on the cut. All of them had a well-defined creamy taste and smell. There were no extraneous tastes and odors. There were no intergroup differences in oil color. It was light yellow and homogeneous throughout the mass.

Discussion. The analysis of the data obtained by us indicates that the crossing of black-and-white cattle with holsteins of foreign breeding had a positive effect not only on the level of milk productivity of the crossbreeds, but also on the quality of milk productivity, as evidenced by its physico-chemical indicators. At the same time, first-calf crossbred cows surpassed in mass fraction of dry matter, SOMO, fat, lactose protein and macronutrient content not only purebred peers of the black-and-white breed, but also purebred Holsteins of German and Dutch breeding.

Thus, there is a manifestation of heterosis on the face in terms of the physico-chemical parameters of milk in crossbred first-calf cows. The effect of animal genotype on the quality and physico-chemical parameters of butter and buttermilk has been established. At the same time, the superiority of Holstein crossbreeds of groups IV and V was noted in terms of the mass of the resulting oil, the mass fraction of fat in it, SOMO and density. In addition, the crossbreeds of groups IV and V differed in the smaller amount of milk and cream spent on obtaining 1 kg of butter. According to the degree of use of cream fat in the production of butter, the leading position was occupied by purebred holsteins of German and Dutch breeding of groups II and III.

Conclusion. Thus, the assessment of the quality of milk, cream and butter indicates a positive effect of crossing black-and-white cattle with holsteins on the quality indicators of products. At the same time, a sensory assessment of the oil obtained from the milk of first-calf cows of all genotypes indicates that all samples were characterized by a homogeneous, dense, plastic consistency, characterized by a shiny surface on the cut. All of them had a well-defined creamy taste and smell. No foreign tastes or odors were noted. There were no intergroup differences in oil color. It was light yellow and uniform throughout the mass.

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ТҮЙІН

Мақалада сүтті бөлу және сары майды өндіру кезіндегі технологиялық қасиеттері берілген. Шаруашылық жағдайында зерттеу үшін сиырлардың тірі салмағын және физиологиялық жағдайын ескере отырып, аналогтық топ принципі бойынша әрқайсысы 12 бастан малдың бес тобы құрылды. Әрқайсысында: I – ақ-қара (таза тұқымды); II – неміс селекциясының голштиндері (таза тұқымды); III – Голланд селекциясының голштиндері (таза тұқымды); IV – ½ неміс селекциясының голштині × ½ ақ-қара; V – Голланд таңдауының ½ голштині × ½ ақ-қара. Алынған мәліметтер IV және V топтағы будандастырылған бірінші бұзаулардың сүті майдың жоғары массалық үлесімен ерекшеленетінін көрсетеді. I топтағы қара-ақ тұқымды бірінші бұзаулар сүттегі майлылығы жағынан олардан төмен болды. Алынған мәліметтер мен олардың талдауы 10 кг сүттен алынған кілегей мен майсыздандырылған сүттің

салмағында топаралық айтарлықтай айырмашылықтардың жоқтығын көрсетеді. Алынған мәліметтер IV және V топтардың кілегей өндірісінде сүт майын тиімдірек пайдаланумен ерекшеленетінін көрсетеді. Генотиптің компоненттерінің массалық үлесіне әсері де атап өтілді. Бұл ретте IV және V топтағы будандастырылған бірінші бұзаулардың майдың, ақуыздың және ҚМСҚ массалық үлесі бойынша жетекші орны атап өтілді. Олар кілегейдегі майлылығы жағынан I топтағы ақ-қара тұқымды және II және III топтағы голштиндер тұқымдас құрдастарынан жоғары болды. IV және V топтағы будандастырылған құнажындардың майсыздандырылған сүтіндегі ҚМСҚ құндылығын арттыру тенденциясы байқалды. Тәжірибе топтарының бірінші бұзау сиырларынан алынған кілегейден сары май өндіру нәтижелерін кешенді бағалау генотиптің оның сапасына да, сары май мен сары майдың физикалық-химиялық көрсеткіштеріне де әсерін көрсетеді. Сонымен бірге алынған мұнайдың массасы бойынша жетекші орындарды IV және V топтағы голштейн кресттері иеленді. Талданатын көрсеткіштің мәні бойынша олар I-III топтағы қара-ақ және голштейн тұқымдарының таза тұқымдас құрдастарынан жоғары болды.

РЕЗЮМЕ

В статье представлены технологические свойства молока при его сепарации и получении масла. Для исследования в условиях хозяйства из числа коров-первотёлок по принципу групп-аналогов с учётом происхождения, живой массы, физиологического состояния были сформированы пять групп животных по 12 гол. в каждой: I – чёрно-пёстрая (чистопородные); II – голштины немецкой селекции (чистопородные); III – голштины голландской селекции(чистопородные); IV – ½ голштин немецкой селекции × ½ чёрно-пёстрая; V – ½ голштин голландской селекции × ½ чёрно-пёстрая. Полученные данные свидетельствуют о том, что молоко помесных первотелок IV и V групп отличалось большей массовой долей жира. Первотелки черно-пестрой породы I группы уступали им по содержанию жира в молоке. Полученные данные и их анализ свидетельствуют об отсутствии каких-либо существенных межгрупповых различий по массе сливок и обезжиренного молока, полученных из 10 кг молока. Полученные данные свидетельствуют, что помеси IV и V групп отличались более эффективным использованием жира молока при получении сливок. Также было отмечено влияние генотипа на массовую долю компонентов масла. В то же время было отмечено лидирующее положение помесных первотелок IV и V групп по массовой доле жира, белка и СОМО. Они превосходили чистокровных сверстников черно-пестрой породы I группы и голштинов II и III групп по содержанию жира в сливках. Наблюдалась тенденция к увеличению значения СОМО в обезжиренном молоке помесных первотелок IV и V групп. Комплексная оценка результатов производства сливочного масла из сливок, полученных от коров-первотелок опытных групп, свидетельствует о влиянии генотипа как на его качество, так и на физико-химические показатели сливочного масла и пахты. При этом по массе получаемого масла лидирующие позиции занимали голштинские помеси IV и V групп. По величине анализируемого показателя они превосходили чистопородных сверстников черно-пестрой и голштинской пород I-III групп.

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ANALYSIS OF THE DEVELOPMENT STATUS OF ORGANIC ANIMAL HUSBANDRY IN KAZAKHSTAN

ANNOTATION

This paper conducts a systematic review of academic literature and information on organic agriculture, organic animal husbandry, and farmers' willingness and behavior in organic agriculture. Based on this review, the paper establishes a research framework using the theory of planned behavior. The paper then analyzes the advantages and conditions of developing organic animal husbandry in Kazakhstan and conducts a questionnaire survey of beef cattle farmers in the country. A total of 410 questionnaires were collected, and using statistical and survey data, the paper systematically analyzes the current production status of organic animal husbandry in Kazakhstan. The paper also employs structural equation model, probit, and ordered probit model to analyze the factors that affect Kazakh beef cattle farmers' willingness and behavior to engage in organic production. The paper selects three representative beef cattle production cases and further analyzes the willingness and behavior of Kazakh farmers to engage in organic animal husbandry production. Finally, the paper proposes countermeasures and suggestions to improve Kazakh farmers' willingness and behavior in engaging in organic animal husbandry production.

This study found that the organic animal husbandry industry in Kazakhstan is still in its infancy, and entrepreneurs engaged in this industry face many challenges and obstacles, such as infrastructure, technology, marketing, logistics, and legal barriers.

In Kazakhstan, organic agriculture began to develop in the early 2000s, with significant milestones including the formulation of the "Organic Production Law" in 2015 and the adoption of national organic production standards in 2017.

Kazakhstan’s geographical and climatic conditions are highly conducive to organic animal husbandry. The country’s extensive pastures and suitable climate provide an ideal environment for raising organic beef cattle. Furthermore, Kazakhstan’s government has shown support for organic agriculture through legislation and international cooperation.

Key words: *Beef cattle breeding; Organic animal husbandry; Production willingness; Production behavior; Kazakhstan.*

Introduction. Kazakhstan's favorable geographical location and climate, abundant pasture and feed land resources, and suitable land for growing feed provide unique conditions for the development of organic animal husbandry. Beef, a traditional meat product in Kazakhstan, offers certain advantages and development space for the organic animal husbandry industry.

Organic agriculture has emerged as a global trend, driven by increasing consumer demand for sustainably produced food and a growing awareness of environmental issues. Kazakhstan, with its expansive grasslands, favorable climate, and significant pastoral resources, has unique potential for the development of organic animal husbandry. However, despite recognition from both the government and enterprises of the importance and opportunities presented by organic agriculture, the sector remains underdeveloped. This paper explores the current state of organic animal husbandry in Kazakhstan, particularly focusing on the beef cattle industry, and provides a detailed analysis of factors influencing farmers' willingness to engage in organic practices.

Organic agriculture has become a global trend in agricultural development, with rapidly growing demand for organic products in international markets. In the context of global low-carbon development, promoting the development of organic agriculture is urgent. In Kazakhstan, organic agriculture began developing in the early 2000s, and both the government and enterprises have recognized the unprecedented opportunities and broad prospects for its growth.

Despite these challenges, the industry has many incomparable advantages, such as low market competition, huge market potential, and improved livestock breeding and land conditions. By conducting a quantitative analysis of the factors influencing the willingness of beef cattle farmers to engage in organic livestock production in Kazakhstan, this study found that farmers' behavioral attitudes, subjective norms, and perceived behavioral control have a significant positive impact on their willingness to engage in organic livestock production. Analysis of the factors influencing the organic production behavior of beef cattle farmers in Kazakhstan indicates that organic production behavior has not been widely adopted, and improving farmers' willingness and perceived behavior control can significantly promote organic production behavior.

Based on the above research conclusions, this thesis proposes countermeasures and suggestions such as increasing government publicity and support, increasing subsidies, and stimulating farmers' enthusiasm for organic production, with a view to promoting the rapid and healthy development of organic animal husbandry in Kazakhstan, and also hopes to provide some theoretical and empirical reference for the development of organic agriculture in the world.

However, when considering the reality of organic animal husbandry development in Kazakhstan, although local government and enterprises recognize the future trend of organic animal husbandry and actively promote its growth, farmers' willingness and behavior to engage in organic animal husbandry production are weak. This has resulted in stagnation of organic animal husbandry development in Kazakhstan. Therefore, taking the beef cattle industry in Kazakhstan as an example, this paper analyzes the influencing factors of farmers' willingness and behavior to engage in organic animal husbandry production based on field survey data. The paper then explores countermeasures to promote organic animal husbandry production behavior in Kazakhstan, thereby promoting the rapid development of organic animal husbandry in Kazakhstan. These findings will provide support for the government to formulate policies and serve as a theoretical and practical reference for global organic animal husbandry development. The research has strong theoretical and practical significance.

Research Framework and Methodology. This thesis mainly uses methods such as questionnaire surveys, interviews, and quantitative analysis to conduct research.

（1）Questionnaire survey method

During the research process, a questionnaire survey was conducted among beef cattle farmers in Kazakhstan to obtain relevant data on their willingness and behavior to engage in organic production. The survey aimed to grasp the current situation of Kazakh farmers' willingness and behavior to engage in organic production and provide empirical data for the quantitative analysis of factors affecting the willingness and behavior of Kazakh beef cattle farmers to engage in organic production.

（2）Interview method

This thesis will conduct in-depth interviews with officials from relevant government departments and beef cattle farmers in Kazakhstan. The interviews will explore the bottlenecks in promoting the development of organic animal husbandry, the deep-seated reasons why farmers are unwilling to engage in organic production, and the reasons why they desire to engage in organic production but have not converted this into practical behavior. The interview data will be summarized and analyzed to draw corresponding conclusions and provide data support for the policy recommendations proposed in this thesis.

（3）Quantitative analysis method

This thesis will use quantitative analysis methods to quantitatively analyze the key influencing factors of the organic production willingness and behavior of beef cattle farmers in Kazakhstan. Based on the survey data, structural equation model (SEM), probit models, and ordered probit models will be constructed to analyze the influencing factors and draw research conclusions.

（4）Case analysis method

To confirm the conclusions obtained from the quantitative analysis, this thesis will use the case analysis method to select three representative animal husbandry farms that have not undergone organic production, are undergoing organic production conversion, and have already undergone organic production. By comparing the benefits of these three different types of farms and the impact of organic production on the environment, economy, and other aspects, this thesis will reach a conclusion.

Results and their discussion. Organic agriculture in Kazakhstan has been taking shape in early 2000, and the growth of this economic sector was also driven by entrepreneurs who recognized the new opportunities and broad prospects for introducing organic agriculture (Baytaeva and Dyrka, 2019; Morkovkin, Hutarava, Ogloblina, Gibadullin, and Kharchenko, 2020). In Kazakhstan, the first producers to obtain organic certification were large agricultural export companies, which independently sought new markets and opportunities to obtain increase the value of their products. These companies promote their products on international exhibition and trade platforms, where they meet the demand for organic products in the global market and increase interest in the industry in the international market. Some companies seek guidance from international consultants, while others invest in training their overseas employees. After acquiring the necessary knowledge and expertise,

they will turn to a certification body to begin the certification process. In the following years, international organizations and professionals played an important role in the development of organic agriculture in the country.

In 2010, Kazakhstan hosted the Third International Conference on Organic Sector Development in Central Asia in Astana. This is an important milestone for Kazakhstan and the wider Central Asian region. The event brought together policymakers, scientists, and practitioners from different countries to explore the challenges and opportunities of organic agriculture in the region (Pilobang, 2016). In 2014, with the support of the Kazakhstan Organic Agriculture Movement Federation (KAZFOAM), the Republic of Kazakhstan launched the formulation of the "Organic Production Law". This process has also received support from international organizations, such as the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme Office in Kazakhstan, and the German Kazakhstan Agricultural Political Dialogue Organization (Baytaeva and Dyrka, 2019; Morkovkin et al., 2020). The Organic Production Law passed in 2015 marks an important step forward in the development of organic agriculture in Kazakhstan. The adoption of this law has promoted the development of regulatory frameworks, road maps, and pilot plans, thereby creating important opportunities for the introduction of organic agriculture and creating conditions for expanding organic production on a larger scale of organic production.

In 2017, Kazakhstan adopted organic production standards, allowing producers to certify their products in accordance with national organic standards. These standards set benchmarks for organic production and contribute to the development of the organic industry in Kazakhstan (Dabiltayeva and Rakhymzhan, 2019; Samenbetova and Patlasov, 2022a). By 2020, Kazakhstan had 279 producers of ecological products, exporting goods worth approximately 9 million euros, including wheat, soybeans, seeds, and oilseed cakes (Bulkhairova and Alieva, 2021). The legislative framework of producing countries is crucial for promoting organic agriculture. Karabasov, Piaget, and Besayeva (2022) reported that in 2019, 103 countries had developed and adopted relevant documents, while other countries were preparing to ratify them. Although Kazakhstan passed the Organic Agriculture Law a few years ago, its implementation is still ongoing, and there are still some challenges, such as underdeveloped infrastructure affecting the efficient operation of the organic market, high cost of ecological product certification, and reliance on international experts and certification bodies (Dabiltayeva and Rakhymzhan, 2019). Nevertheless, the Government of Kazakhstan has laid the legal foundation for organic agriculture in the country by adopting the "Kazakhstan 2050" strategy (2012), the concept of transition to a "green economy" (Linn, 2014), and the Organic Product Production Law of the Republic of Kazakhstan (2015) (Oscar, 2021). Therefore, Kazakhstan is entering the era of organic agriculture, and actively cooperating with international organizations to promote environmentally friendly products will help attract more funds into the country's economy. However, consumer demand for ecological products is the most critical factor in expanding the global and domestic organic product market (Nasiyev, Vassilina, Zhylkybay, Shibaikin, and Salykova, 2021). Table 1-2 shows the development level of organic crop production in Kazakhstan (Weiler et al., 2021), reaching the maximum amount of organic land in 2015, but reducing the area by about two-thirds in subsequent years (as shown in Table 1).

Table 1 – Organic agricultural area and growth rate in Kazakhstan from 2009 to 2020

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Area (1000Ha)	134,9	133,6	196,2	291,2	291,2	291,2	303,4	303,4	277,1	192,1	294,3	114,9
Increase compared to 2009 (%)	100	99	145	216	216	216	225	225	205	142	218	85

The total organic crop yields in the regions of Akmola and North Kazakhstan from 2019 to 2022 are shown in Table 2. It should be noted that the data in the table are limited to these two

regions, as the statistics do not include the Kostanay region. However, recent research has shown that Kostanay has approximately 30 organic product producers, who are also major exporters.

Table 2 – Total Organic Crop Production in Kazakhstan from 2019 to 2022 (Unit: thousand tons)

Region	Cereals (including rice and beans)			Wheat			Beans and vegetables			Oil crops		
	2020	2021	2022	2020	2021	2022	2020	2021	2022	2020	2021	2022
The Republic of Kazakhstan	165,7	135,2	141,4	131,9	109,3	120,2	0,084	0,07	0,075	0,56	0,52	0,59
Akmora Region	9,8	7,5	8,7	10,2	8,3	9,7	0,076	0,09	0,08	0,6	0,71	0,75
north kazakhstan	139,1	112,7	149,6	112,2	95,3	117,2	0,31	0,23	0,3	0,12	0,1	0,13
Organic plant yield	0,92	0,75	0,78	1,1	0,93	1,02	-	-	-	-	-	-

From the perspective of growth rate, current area, and output, there has been good development in organic agriculture in Kazakhstan. Thanks to the strong promotion by the government, Kazakhstan is ranked 49th globally in organic agriculture. Australia and Argentina are among the top countries in the world for organic agriculture, with up to 80% of organic land used for environmentally friendly animal husbandry. This presents great opportunities for the development of organic agriculture in Kazakhstan, which has vast pastures and grasslands. However, despite most farmers intending to or already actively engaging in organic production, factors such as the complexity of organic certification, lack of experience, and underdeveloped organic market present significant obstacles to the development of organic animal husbandry in Kazakhstan. Therefore, in the context of vigorously promoting organic agriculture globally, developing organic animal husbandry in Kazakhstan poses both opportunities and challenges (Kostrova, Martynushkin, and Sattarova, 2020). Addressing the key issue of enabling farmers to practice organic production, and producing high-quality, green, and healthy organic animal products is urgent.

Based on the above review of relevant literature, domestic and foreign scholars have accumulated a large number of achievements in research on the factors that affect farmers' adoption of organic agriculture, the direction and motivation of farmers' organic agriculture, and countermeasures to promote the development of organic agriculture, providing a rich research perspective and theoretical reference for this article's research on organic agriculture. However, in the context of organic agriculture research in Kazakhstan, the existing research needs to be further studied in the following aspects.

First, research on organic agriculture based on the perspective of Kazakhstan is insufficient. The development of organic agriculture in various countries around the world contributes to international trade and environmental protection, but existing research has paid insufficient attention to Kazakhstan. Kazakhstan has natural advantages in developing organic agriculture, especially organic animal husbandry. However, in recent years, the development of organic agriculture in Kazakhstan is in its infancy, with fewer farmers engaged in organic agriculture, and the willingness of traditional farmers to transform to organic farmers is low.

Secondly, it ignores the practice of farmers' willingness to shift to organic production behavior in organic agriculture. Existing research has emphasized the importance of understanding factors such as economic incentives and environmental pressures that affect farmers' decision to adopt organic agriculture. It has been proposed that developing consumer awareness plans, training, agricultural associations, and financial subsidies can all play an important role in promoting sustainable agriculture. These research findings can provide support and reference for policies and decision-making to promote the long-term sustainability of organic agriculture and improve farmers' adaptability to environmental and socio-economic challenges. However, little attention has been paid to the influencing factors of farmers' willingness to engage in organic production, especially the driving factors of farmers' conversion to organic production behavior, as well as the specific practice of how their willingness is converted into organic behavior. Therefore, the lack of effective incentives to enable farmers to convert their willingness to organic production into actual organic production behavior hinders the application of theory into specific practice.

In general, with the high market demand and value of organic agricultural products, as well as the increasing demand for safe and healthy food, organic agriculture will have broad development space. However, existing research specifically targeting the development of organic animal husbandry in Kazakhstan has not yet been seen, and there is a lack of research on specific production practices that promote the conversion of farmers' willingness to organic production into organic behavior.

Additionally, while the current academic community has conducted relevant research and analysis on the factors that affect farmers' willingness to engage in organic production, it has ignored the process of transforming organic production willingness into actual behavior. In fact, many farmers, although they have the willingness to organic production, have not converted into practical actions. Hence, this thesis incorporates farmers' willingness and behavior towards organic production into the same analytical framework, using relevant theories. Moreover, this thesis seeks to explore the factors that drive farmers to transform their willingness into practical actions towards organic production.

Finally, in terms of research methods, based on the theory of planned behavior, this paper uses the econometric economic model to conduct quantitative analysis on the influencing factors of the organic production willingness and behavior of Kazakh beef cattle farmers, in order to identify the key factors affecting the organic production willingness and behavior of Kazakh beef cattle farmers. At the same time, using case analysis method, three typical beef cattle farming farms were selected, namely traditional farming, conversion from traditional farming to organic farming, and organic farming, to compare and analyze, in order to summarize the key factors for the conversion of beef cattle farmers from traditional farming to organic farming. The method of combining quantitative analysis with case analysis is also an innovation of this thesis.

Kazakhstan is located in central Asia, bordering Russia to the north, Uzbekistan, Turkmenistan, and Kyrgyzstan to the south, the Caspian Sea to the west, and China to the east. Kazakhstan is the largest landlocked country in the world, accounting for approximately 2% of the Earth's land surface area. Its territory spans Asia and Europe, with the Ural River as the continental boundary. The total length of its border line exceeds 10,500 kilometers. Kazakhstan has a complex terrain, mainly composed of plains and lowlands, with a temperate continental climate and abundant oil and mineral resources. Kazakhstan has 14 prefectures and 3 municipalities, with a total population of 19,765,004, including 12,208,200 urban residents and 7,556,700 rural residents. In 2021, Kazakhstan's GDP was 197.11 billion US dollars, with a growth rate of 3.20%. The per capita GDP was 11,298.36 US dollars, lower than the international average of 12,517 US dollars.

Agriculture is an important foundation of the national economy. Although Kazakhstan's agricultural output value only accounts for 4.4% of GDP, it is of great significance for the stable operation of the economy, the stable development of foreign trade, and the daily life of the people. In 2021, Kazakhstan possessed 11.8 hectares of agricultural and animal husbandry land per capita, making it one of the countries with the largest per capita agricultural and animal husbandry land in the world. United Nations personnel once predicted that if Kazakhstan used their land well, it could feed 1 billion people. Regardless of whether this assertion is true ot false, it reflects the enormous potential of Kazakhstan's agricultural development. The main crops in Kazakhstan include wheat, corn, barley, oats, rye, etc., and the main livestock products include cattle, sheep, horses, pigs, etc., which making Kazakhstan a major food country in the world. The history of agricultural development in Kazakhstan can be divided into three stages: the transition period before independence, the transition period after independence, and the period since the 21st century. Before independence, thanks to the strong support of the Soviet government, Kazakhstan's agriculture developed into a prosperous scene, with the labor force engaged in agricultural production accounting for 52% of the total labor force in the region. Data such as food production and livestock inventory are relatively considerable. However, at this stage, there are also problems of excessive reliance on financial support and planned economy, laying hidden dangers for agricultural development. In the transformation period after independence, due to the collapse of the Soviet Union and the shrinking market in surrounding areas, agricultural production in Kazakhstan experienced a significant decline. In addition, due to frequent natural disasters, inadequate reform, and insufficient government attention, Kazakhstan's agriculture entered a recession period. Since the 21st century, thanks to the vigorous development of the oil industry, Kazakhstan's economy has passed a trough period, with gradually increasing investment in agriculture, and agricultural production gradually recovering. In 2003, the Kazakh government promulgated the National Agricultural Food Plan (AFP) to increase agricultural investment, promote the development

of agricultural business organizations, stimulate agricultural trade, and promote the recovery and development of the agricultural economy.

Favorable geographical location and suitable climate and other natural resources are the main advantages of Kazakhstan in developing organic animal husbandry (D. Zhang and Sun, 2022). From geographical perspective, Kazakhstan is located in a strategic location on the Eurasian continent, which is an important link connecting Europe and Asia. Kazakhstan has a huge transit potential, shares a common border with China, and has a huge market capacity, making it an ideal location for organic agriculture (Kazanbayeva, 2018; Kurmanova, 2022; Shukurov and Shukurova, 2019).

Most regions of Kazakhstan have a temperate continental climate, with cold winters and hot summers. The annual temperature ranges are large. Despite severe climatic conditions, Kazakhstan has a large number of pasture lands, feed land resources, and land suitable for growing feed crops (Baimuratov, Bastaubayeva, Arslan, and Yeraliyeva, 2021). It is worth noting that compared to foreign countries, Kazakhstan's agriculture uses an average of 6-15 kilograms of fertilizer per hectare, while foreign countries use 90-100 kilograms of this data (Batyrbek, Abbas, Fan and Han, 2022), which also shows that almost all of Kazakhstan's land is suitable for mechanized agriculture.

Geographical location and climatic conditions play a crucial role in the species, species composition, food, water availability, and pasture access of livestock (Vlasenko, Rybashlykova &Turko, 2022). Although most areas of Kazakhstan are arid and semi-arid grasslands, with low rainfall, cold winters, and hot summers, the mountains in the east and southeast of the country provide good climatic conditions for agriculture (Agriculture, 2022; Bolatova and Engindeniz, 2021) (Fig. 3-1). The southern and south-eastern regions of the country have the highest proportion of livestock raised on rangelands, while the northern regions have the largest number of pigs (Schettino et al., 2021).

Natural conditions in Kazakhstan also affect the distribution of livestock and cattle, particularly in the form of ownership by different agricultural producers (Kvartiuk and Petrick, 2021). Due to the advantageous agricultural conditions in the southern and northern regions, cattle are more concentrated in individual, with the northern region characterized by rain farming being more prominent due to its potential for industrial and intensive cattle farming (Hankerson et al., 2019).

The country has 186 million hectares of pasture, accounting for 84.1% of all farmland in Kazakhstan, and currently only 58 million hectares have been utilized. The 3.8 million rural sound population includes 1.6 million agricultural employed people. In addition, Kazakhstan is relatively close to the main market and development feed base, which total annual import volume of beyonds 3 million tons. The area of irrigated land is expected to increase to 2 million hectares by 2022 and 3 million hectares by 2030. Kazakhstan will stand in a unique position to become a major player in the global organic agricultural market, especially in the organic livestock industry (Sembayeva, Mussina, Kazbek, Dosmaganbetov, and Xenarios, 2023).

Meat and meat products are traditional foods for the majority of the population of Kazakhstan. The country's demand for beef is currently fully met by domestic production, with beef exports ten times higher than imports. Kazakhstan is self-sufficient in beef and mutton, and various factors affect meat consumption levels, including per capita monetary income, seasonality, religious views, lifestyle, natural and climatic conditions (Kazanbayeva, 2018; Kurmanova, 2022; Shukurov and Shukurova, 2019).

In summary, Kazakhstan's natural resources, including its advantageous geographical location, climatic conditions, and other factors, provide unique competitive advantages for organic agriculture. Climate conditions largely determine the distribution of livestock among different forms of ownership and agricultural producers. The conditions conducive to the development of animal husbandry in Kazakhstan have led to a greater concentration of cattle on individual and in industrialized and intensively fattened areas in certain regions. Although the climate conditions in most regions are quite harsh, Kazakhstan not only possesses a large amount of pasture and feed resources, but also has a much lower use of fertilizer and production costs. It is also located in a strategic geographical location in Central Asia, with relatively developed trade and transportation. At the same time, traditional foods in Kazakhstan are domestic and meat products (Akhmetova et al., 2022). Its demand for beef is fully met by domestic production, and some surplus meat products are used for export, which means that Kazakhstan's organic livestock industry, especially beef cattle and livestock industry, has broad market demand.

Organic agriculture in Kazakhstan began to take shape in the early 2000s, and entrepreneurs recognized the opportunities and prospects of organic agriculture and introduced it into Kazakhstan. The history and main stages of the development of organic agriculture in Kazakhstan have been described in detail in many literature materials (Baytaeva and Dyrka, 2019; Morkovkin, Hutarava, Ogloblina, Gibadulin, and Kharchenko, 2020). Initially, the first batch of producers who obtain organic certification were large agricultural export companies that independently sought new markets and opportunities to obtain excess value. These companies share their products on international exhibition and trading platforms, meeting the demand for organic products in the global market through foreign trade, which has increased the interest of entrepreneurs in the industry. Many enterprises acquire the necessary knowledge through seeking guidance from international consultants, overseas investment and training of employees, then complete organic certification and enter the organic agriculture industry. In the following years, international organizations and projects played an important role in the development of organic agriculture in Kazakhstan.

In 2010, Astana, Kazakhstan, hosted the Third International Conference on Organic Sector Development in Central Asia. This is an important milestone for Kazakhstan and the entire Central Asian region. The event brought together policymakers, scientists, and practitioners from various countries to discuss the challenges and opportunities of organic agriculture in the region (Pierobon, 2016). In 2014, with the assistance of the Kazakhstan Organic Agriculture Movement Federation (KAZFOAM), the formulation of the Organic Production Law of the Republic of Kazakhstan was initiated. This has been supported by institutions such as the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme Office in Kazakhstan, and the German Kazakhstan Land Political Dialogue (Baytaeva&Dyrka, 2019; Morkovkin et al., 2020). The adoption of the Organic Production Law in 2015 marked an important step in the development of organic agriculture in Kazakhstan. In 2017, Kazakhstan adopted organic production standards, allowing producers to certify their products as organic agricultural products according to national organic standards. The setting of these standards sets benchmarks for organic production and contributes to the development of the organic agricultural sector in Kazakhstan (Dabltayeva and Rakhymzhan,2019; Samenbetova and Patlasov, 2022a).

In 2020, there were 279 organic product producers in Kazakhstan, exporting goods worth approximately 9 million euros, including wheat, soybeans, seeds, and oilseed cakes (Bulkhairova and Alieva, 2021). Although Kazakhstan passed a law on organic agriculture a few years ago, the implementation of the law is still ongoing. In this stage, there were many problems, such as underdeveloped infrastructure that affects the effective operation of the organic market, high costs for certification of ecological products, and reliance on international experts and certification agencies (Dabltayeva and Rakhymzhan, 2019). Nevertheless, the Government of Kazakhstan has laid the legal foundation for organic agriculture in the country by implementing the "Kazakhstan 2050" strategy (2012), promoting the concept of a transition to a "green economy" (Linn, 2014), and implementing the Organic Product Production Law of the Republic of Kazakhstan (2015) (Oscar, 2021). Therefore, Kazakhstan is moving towards effective management of organic agriculture, and actively cooperating with international organizations to help attract more funds into the country's economy. However, consumer demand for organic products is the most critical factor in expanding the global and domestic organic product market (Nasiyev, Vassilina, Zhylkybay, Shibaikin, and Salykova, 2021). Table 3-1 shows the development level of organic crop production in Kazakhstan (Willer et al., 2021). The country reached its maximum amount of organic land in 2015, but the area gradually decreased in the following years.

According to data, Kazakhstan ranks 49th in the global ranking of organic agriculture, with Australia and Argentina occupying the top spot, and 80% of its organic land is used for organic animal husbandry. Kazakhstan has vast pastures and grasslands, so it has the potential to take advantage of these advantages. In addition, the observation results indicate that many farms in Kazakhstan take organic principle for granted, but due to various factors such as the complexity of certification, limited availability of domestic certification companies, lack of experience, and underdevelopment of the domestic organic market, they still do not obtain certification (Kostrova, Martynushkin, and Sattarova, 2020). There is no doudt that these farms may initiate a conversion process to certified organic production in the future (Ozdemir, 2018).

The data used in this study are survey data, including questionnaire surveys and face-to-face interviews. The survey questionnaire is the carrier of the main content of the survey, mainly including three parts covering a total of 30 questions: first part contains measuring herdsmen's attitudes, subjective norms, perceived behavior control, the second is demographic characteristics, and the third is farmers' willingness to engage in organic practices. As this study explores the practical willingness of pastoralists to engage in organic agriculture, the subjective questions in the survey questionnaire are measured using seven levels of Likert scales: "strongly disagree", "disagree", "slightly disagree", "neither agree nor disagree", "slightly agree", "agree", and "strongly agree". Face-to-face interviews are conducted by researchers one-on-one with interviewees, mainly including farmers' understanding and willingness to engage in organic agriculture.

The demographic characteristics of the respondents in the survey questionnaire include age, gender, farming years, educational background, etc; The respondents' attitude characteristics include their views on environmental protection, pollution issues, organic agricultural profitability, and organic meat marketing channels; The subjective normative characteristics of respondents are manifested in the impact of others on farmers' willingness to engage in organic agriculture, specifically including the impact of family members, media, friends, suppliers, and buyers on respondents' willingness to engage in organic agriculture; The characteristics of respondents' perceived behavioral control are reflected in their ability to control results, measured by their confidence in obtaining organic certification, their ability to find input suppliers such as feed, and their ability to learn organic breeding techniques; Farmers' willingness to engage in organic agriculture was measured using the Likert scale at 7 levels, with 1-7 indicating a range from very disagree to very agree.

In agricultural development, animal husbandry accounts for 45% of total agricultural production in Kazakhstan (Kr ä mer et al., 2015). The country has many unique natural advantages, including vast territory, rich natural resources, a long history of nomadic animal husbandry, ecologically clean pastures, and considerable forage resources and etc. These conditions enable Kazakhstan to develop organic animal husbandry and create the necessary environment for the industry (Robinson&Milner Gulland, 2003). However, the success of animal husbandry depends on improving breeding, strengthening feed base construction, and organic production methods. Over the years, Kazakhstan has made significant progress in animal selection and reproduction, reproductive biology, artificial insemination, and rational feeding practices (Bekseitov, Abeldinov&Mukatayeva, 2016; Faye&Ratto, 2022; Nassanbaev, Akhmetalieva, Nugmanova &Kulbaev, 2019). At the same time, Kazakhstan is an ideal candidate for the production of organic products due to its long agricultural tradition and vast agricultural land, as well as its low level of criminal conviction for agro industrial complexes.

In terms of supporting measures, Kazakhstan takes full advantage of its core geographical location to carry out infrastructure construction such as transportation and logistics, reduce trade costs, and actively carry out foreign trade with the help of Internet e-commerce by taking advantage of economic and trade belts such as the the Belt and Road. In terms of legal norms, Kazakhstan has implemented the Organic Production Law, formulated regulations and standards for the production and sales of organic products (Almukametova, Yermankulova, Tokayeva, and Keneshbayev, 2017), formulated unified and standardized standards, and clearly defined terms that reflect different environmental protection meanings, thereby forming a fixed organic product certification system that includes multiple links such as production, certification, labeling, and circulation. In terms of the use of organic technology, Kazakhstan combines biogas production with animal husbandry, converting a large amount of organic waste generated in animal husbandry production into organic fertilizer through fermentation, improving the soil environment, and obtaining energy for cooking and power generation (O'Connor et al., 2021). This technology can not only improve the soil environment, crop quality, living energy, and reduce atmospheric pollution, but also eliminate discrimination and barriers for farmers. Farmers can learn to build large and small-scale biogas digesters, fully utilize organic wastes such as animal manure generated by their farms, and realize the transformation of waste into treasure. In terms of beef cattle breeding, the production stage is roughly divided into two stages: reproduction (cow calf system) and intensive fattening of young livestock slaughtered cows. During the breeding phase, Kazakhstan mainly adopts low-cost intensive ranching technology to achieve cow breeding. The main approach is to feed cows with coarse fodder in winter and allow them to graze during the ranching season. In the second stage, it is mainly through weighing and developmental

morphology to choose whether to continue feeding or selling. In terms of rangeland management technology, in order to achieve optimal grazing and release higher productivity, Kazakh pastoralists will choose the measure of rangeland fencing. This measure allows for appropriate grazing management, increases the feed capacity of pastures, and improves land quality (Kazambayeva, Tarshilova, and Zhangaliyeva, 2022), which provides livestock with sufficient living space and sufficient forage to improve the quality of livestock products.

Based on the planned behavior theory, this chapter will analyze the willingness of beef cattle farmers to engage in organic production from three dimensions: behavioral attitudes, subjective norms, and perceived behavioral control. At the same time, relying on 410 field survey data, using structural equation model to empirically test the influencing factors of Kazakhstan beef cattle farmers' willingness to organic production.

According to the theory of planned behavior, behavioral attitude, subjective norms, and perceived behavioral control are three core variables that determine an individual's willingness. Therefore, this chapter will analyze the willingness of beef cattle farmers to engage in organic production from three dimensions: behavioral attitudes, subjective norms, and perceived behavioral control.

Secondly, most farmers (49.5%) believe that they care about the environment and strive to reduce pollution based on daily farm activities. This indicates a growing awareness of the need for sustainable and environmentally friendly organic livestock farming practices, which reflects the positive attitude of farmers towards organic production.

Thirdly, over 58.1% of farmers believe that organic farming is more profitable than traditional farming. This view can be attributed to various factors, such as the growing demand for organic animal products, rising market prices, and reduced input costs resulting from the reduced use of synthetic feeds and drugs. Many farmers hope to obtain experienced economic benefits through the use of organic farming methods, such as reducing input costs, increasing prices, and improving production profit margins.

Fourth, 48.4% of respondents believe that following the recommendations of scientists may affect their decision to adopt organic livestock production. This means that scientists need to make more efforts to improve farmers' awareness of organic production behavior and address misunderstandings or concerns that may hinder their willingness to produce organic.

Fifthly, 57.8% of respondents believe that the availability of social networks will affect their decision to adopt an organic livestock farming approach. This is because some farmers can obtain information and resources through social networks, which can help farmers overcome obstacles to adopting organic production.

Sixth, 57.6% of farmers believe that the upfront cost of organic livestock farming is higher than traditional farming. Due to the lack of material capital of small-scale farmers, this perception may pose challenges to their organic production.

Seventh, 44.5% of farmers believe that using organic farming methods requires more effort than using non organic farming methods. To address this challenge, more education and policy support are needed for farmers, including providing organic production training and providing subsidies for organic production transformation.

Eighth, 49.3% of respondents from most farmers believe that organic certification can help improve livestock farming technology and ensure the quality of consumers. Organic certification systems typically have strict standards that can motivate farmers to adopt more optimized livestock farming techniques, leading to a shift to organic livestock farming.

Ninth, 61.9% of respondents believe that government or non-governmental promotion services such as organic training, seminars, and subsidies are beneficial to organic livestock breeders.

Table 4-2 shows the descriptive statistical results of Kazakhstan beef cattle farmers' subjective norms for organic production. Specifically, first, 44.5% of respondents believe that media coverage and advertising will have an impact. This indicates that people may be influenced by the information and information they receive through various forms of media, such as television advertising, social media advertising, or articles in newspapers or magazines.

Secondly, 44.2% of respondents believe that their friends' success in organic farming will inspire them. This indicates that social impacts can play an important role in the decision of farmers to adopt organic production.

Thirdly, 47.5% of respondents believe that family members can motivate them to start organic livestock farming. This shows that family members can play an important role in promoting sustainable farming practices in families and communities.

Fourth, 48.4% of respondents believe that following the recommendations of scientists may affect their decision to adopt organic livestock production. This means that scientists need to make more efforts to improve farmers' awareness of organic production behavior and address any misunderstandings or concerns that may hinder their willingness to produce organic.

Fifthly, 57.8% of respondents believe that the availability of social networks will affect their decision to adopt an organic livestock farming approach. This is because some farmers can obtain information and resources through social networks, which can help farmers overcome obstacles to adopting organic production.

Sixth, 45.7% of respondents believe that meat buyers and distributors can encourage farmers to switch from traditional farming to organic livestock farming. This indicates that farmers are aware of the market forces driving demand for organic products and are willing to adapt to these needs. By working with buyers and distributors, farmers can enter new markets for organic products, increase their income, and potentially reduce the financial risks associated with the transition to organic livestock.

Seventh, 45% of respondents believe that the government should encourage farmers to adopt organic farming methods. This is due to the high cost of switching from traditional to organic production, including new technologies, training, and certification programs. Therefore, by providing financial support, tax relief, subsidies, or other incentives, the government can effectively reduce the conversion costs of farmers.

The survey also showed that the majority of respondents were confident that the government would support their efforts to engage in organic farming, with 63.7% believing that they could receive subsidies for traditional animal husbandry. In addition, 52.3% of respondents believe that they have the skills required to practice organic animal husbandry, and 53.7% believe that they can confidently learn organic animal husbandry if necessary. Table 4-3 lists the perceived behavioral control factors that may affect farmers' intentions towards organic farming.

Conclusion. Based on the findings, several recommendations are proposed to enhance the development of organic animal husbandry in Kazakhstan:

- Increase Government Support: Enhanced financial subsidies and technical support can alleviate the burden of certification costs and infrastructure development.
- Improve Market Access: Developing domestic and international market channels for organic products can provide better opportunities for farmers.
- Strengthen Training and Education: Providing training and resources to farmers on organic practices and certification can improve their confidence and capability to engage in organic production.
- Promote Public Awareness: Increasing public awareness about the benefits of organic products can drive consumer demand and support for organic farmers.

The development of organic animal husbandry in Kazakhstan holds significant potential due to the country's favorable conditions for organic beef production. However, the sector is currently limited by several challenges, including infrastructure deficits, high certification costs, and market barriers. By addressing these challenges through targeted policies and support measures, Kazakhstan can foster a more robust organic animal husbandry industry. This, in turn, will contribute to the global trend of sustainable agriculture and provide valuable insights for other countries looking to develop their organic sectors.

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ТҮЙІН

Мақалада органикалық ауыл шаруашылығы, органикалық мал шаруашылығы туралы ғылыми әдебиеттер мен көрсеткіштерге шолу, сонымен қатар фермерлердің органикалық ауыл шаруашылығына деген ұмтылысы мен мінез-құлқы ашылады, Қазақстанда органикалық мал шаруашылығын дамытудың артықшылықтары мен шарттары талданады және сауалнама жүргізілді. елдегі етті мал шаруашылығымен айналысатын фермерлердің. Соңында, мақалада қазақстандық фермерлердің органикалық мал шаруашылығына қатысуға дайындығы мен мінез-құлқын жақсарту бойынша ұсыныстар берілген.

Бұл зерттеу Қазақстандағы органикалық мал шаруашылығы саласы әлі қалыптасу сатысында екенін және осы саламен айналысатын кәсіпкерлер инфрақұрылым, технология, маркетинг, логистика және заңдық кедергілер сияқты көптеген қиындықтар мен кедергілерге тап болатынын көрсетті. Қазақстанда органикалық ауыл шаруашылығы 2000 жылдардың

басында дами бастады, маңызды кезең 2015 жылы Органикалық өндіріс туралы заңның әзірленуі және 2017 жылы органикалық өндірістің ұлттық стандарттарының қабылдануы болды. Қазақстанның географиялық және климаттық жағдайы органикалық мал шаруашылығына қолайлы. Кең жайылымдар мен қолайлы климат органикалық етті мал өсіруге тамаша жағдай жасайды. Сонымен қатар, Қазақстан үкіметі органикалық ауыл шаруашылығына заңнамалық және халықаралық ынтымақтастық арқылы қолдау көрсетеді.

РЕЗЮМЕ

В статье раскрыт обзор научной литературы и показателей об органическом сельском хозяйстве, органическом животноводстве, а также о желании и поведении фермеров в органическом сельском хозяйстве. На основе обзора определена схема исследования с использованием теории планируемого поведения. В статье анализируются преимущества и условия развития органического животноводства в Казахстане и проводится анкетный опрос фермеров, занимающихся мясным скотоводством в стране. Всего было собрано 410 анкет, и, используя статистические и опросные данные, в статье проводится систематический анализ текущего состояния производства органического животноводства в Казахстане. В работе также используются модель структурных уравнений, пробит и упорядоченная пробит модель для анализа факторов, влияющих на желание и поведение казахстанских фермеров, занимающихся мясным скотоводством, участвовать в органическом производстве. В работе выбраны три репрезентативных примера производства мясного скота и проведен анализ готовности и поведения казахстанских фермеров участвовать в органическом животноводстве. Наконец, в статье предлагаются предложения по улучшению желания и поведения казахстанских фермеров участвовать в органическом животноводстве.

Данное исследование показало, что отрасль органического животноводства в Казахстане все еще находится в зачаточном состоянии, и предприниматели, занятые в этой отрасли, сталкиваются с многочисленными проблемами и препятствиями, такими как инфраструктура, технологии, маркетинг, логистика и правовые барьеры.

В Казахстане органическое сельское хозяйство начало развиваться в начале 2000-х годов, а значительными вехами стали разработка «Закона об органическом производстве» в 2015 году и принятие национальных стандартов органического производства в 2017 году.

Географические и климатические условия Казахстана благоприятствуют органическому животноводству. Обширные пастбища и подходящий климат обеспечивают идеальные условия для выращивания органического мясного скота. Кроме того, правительство Казахстана оказывает поддержку органическому сельскому хозяйству через законодательство и международное сотрудничество.

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THE VALUE OF GOAT MILK AND ITS BENEFICIAL PROPERTIES

ANNOTATION

This article presents the results of an evaluation of the nutritional and biological value of goat milk obtained from local farmers, as well as their health benefits.

The dry matter content of goat's milk is 8% higher than cow's milk, and it can be seen that the content of fat and protein in goat's milk is higher than that of cow's milk, and the content of lactose is lower. The low lactose content of goat's milk is beneficial for consumption by people with lactose intolerance.

The amount of casein in goat's milk protein is lower than that of cow's milk. In goat's milk, α_{S1} - and α_{S2} 2-casein fractions are two times smaller, and β-casein is 2.3 times higher. This proves that goat's milk casein forms a soft clot that is easily digested in the human stomach, has high digestibility and low allergenicity compared to cow's milk.

The amount of non-replaceable amino acids in goat milk is 45.87%, in cow's milk it is 42.61%, and the balance of non-replaceable amino acids is well balanced.

Goat and cow milk are high in unsaturated fatty acids and low in mono and polyunsaturated fatty acids. Short-chain fatty acids (C6-10) were higher in goat's milk than cow's milk, which can be concluded that the fat of goat's milk is better digested and absorbed, as well as has preventive and healing properties.

Goat's milk has been found to contain more B vitamins and niacin acid, calcium, phosphorus, zinc and selenium than cow's milk.

Key words: *goat's milk, nutritional value, amino acids, fatty acids, composition, function, fraction.*

Introduction

Goat farming is an important sector of animal husbandry. The significance of goat milk in human nutrition was recognized in the early stages of their domestication. The first published research articles on goat milk appeared in "The Lancet," highlighting its important role in infant nutrition and analysis [1]. Although the productivity of goat milk is much lower than cow's milk, in regions where cow's milk is scarce, goat milk has found use as a nutritional resource. Goats have a stable average lactation period of 7-9 months, and their annual milk production ranges from 600-800 kg. In 2018-2019, it was determined that there are approximately 1.003 billion goats worldwide, with about 203 million producing 1.526 million tons of milk annually. Asia accounts for more than half of the world's goat milk production, with India, Pakistan, and Bangladesh taking subsequent shares [2]. Despite the lower productivity of goat milk compared to cow milk, there has been a growing trend in the use of goat milk on a global scale in recent years. In European countries, goat milk consumption exceeds 80%, and products made from goat milk are twice as expensive as those made from cow milk. The first pedigree goat farm in our country meets the needs of other regions and exports 30% of its products [3].

The genetic variability of goats is much higher than that of cows. Goat milk is one of the most beneficial and complete types of milk. The content and concentration of proteins, fats, vitamins, and minerals in goat milk differ significantly from cow milk [4]. While goat and cow milk appear similar in external appearance, the breed of the goat, its diet, and the environment influence the taste and composition of the milk to a certain degree. Goat milk's overall dry matter content is higher than that of cow milk. Moreover, the unique physico-chemical properties of goat milk bring significant differences in its nutritional value and physiological effects [5].

In the Middle Ages, infants who could not be breastfed were nourished with goat milk. Since the late 19th century, the processing of goat milk has seen significant development. Recent years have seen extensive animal experiments and clinical studies on the nutritional value, bioavailability, and functional properties of goat milk, leading to significant achievements. Today, various products made from goat milk are gradually becoming popular among the public. These ecologically clean products are especially useful for infants and young children who cannot tolerate other types of milk, children with gastrointestinal diseases, and even elderly people. Goat milk helps enhance the body's defense mechanisms, remove heavy metal salts and radionuclides from the body, and treat and prevent poor vision, among other health benefits [6].

In foreign countries where goat farming is developed, quantitative and qualitative research on the casein, whey proteins, and membrane proteins in goat milk fat globules is being conducted extensively, following the development of proteomics technology [7]. In our country, efforts are underway to improve dairy goat breeds, expand the capacity of milk processing enterprises, and

update processing technologies, which is leading to an increase in goat milk consumption. However, compared to cow milk consumption in the market, it is still very low. The organoleptic and physico-chemical properties of goat milk are unique compared to the milk of cows or other agricultural animals [8]. Consequently, the nutritional value and properties of goat milk produced in our country have been studied.

Materials and methods of research. Goat milk from Saanen breed goats raised in private farms in the Zhambyl district of Almaty region was selected. Cow's milk were chosen as comparative controls. Milk samples were labeled and stored in a special thermocontainer after the morning milking to determine their chemical composition and were immediately sent to the laboratory for analysis. The research was conducted at the "Reference Laboratory of Dairy Products" of the Kazakh National Agrarian Research University. Determination of the content of fatty acids in milk was carried out using the Shimadzu GC-2010 Plus gas chromatograph.

Determination of the Chemical Composition of Milk Samples. The total concentration of fat, protein, and lactose was determined using an automatic milk analyzer (MilkoScan FT 120, Foss A/S, Hillerød, Denmark).

Determination of Total Protein Content. Measured with a Kjel-Foss nitrogen analyzer (protein content = N% × 6.38). First, a 1 g sample was placed in a Kjeldahl flask, to which 0.4 g of copper sulfate (Cu_2SO_4), 6 g of potassium sulfate (K_2SO_4), and 20 ml of concentrated sulfuric acid were added, and heated at 420°C for 1 hour. After mineralization, a light green transparent solution appeared in the flask. The cooled flasks were filled with 50 ml of water and the solutions were poured into the Kjeldahl apparatus, where the processes of distillation, titration, and recording of titration indicators were carried out automatically [9].

Determination of Amino Acids. Amino acids in milk hydrolysates were determined on a high-precision liquid chromatography apparatus. In this study, the total concentration of amino acids was determined using acid hydrolysis and the basic method for analyzing tryptophan. The composition of amino acids was determined by derivatization on a high-performance liquid chromatography (HPLC) column with diethyl ethoxymethylenemalonate (DEEMM) [10].

Determination of Fatty Acid Composition. The composition of fatty acids in milk fat was determined as methyl esters using a Packard 419 gas chromatograph with a flame ionization detector and a Hewlett-Packard 33900 electronic integrator. Quantitative evaluation of methyl esters was carried out by assuming that the weight percentage proportions of the esters are equal to the proportions of the corresponding peaks on the chromatogram [11].

Determination of Vitamins. To determine the content of vitamins A, D3, and E in the milk, samples (5 ml) were saponified with an alcoholic pyrogallol solution and 2.5 ml of 80% potassium hydroxide. The material obtained was extracted in an alcohol-n-hexane system. The extract was purified and diluted in 200 µl of methanol; 20 µl of the solution was injected into a 250 × 5 mm column with 10 µm particle size Parcial OD, and the concentration of vitamins was determined on a Pye UNICAM LC-XP HPLC. Elution was carried out with a solution of 85:15 methanol at a drift speed of 14 ml/min. Quantitative evaluation was based on vitamin standards from MERCK. The amount of vitamin C in milk samples was determined using 2,6-dichlorophenolindophenol (2,6-DCPIP). The amount of vitamin C in the test material was determined based on the amount of reagent consumed in the oxidation of vitamin C. The amount of vitamin C is determined using the formula [12]:

$$\text{Vitamin C} = V_{dye} * T_{dye} * 0{,}088 * 2 * \text{titration error [mg/l]} \quad (1)$$

where:

- A = amount of $KMnO_4$ used for titrating 10 ml of Mor salt (ml)
- B = amount of $KMnO_4$ used for titrating 10 ml of oxalic acid (ml)
- C = amount of Mor salt used for titrating 10 ml of dye solution (ml)
- 1 ml of 0.001 N dye = 0.088 mg of ascorbic acid.

Determination of Mineral Content. Calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), and phosphorus (P) were determined by inductively coupled plasma–optical emission spectrometry. The concentrations of copper (Cu), iodine (I), selenium (Se), and zinc (Zn) were

measured by inductively coupled plasma–mass spectrometry. Before the inductively coupled plasma analysis, samples for I and Se determination were prepared using tetramethylammonium hydroxide, while samples for Ca, Mg, K, Na, P, Cu, and Zn analysis were mineralized using nitric and hydrochloric acids (method 3030F). The chloride (Cl) content was determined by potentiometric titration (AOAC 971.27). The soluble fractions of Ca, Mg, and P were determined in skimmed milk obtained by ultracentrifugation of raw defatted milk, followed by filtration through Amicon® Ultra-15 (10 kDa) filters. Ionized Ca concentration was determined using a calcium-selective electrode as described by Li et al. [13].

Research results and their discussions. Excessive amounts of nutrients in the diet increase the kidney load for individuals with poor health and for infants and young children whose bodies are not fully developed. Goat milk contains all the necessary nutrients for the growth and improvement of health. The nutritional and energy value of goat milk is higher than that of cow milk [14]. Table 1 presents the nutritional and energy value of goat and cow milk.

Table 1 – Nutritional and Energy Value of Goat and Cow Milk (%)

№	The composition	Goat Milk	Cow Milk
1	Dry matter	12.94	11.97
2	Fat	4.22	3.62
3	Protein	3.61	2.91
4	Lactose	4.33	4.75
5	Ash	0.78	0.69
6	Energy value (kcal)	69.74	63.22

From Table 1, it can be seen that the dry matter content of goat's milk is 8% higher than that of cow's milk, with higher fat and protein content, but lower lactose content. The nutritional and energy value of goat's milk does not differ much from cow's milk, but it is softer and better digested for infants and young children. The low lactose content of goat's milk is beneficial for people with lactose intolerance and helps prevent large fluctuations in blood sugar levels, making it suitable for diabetics or individuals needing blood sugar control.

The protein composition and spatial configuration of goat and cow milk proteins differ significantly. Their protein structures are not the same, hence their protein charges differ as well [15, 16]. The variation in milk protein content is mainly due to the polymorphism of the α_{S1}-casein fraction, as well as factors such as the animal's age, care, and milking season [17, 18]. The higher the casein content in milk, the poorer the protein digestion, as casein forms large coagulates under the influence of stomach acid. Goat and cow milk have higher casein content compared to other animal milk, but they differ in casein fractions [19, 20]. Table 2 presents the comparative composition of casein fractions in goat and cow milk.

Table 2 – Comparative Composition of Casein Fractions in Goat and Cow Milk

№	The composition	Goat Milk	Cow Milk
1	Total Casein	2,46	2,33
2	α_{S1}- casein	0,40	0,84
3	α_{S2}- casein	0,05	0,17
4	β- casein	1,35	0,94
5	κ- casein	0,14	0,38

From Table 2, it can be seen that the proportion of casein in total protein is 70% in goat's milk and 80% in cow's milk. This means that goat's milk has a lower casein content than cow's milk, so it is better absorbed by the human body. In terms of the content of casein fractions, goat milk has two times less α_{S1}- and as_2-casein compared to cow's milk, and β-casein is 1.3 times higher, which proves that goat's milk casein forms a soft clot that is easily digested in the human stomach compared to

cow's milk, has high digestibility and low allergenic properties. Table 3 presents the amino acid composition of goat and cow's milk.

Table 3 – Amino acid composition of goat and cow's milk, g / 100 g

№	Amino acids	Goat Milk	Cow Milk
1	Isoleucine	0.17	0.126
2	Leucine	0.343	0.263
3	Lysine	0.345	0.251
4	Methionine	0.079	0.070
5	Phenylalanine	0.178	0.132
6	Threonine	0.139	0.113
7	Tryptophan	0.048	0.049
8	Valine	0.217	0.144
9	Histidine	0.128	0.092
10	Cysteine	0.033	0.025
11	Tyrosine	0.172	0.164
12	Arginine	0.146	0.128
13	Alanine	0.128	0.098
14	Asparagine	0.252	0.223
15	Glutamine	0.695	0.564
16	Glycine	0.058	0.052
17	Proline	0.314	0.267
18	Serine	0.156	0.149
	Total	3.61	2.91

From Table 3, it can be seen that goat and cow milk contain 18 different amino acids. The amount of non-replaceable amino acids in goat milk is 45.87%, and in cow's milk, it is 42.61%. The replaceable amino acids are 54.13% in goat milk and 57.39% in cow's milk. The obtained data showed that the biological value of goat milk is higher than that of cow's milk.

To quantify the biological value of food protein, the composition of non-replaceable amino acids in the sample being studied is compared with the ideal protein composition accepted by the FAO/WHO scale as a reference, and the amino acid score value is calculated. The higher the amino acid score of the samples under study, the higher the nutritional and biological value [21, 22]. The amino acid score of goat and cow milk proteins is presented in Table 4.

Table 4 – Amino acid score of goat and cow milk proteins, mg/g

№	Amino acids	FAO / WHO scale	Goat Milk		Cow Milk	
			AA	Score %	AA	Score %
1	Isoleucine	40	47	117	43	107.5
2	Leucine	70	95	135.7	90	128.6
3	Lysine	55	96	174.6	95	172.7
4	Methionine + cysteine	35	31	88.6	33	94.3
5	Phenylalanine + tyrosine	60	97	161.7	102	170
6	Threonine	40	39	97.5	39	97.5
7	Tryptophan	10	13	130	17	170
8	Valin	50	60	120	50	100
9	Histidine	26	35	134.6	32	123.1

From Table 4, it can be seen that the amounts and scores of 9 different essential amino acids in goat and cow milk are compared. Except for methionine + cysteine and threonine, the scores of all

essential and semi-essential amino acids were higher than the FAO/WHO scale. The highest values were shown for lysine amino acid scores in goat and cow milk samples, 174.6% and 172.7%, respectively. This indicates that the amino acid balance of goat milk is well-balanced.

The quantitative and qualitative composition of fat in goat's milk and cow's milk differs significantly. The fat content in goat's milk is higher than in cow's milk. The diameter of fat globules in goat's milk is about 2.5-2.8 μm, which is smaller than the 3.3-5.5 μm in cow's milk. As visible structural elements of milk, fat globules strongly refract light and can be clearly seen under a microscope in the form of light droplets [23]. The fat globules in goat's milk are smaller and more evenly distributed than those in cow's milk. They have a larger surface area for contact with digestive enzymes and are better protected from sticking together, which makes them easier to digest [24]. Nutritional fats consist of short (C_{4-10}), medium (C_{10-17}), and long-chain ($C \geq C_{18}$) fatty acids. From a digestive standpoint, short and medium-chain fatty acids are absorbed more quickly and easily compared to long-chain fatty acids and have the property of being rapidly oxidized in the body. According to David et. Al., short-chain fatty acids regulate intestinal flora and can maintain the balance of body fluids and electrolytes [25]. The ratio of different fatty acids plays an important role in evaluating the value of fatty acids. The fatty acid content of goat and cow milk is given in Table 5.

Table 5 – Fatty Acid Composition of Goat and Cow Milk, g/100 g

№	Fatty Acids	Goat Milk	Cow Milk
1	$C_{4:0}$	1.95	2.54
2	$C_{6:0}$	1.90	1.88
3	$C_{8:0}$	2.92	1.57
4	$C_{10:0}$	7.37	3.15
5	$C_{11:0}$	0.14	0.21
6	$C_{12:0}$	3.92	2.83
7	$C_{14:0}$	8.29	9.74
8	$C_{15:0}$	1.05	1.03
9	$C_{16:0}$	30.22	29.34
10	$C_{18:0}$	9.43	12.76
11	$C_{14:1}$	0.18	0.89
12	$C_{16:1}$	1.29	1.33
13	$C_{18:1}$	22.34	25.52
14	$C_{18:2}$	3.45	2.97
15	$C_{18:3}$	0.95	0.75
	SPA	67.19	65.05
	MUFA	24.69	27.74
	PUFA	4.40	3.72

From Table 5, it can be seen that unsaturated fatty acids are higher in goat's and cow's milk, while monounsaturated and polyunsaturated fatty acids are lower. Goat's milk contains more short-chain fatty acids (C_{6-10}) compared to cow's milk, which contributes to the better digestion and absorption of goat's milk fat. Additionally, it inhibits cholesterol accumulation and is beneficial for preventing and treating diseases such as intestinal dysfunction, gallstones, ischemic heart disease, and bladder fibrosis.

Lactose is broken down into glucose and galactose in the small intestine. Glucose is easily absorbed, while galactose acts as a catalyst for the growth of intestinal bacteria that synthesize vitamin K and B-group multivitamins. Lactose, influenced by intestinal bacteria, regulates lactic acid, improving the activity of the intestinal tract and the secretion of digestive glands. Lactic acid enhances the absorption of mineral elements such as calcium, phosphorus, magnesium, and barium. Goat's and cow's milk contain few oligosaccharides, but goat's milk has a greater variety of oligosaccharides, with some even present in higher amounts than in cow's milk [27, 28]. Research results show that the lactose content in goat's and cow's milk is 4.33% and 4.75%, respectively, with lactose in goat's milk

accounting for 34% of the total dry matter. Therefore, goat's milk can fully meet people's carbohydrate needs and is recommended for consumption by those with lactose intolerance.

Vitamins A and D are very important for the growth and development of infants aged 0-3 years and are fat-soluble vitamins in the human body. The antioxidant properties of milk from agricultural animals in the early lactation period are due to the antioxidant activity of many components with different chemical properties. Ascorbic acid (vitamin C) and polyphenols, such as tocopherol (vitamin E) and retinol (vitamin A), in cow's milk significantly contribute to antioxidant activity [29, 30]. Table 6 provides comparative data on the vitamin content of goat's and cow's milk.

Table 6 – Vitamin Composition of Goat and Cow Milk (per 100 g)

№	Vitamins	Goat Milk	Cow Milk
1	Retinol (mg)	0.06	0.04
2	β-carotene (mg)	-	0.02
3	Vitamin D (µg)	0.06	0.05
4	Tocopherol (mg)	0.04	0.11
5	Thiamine (mg)	0.05	0.04
6	Riboflavin (mg)	0.18	0.16
7	Niacin (mg)	0.29	0.08
8	Pantothenic acid (mg)	0.35	0.32
9	Pyridoxine (mg)	0.05	0.04
10	Biotin (µg)	1.25	2.00
11	Folic acid (µg)	1.00	5.00
12	Cyanocobalamin (µg)	0.06	0.36
13	Ascorbic acid (mg)	2.49	0.74

From Table 6, it is evident that goat's milk contains higher levels of B-group vitamins, niacin acid, biotin, and vitamin C compared to cow's milk. However, it has lower levels of folic acid, cobalamin, and tocopherol, and is deficient in β-carotene. The antioxidant content in goat's milk is 3-4 times higher than in cow's milk, indicating its potential as a new raw material for producing products with a longer shelf life and higher biological value.

Mineral substances play an important role in the metabolic processes of the human body and are indispensable nutrients for maintaining normal physiological functions. Calcium and phosphorus are crucial minerals for keeping bones and teeth healthy. Zinc plays an important role in the functioning of the immune system, and in cell growth and repair. Selenium is one of the essential trace elements in the human body, with many biological roles such as anticancer, antioxidant, and free radical scavenging properties [31]. Table 7 provides the mineral content of goat's and cow's milk.

Table 7 – Mineral Content of Goat and Cow Milk (mg per 100 g)

№	Minerals	Goat Milk	Cow Milk
1	Calcium	133	121
2	Phosphorus	121	92
4	Potassium	185	150
5	Sodium	40	55
6	Chlorine	160	110
7	Magnesium	16	12
8	Zinc	0.54	0.53
9	Iron	0.06	0.07
10	Copper	0.05	0.06
11	Manganese	0.031	0.02
12	Iodine	0.022	0.021
13	Selenium (µg)	1.30	0.96

From Table 7, it can be seen that goat's milk contains higher levels of minerals such as calcium, phosphorus, potassium, magnesium, chloride, zinc, and selenium. This makes it a valuable dietary supplement, playing a significant role in maintaining normal bodily functions, boosting immunity, and preventing diseases.

Conclusion. The findings of the study indicate that goat's milk is rich in various nutrients, particularly having higher levels of fat and protein compared to cow's milk, while containing less lactose. This makes it an effective source of low-lactose milk. The protein in goat's milk has lower levels of casein than cow's milk, with the α_{S1}-and α_{S2}-casein fractions being half as much, but β-casein being 2.3 times higher. This suggests that goat's milk casein is more easily digested, has higher absorbability, and lower allergenic properties in the human stomach. Goat's milk contains higher levels of essential amino acids than cow's milk, with a well-balanced profile. It also has a higher proportion of unsaturated fatty acids compared to cow's milk, with an equal ratio of the three types of fatty acids. The proportion of medium-chain fatty acids (C8-12) in goat's milk is twice as high as in cow's milk. Additionally, goat's milk contains higher levels of B-group vitamins, niacin acid, calcium, phosphorus, zinc, and selenium compared to cow's milk. The value and beneficial properties of goat's milk for human health warrant further research.

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ТҮЙІН

Бұл мақалада жергілікті фермерлерден алынған ешкі сүтінің тағамдық және биологиялық құндылығы, олардың денсаулыққа пайдасы туралы бағалау нәтижелері келтірілген.

Ешкі сүтінің құрғақ зат мөлшері сиыр сүтінен 8% жоғары, оның ішінде май мен ақуыз мөлшері ешкі сүтінде сиыр сүтінен жоғары, ал лактоза мөлшері төмен екендігін көруге болады. Ешкі сүтінде лактозаның төмен болуы лактозаға төзімсізлігі бар адамдардың тұтынуына пайдалы.

Ешкі сүтінің ақуызында казеиннің мөлшері сиыр сүтінен төмен, онда α_{S1}- және α_{S2}-казеин фракциялары екі есеге аз, β-казеин 2,3 есе жоғары, бұл ешкі сүті казеині сиыр сүтімен салыстырғанда адам асқазанында оңай қорытылатын жұмсақ тромб түзетіндігін, сіңімділігінің жоғары және аллергендік қасиетінің төмен екендігін дәлелдейді.

Ешкі сүтінде ауыстырылмайтын амин қышқылдар мөлшері 45,87%, сиыр сүтінде 42,61%, сондай-ақ ауыстырылмайтын амин қышқылдарының балансы жақсы теңестірілген.

Ешкі және сиыр сүттерінде қанықпаған май қышқылдары жоғары, ал моно және полиқанықпаған май қышқылдары төмен. Ешкі сүтінде сиыр сүтіне қарағанда қысқа тізбекті май қышқылдары (С6-10) жоғары болды, бұл ешкі сүтінің майы жақсы қорытылады және

сіңетіндігін, сондай-ақ аурулардың алдын алу және сауықтыру қасиеті бар деген қорытынды жасауға болады.

Ешкі сүтінде В тобы дәрумендері мен ниацин қышқылы, кальций, фосфор, мырыш және селеннің мөлшері сиыр сүтінен жоғары екендігі анықталды.

РЕЗЮМЕ

В данной статье представлены результаты оценки пищевой и биологической ценности козьего молока, полученного от местных фермеров, а также их пользы для здоровья.

Содержание сухого вещества в козьем молоке на 8% выше, чем в коровьем, причем видно, что содержание жира и белка в козьем молоке выше, чем в коровьем, а содержание лактозы ниже. Низкое содержание лактозы в козьем молоке полезно для людей с непереносимостью лактозы. Количество казеина в белке козьего молока ниже, чем в коровьем.

В козьем молоке фракции α_{S1} - и α_{S2} -казеина в два раза меньше, а β-казеина в 2,3 раза больше. Это доказывает, что казеин козьего молока образует мягкий сгусток, который легко переваривается в желудке человека, обладает высокой усвояемостью и низкой аллергенностью по сравнению с коровьим молоком.

Количество незаменимых аминокислот в козьем молоке составляет 45,87%, в коровьем – 42,61%. Баланс незаменимых аминокислот хорошо сбалансирован.

В козьем и коровьем молоке много ненасыщенных жирных кислот и мало моно- и полиненасыщенных жирных кислот. Короткоцепочечные жирные кислоты (С6-10) в козьем молоке выше, чем в коровьем, из чего можно сделать вывод, что жир козьего молока лучше переваривается и усваивается, а также обладает профилактическими и лечебными свойствами.

Было обнаружено, что козье молоко содержит больше витаминов группы В и ниациновой кислоты, кальция, фосфора, цинка и селена, чем коровье молоко.

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THE EFFECTIVENESS OF USING BLACK SOLDIER FLY LARVAE IN FEEDING DUCKS

ANNOTATION

As global demand for poultry products grows, the poultry industry is facing both serious challenges and new opportunities. Thus, this article presents a comprehensive review and study of sustainable poultry farming, which focuses on alternative feeds, precision technologies, waste management and innovative feed sources. The growing global demand for animal protein highlights the urgent need to explore alternative protein sources. The study of the nutritional properties of new alternative proteins is vital for the feed industry and their acceptance by consumers. This study examined the chemical analysis and availability of the amino acid composition of the main feed for waterfowl. Alternative proteins from the sources of black soldier fly larvae demonstrate a rich amino acid composition and various digestion mechanisms, which expands the possibilities of their use as nutritious food ingredients in the future, which contributes to filling protein deficiency in the animal body, and replacing fish meal, as a result of which will lead to a decrease in dependence on imported feed. In response, transitioning towards alternative protein sources has become imperative.

Key words*: waterfowl; black soldier fly; meat productivity; preservation; egg production; larvae*

Introduction. Feeding and keeping of waterfowl are important aspects of their breeding, which is especially important in conditions of intensification of agricultural production. In recent years, numerous studies have been conducted aimed at improving the diet and methods of keeping these birds to increase their productivity and improve well-being.The quality of poultry products is directly related to and depends on the technology of keeping and feeding poultry.[1]One of the key aspects of water supply is the provision of the right balance of useful substances, necessary for growth, reproduction and health support. Important results were obtained in research, related to the distribution of corms. The report, published in 2023, showed that the addition of enzymatic cells can significantly improve growth, antioxidant activity and the content of nutrients. [2] This highlights the importance of developing specific diets that meet the needs of individual breeds.

Similar results were obtained in a study on feeding ducks using honeycomb extracts. The addition of these extracts to the feed improved the quality of eggs, increased the level of antioxidants and immune functions in laying hens. [3] This indicates the prospects of using natural additives to increase the productivity and health of birds.

The maintenance of waterfowl is directly related to their well-being and productivity. One of the key factors affecting well-being is the density of bird planting. Studies have shown that high density can negatively affect the behavior and health of birds. For example, in Beijing ducks, with an increase in planting density, there was a deterioration in feather quality and an increase in aggressive behavior. [4] Geese also show a decrease in feather quality and an increase in stress behavior with an increase in planting density. These findings highlight the need for careful selection of a content system to minimize stress and improve product quality. [5]

Research also shows the importance of adapting to natural conditions and using natural behavioral models to optimize content. For example, ducks and other waterfowl may use specific feeding techniques depending on the availability of food in their natural environment.[6] This knowledge can be useful in creating conditions of detention that mimic their natural needs, which increases their comfort and reduces stress levels.

The immune system of chicks is not formed after incubation, and any inconsistencies with zoohygenic parameters (temperature, humidity, crowding, room illumination) lead to a decrease in the body's protective mechanisms and susceptibility to metabolic disorders, which certainly affects a decrease in weight gain, an increase in growing time, the development of diseases, up to death. To increase the indicators of natural resistance of the body, scientists suggest adding various biological substances to the poultry diet (mineral and vitamin supplements, probiotics, prebiotics, nutraceuticals, eubiotics, etc.) [7,8]

In meat products, the presence of proteins, consisting of essential and interchangeable amino acids, which in turn determine its biological value, is of great importance.[9] In industrial duck-breeding and goose-breeding farms, dry and combined types of feeding are used. It is most rational and economical to give granular feed to young and adult ducks and geese. [10]

Feed with the addition of black soldier larvae (BSF) is becoming increasingly popular as a protein-rich substitute for fishmeal and soy in animal feed. In the feed, the larvae are able to replace significant amounts of soy without any harmful effects on the health of birds. In addition, feed with

the addition of larvae significantly affects the growth of broilers and, thus, is important for private farmers and commercial agricultural enterprises. [11,12]

An additional advantage when using black lion larvae is their ability to significantly reduce the content of harmful bacteria in organic waste such as manure. When manure or manure is processed by larvae, its mass decreases by 50%, and the nitrogen concentration decreases by 62%. This is important because excess nitrogen from manure is washed out by rains into the soil and reservoirs, and heavily pollutes them. In addition, the rapid consumption of waste by black lion larvae makes it possible to eliminate the appearance of unpleasant odors emitted by manure and manure storage facilities, as well as the formation of methane gas during the decomposition of organic matter, which poisons the atmosphere. [13, 14, 15]

Materials and methods of research. The research was carried out within the framework of grant funding AP19579335 for fundamental and applied scientific research on scientific and (or) scientific and technical projects for 2023-2025 on the project "Technological justification for intensifying the production of meat of waterfowl in the West Kazakhstan region".

The research was conducted in 2024, the main feed samples were taken from the SEC «Menzhan-Agro». The research was carried out in accordance with the methodology adopted in the study of issues of breeding work in poultry farming, assessment of breeding value and productivity of poultry. General methods of empirical knowledge (observation, measurement, evaluation, experiment) and theoretical (comparison, analogy, synthesis, logical analysis), as well as special methods: zootechnical, monographic, economic and statistical, were used in the research. Chemical analysis was performed in the laboratory of zootechnical analysis at the testing center of the West Kazakhstan Agrarian Technical University named after Zhangir Khan.

First, before setting up the experiment, a chemical analysis of the main samples of feed for waterfowl was carried out. Chemical analysis is important to identify the nutritional value of feed, the amino acid composition of proteins.

Balanced nutrition of animals is the most important factor that allows you to get maximum profit at the lowest cost. Mixing different types of feed in the right proportions allows you to create a diet with high nutritional value, provide livestock with all the necessary nutrients and in a short time increase the live weight gain and productivity of animals and poultry. Chemical analysis of feed is the primary indicator of their nutritional value.[16]

Based on the data of the chemical composition of the feed, the total nutritional value of the feed in feed units and the energy nutritional value in energy units are calculated.

To fulfill the tasks set in the conditions of the Non-profit Joint–Stock Company "West Kazakhstan Agrarian and Technical University named after Zhangir Khan" of the West Kazakhstan region, scientific and economic experiments were conducted, as well as an analysis of the composition of feed for young ducklings of the Medeo breed (Beijing White). Samples of the main types of feed (barley, wheat, corn, rye, sorghum, millet, soy, cake, wheat bran, sunflower meal, soy meal, fish meal and black soldier larva) were selected and the nutritional value of the feed was determined in the laboratory of the Zhangir Khan Test Center of the WKAU.

To achieve this goal, as well as to fulfill the tasks of research, production checks to study the composition of feeds and feed additives from local resources and recipes for feed mixtures for each sex and age group of poultry, taking into account the periods of their productivity, were compiled.

To conduct physiological experiments to study the effect of feeding types on the growth and development of young animals, 4 groups: 1 control group and 3 experimental groups with joint cultivation of 50 heads of day-old ducklings were formed according to the principle of analogues.According to the accepted technology, young ducklings and goslings up to the age of 14 days were kept in cell batteries, from 14 days to 49 days of age on a deep litter.

All technological parameters during cultivation and feeding conditions of young ducklings corresponded to the norms. Feeding scheme: in the control group, ducklings were fed with the main recipe of the feed mixture, and in the experimental groups, together with the main recipe of the feed mixture, black soldier fly larvae (BSFL) were moderately introduced in 2%;4%;6%. (Table 1)

Table 1 – Scheme of experience

Groups	Age, week	Number	Duration, day	
			Thepreparatoryperiod	Themainperiod
Control group I	0-49	50	The main recipe for a feed mixture	

Experimental Group II	0-49	50	The main recipe for a feed mixture + 2% BSFL
Experimental Group III	0-49	50	The main recipe for a feed mixture + 4% BSFL
Experimental Group IV	0-49	50	The main recipe for a feed mixture + 6% BSFL

Ducklings were weighed weekly to determine the absolute, relative, and average daily weight gain. During the experimental period, duck deaths were recorded daily.

Based on the data of the live weight of young animals, the absolute and relative increments are calculated for the growing periods. The absolute average daily increase is calculated by dividing the difference between the live weight at the end and at the beginning of the experiment period by the number of days of experience, and the relative one according to the Brody formula.

To study the morphological and biochemical parameters of blood and the natural resistance of ducklings, blood sampling in all experimental and control groups was carried out in two stages: the first at the beginning of the experiment and the second at the end of the experiment.

All the data obtained were subjected to biometric processing using the Microsoft office Excel computer program.

The results and their discussion. During all stages of the research, daily clinical examinations were carried out, during which the activity of birds in groups, feed intake, growth, development of ducklings and the safety of livestock were noted. Ducklings were weighed at the same frequency to track the dynamics of live weight.

In the conditions of the West Kazakhstan region, we studied the technology of feeding waterfowl, the chemical composition of feed and feed additives, and based on the experimental data obtained, we created a formula for compound feeds with a balanced diet for feeding experimental groups of ducks and drakes.

According to the data presented in table 2, an analysis of the chemical composition and nutritional value of the feed was carried out, on the basis of which recipes for preparing feed mixtures for ducks of different sex and age groups with the addition of black soldier larvae were compiled.

The analysis of the results showed that the content of exchange energy ranged from 7,3 to 16,2 MJ, and the highest exchange energy was in the larvae of black soldier flies (16,2 MJ) and in soybean meal, with soy there was a slight difference (11,6;11,5 MJ).

Comparatively, the highest crude protein content per 100g is observed in black soldier larvae, technical waste feed, and soybeans (from 218,6 to 506,2 g).

Table 2 – Chemical composition of feed in the West Kazakhstan region

Feed	Typesoffeed												
	1	2	3	4	5	6	7	8	9	10	11	12	13
	Sudan grain	CrushedCorn	Millet	Rye	Sorghum	Barley	Crushedwheat	Soy	Cake	Soymeal	Wheatbran	Sunflowermeal	Thelarva
Exchangeene	9,2	10,1	9,5	9,7	9,8	10,9	11,2	11,5	10,7	11,6	7,3	10,8	16,2
Drymatter,	850	847,3	846,2	860,7	848,7	886,8	837,5	843,8	908	893,8	839,7	890	904,8
Crude	108	96,5	105,7	109	101,2	150,8	118,6	218,6	356,4	387,6	149,6	361,5	506,2

Digestiblep	81,6	65,4	67	72,6	69,2	107,8	78,9	138,3	213,7	231,7	83,6	208,4	303,7
1		2	3	4	5	6	7	8	9	10	11	12	13
Lysine, g	3,6	2,9	2,1	3,8	2,6	5	3,1	41,7	12,6	22,5	3,4	12,1	31,23
Methionine+cyst	3,2	2,6	4,5	3,3	2,3	2,3	4,6	7,6	14,3	11,3	3,8	9,8	14,07
Tryptophan,	1,1	0,9	1,6	0,9	0,6	0,8	1,2	2,7	4,7	2,3	0,6	4,6	7,9
Crudefat,	16,1	33,6	32	17	26,9	25,4	23,9	36,8	56,3	24,4	28,4	32,3	91,4
Crudefiber, g	37	28,2	37	19,7	29,8	27,4	17,6	37,9	98,2	59,4	79,1	106,7	94,54
NES, g	573	663	562	664,4	649	870,4	672	0	224,5	308,4	511	201,3	430,1
Sugar, g	15	22	13	12	39	12,4	18,6	0	56,4	86,4	33	51,4	0
Calcium, g	1,5	0,4	0,8	0,6	0,9	0,8	0,5	3,9	6,3	1,9	1,1	2,7	15,1
Phosphorus,	3,4	3,8	5,3	2,3	3,2	2,8	3,2	6,8	15,1	9,8	9,8	10,8	6,5
Magnesium,g	1,2	2,8	0,8	0,6	0,8	1,9	1,6	2,1	3,7	2,7	3,3	2,60	0

Potassium,g	5,4	4,2	3,6	4,3	2,7	4,7	5	19,7	8,4	16,9	7,8	5,6	0
1		2	3	4	5	6	7	8	9	10	11	12	13
Sulfur,g	1,4	1,1	0,2	0,2	0,2	0	0,1	0,1	4,7	2,5	1,1	1,9	0
Iron,mg	31,8	7,6	33,7	62,5	45,1	1,1	43,9	112	118	203,4	131	282,5	23,7
Copper,m	4,9	6	13,4	6,2	8,6	7,5	6,2	13,1	15,1	14,1	8,5	21,5	90
Zinc,mg	22,5	24,2	27,8	18,9	11,6	28,7	22,6	26	46,6	37,4	53	37,4	19,4
Manganese,mg	20,5	10,7	15,7	29,6	14,5	36,8	47,6	18,6	40,1	31	101,2	16,8	0,06
Cobalt,mg	0,07	0,4	0,01	0,05	0,1	0,4	0,3	0,02	0,14	0,09	0,3	0,21	0
Carotene,mg	1,3	2,1	1,2	0,3	0,9	0	2,4	1,1	2,4	0,08	1,7	0	0

Among grain feeds, soy contains more protein than barley, wheat, millet and corn, respectively, by 67,8 g (31,02%), 100,0 g (45,75%), 112,9 g (51,65%) and 122,1 g (55,86%). An important indicator is the percentage of amino acids such as lysine, methionine and cystine, which have a direct impact on productivity and full development of the body. The highest content of amino acids is observed in larvae and soy (31,23 – 41,7 / 14,07 – 14,3).Based on the data on the chemical composition of feed farms in the West Kazakhstan region, it is possible to make recipes for feed mixtures that will be most effective.One of the conditions for obtaining maximum productivity of poultry is balanced feeding. The diets of birds are based on the physiological needs of the body for nutrients.According to the study of the chemical composition of feed, recipes for feed mixtures forwaterfowl in the Western region of Kazakhstan were compiled.

Table 3– Feeding ration for ducklings aged 1-14 days

Indicators , %	**Groups**			
	Control	**I**	**II**	**III**
1	2	3	4	5
Sudan grain	5	5	5	5

CrushedCorn	16	14	12	10
Millet	5	5	5	5
Rye	3	3	3	3
Sorghum	3	3	3	3
1	2	3	4	5
Barley	10	10	10	10
Crushedwheat	25	25	25	25
Soy	5	5	5	5
Cake	4	4	4	4
Soymeal	12	12	12	12
Wheatbran	5	5	5	5
Sunflowermeal	5	5	5	5
Thelarva	-	2	4	6
Seashell	2	2	2	2
100 g of compound feed contains:				
Exchangeenergy, MJ	1,03	1,04	1,06	1,07
Kcal	246,01	248,40	253,18	255,57
Drymatter, g/kg	84,20	84,31	84,43	84,54
Crude protein, g/kg	17,44	18,26	19,08	19,90
Digestibleprotein(DP),g/kg	11,05	11,53	12,01	12,48
Lysine, g	0,83	0,88	0,94	1,00
Methionine+cystine, g	0,53	0,56	0,58	0,60
Tryptophan, g	0,16	0,17	0,18	0,20
Crudefat, g/kg	2,77	2,88	3,00	3,11
Crudefiber, g	3,91	4,04	4,17	4,31
NES, g	53,89	53,42	52,96	52,49
Sugar, g	2,92	2,87	2,83	2,79
Calcium, g	0,93	0,96	0,99	1,02
Phosphorus, g	0,54	0,55	0,55	0,56
Magnesium,g	0,29	0,28	0,27	0,27
Potassium,g	0,71	0,70	0,69	0,68
Sulfur,g	0,09	0,09	0,09	0,09
Iron,mg	7,42	7,45	7,49	7,52
Copper,mg	0,91	1,08	1,24	1,41
Zinc,mg	2,80	2,79	2,78	2,77
Manganese,mg	3,26	3,24	3,22	3,19
Cobalt,mg	0,02	0,02	0,02	0,02
Carotene,mg	0,13	0,13	0,13	0,12

Thus, for each sex and age group of ducklings of the Medeo breed (Pekin's white) of the West Kazakhstan region, for the period of cultivation for 0-14(table 3) and 14-49days (table 4), a formula of a feed mixture for various experimental groups was developed.

The feed mixture recipe is designed with an optimal feed ratio for easy assimilation by young waterfowl.

The recipe for a feed mixture for young ducklings of the control group consists of 13 components, and the experimental group of 14 components. The difference between the diets consists in the percentage of black soldier larvae input of 2%;4%;6%, and the diet of the control group consists of the main diet.

To determine the effectiveness of using a recipe for feed mixtures for waterfowl in the conditions of the West Kazakhstan region, the growth and development, safety of the duck population of experimental groups were studied.

Important indicators characterizing the level of productivity of young ducks are their live weight and indicators of average daily and absolute gains.

Table 4– Feeding ration of ducklings aged 14-49 days

Indicators , %	**Groups**			
	Control	**I**	**II**	**III**
Sudan grain	3	3	3	3
CrushedCorn	9	7	5	3
Millet	3	3	3	3
Rye	3	3	3	3
Sorghum	3	3	3	3
Barley	7	7	7	7
Crushedwheat	41	41	41	41
Soy	2	2	2	2
Cake	8	8	8	8
Soymeal	13	13	13	13
Wheatbran	3	3	3	3
Sunflowermeal	3	3	3	3
Thelarva	-	2	4	6
Seashell	2	2	2	2
100 g of compound feed contains:				
Exchangeenergy, MJ	1,05	1,07	1,08	1,09
Kcal	250,79	255,57	257,95	260,34
Drymatter, g/kg	84,15	84,26	84,38	84,49
Crude protein, g/kg	17,92	18,74	19,56	20,38
Digestibleprotein(DP),g/kg	11,32	11,80	12, 28	12,75
Lysine, g	0,75	0,80	0,86	0,92
Methionine+cystine, g	0,59	0,61	0,63	0,65
Tryptophan, g	0,16	0,18	0,19	0,21
Crudefat, g/kg	2,76	2,88	2,99	3,11
Crudefiber, g	3,73	3,86	3,99	4,13
NES, g	54,90	54,43	53,97	53,50
Sugar, g	3,11	3,07	3,02	2,98
Calcium, g	0,94	0,96	0,99	1,02
Phosphorus, g	0,55	0,56	0,56	0,57
Magnesium,g	0,28	0,28	0,27	0,26
Potassium,g	0,69	0,68	0,67	0,67
Sulfur,g	0,10	0,10	0,09	0,09
Iron,mg	7,45	7,48	7,51	7,54
Copper,mg	0,88	1,05	1,22	1,38
Zinc,mg	2,77	2,76	2,75	2,74
Manganese,mg	3,66	3,64	3,62	3,60
Cobalt,mg	0,02	0,02	0,02	0,02
Carotene,mg	0,16	0,15	0,15	0,14

Feed additives are currently becoming important in poultry farming due to their wide range of beneficial effects: stimulating growth and increasing productivity, strengthening immunity and protecting health.

The results of the study showed that with the same technology of maintenance, but with different composition of the diet, the live weight of ducks changed in different ways (Tables 5, 6).

Differences in live weight and growth dynamics of young animals aged 1-7 days for ducks and drakes were insignificant, they were almost at the same level.

Table 5– Feeding ration of ducklings aged 14-49 days, ($\bar{X}$±Sx, n=50)

Age, days	Control			I			II			III		
	Drakes											
Возраст	$\bar{X}_{\pm Sx}$	σ	Cv	$\bar{X}_{\pm Sx}$	σ	Cv	$\bar{X}_{\pm Sx}$	σ	Cv	$\bar{X}_{\pm Sx}$	σ	Cv
При рождении	51,12±0,27	1,90	3,72	49,86±0,40	2,83	5,67	52,6±0,51	3,57	6,80	51,40±0,35	2,46	4,78
7 дней	201,40±0,82	5,79	2,88	198,50±0,79	5,57	2,81	201,5±1,09	7,69	3,82	209,60±1,19	8,39	4,00
14	599,56±1,53	10,80	1,80	536,20±2,09	14,76	2,75	612,72±2,34	16,56	2,70	654,82±3,42	24,17	3,69
21	1031,70±3,71	26,27	2,55	1096,88±4,66	32,97	3,01	1174,48±5,56	39,29	3,34	1163,28±6,18	43,67	3,75
28	1458,48±5,41	38,25	2,62	1653,56±6,80	48,08	2,91	1740,84±7,32	51,77	2,97	1709,64±9,21	65,10	3,81
35	1967,24±6,91	48,84	2,48	2205,44±7,25	51,24	2,32	2309,32±8,60	60,81	2,63	2281,10±9,08	64,18	2,81
42	2504,10±8,57	60,61	2,42	2763,02±8,81	62,30	2,25	2890,94±10,40	73,51	2,54	2909,72±11,47	81,08	2,79
49	2971,96±12,95	91,59	3,08	3311,96±14,04	99,26	3,00	3482,4±16,48	116,56	3,35	3675,42±18,03	127,50	3,47
Absolute growth, 0-49 days	2920,84±12,90	91,20	3,12	3262,1±14,12	99,86	3,06	3429,8±16,48	116,51	3,40	3624,02±18,02	127,44	3,52
	Самки											
	$\bar{X}_{\pm Sx}$	σ	Cv	$\bar{X}_{\pm Sx}$	σ	Cv	$\bar{X}_{\pm Sx}$	σ	Cv	$\bar{X}_{\pm Sx}$	σ	Cv
При рождении	49,80±0,23	1,60	3,22	48,6±0,37	2,62	5,39	49,1±0,41	2,89	5,88	49,00±0,25	1,80	3,66
7 дней	189,52±0,73	5,20	2,74	193,46±0,85	5,99	3,10	199,64±1,06	7,49	3,75	204,68±1,80	12,71	6,21
14	487,60±1,44	10,15	2,08	515,46±1,99	14,10	2,74	578,9±2,02	14,26	2,46	619,48±3,27	23,09	3,73
21	986,50±3,40	24,05	2,44	982,26±3,68	26,03	2,65	1004,76±4,64	32,84	3,27	1126,34±5,12	36,19	3,21
28	1425,64±4,96	35,04	2,46	1478,24±5,42	38,35	2,59	1509,36±6,33	44,79	2,97	1663,06±7,31	51,69	3,11
35	1884,12±6,02	42,55	2,26	1978,88±6,34	44,85	2,27	2031,02±7,22	51,03	2,51	2211,52±8,23	58,18	2,63
42	2416,74±7,62	53,85	2,23	2494,52±7,80	55,16	2,21	2557,7±9,68	68,42	2,68	2757,2±10,25	72,51	2,63
49	2839,06±12,43	87,86	3,09	3007,1±13,17	93,15	3,10	3141,9±14,61	103,30	3,29	3311,42±16,52	116,82	3,53
Absolute growth, 0-49 days	2789,26±12,47	88,21	3,16	2958,50±13,16	93,06	3,15	3092,80±14,57	103,05	3,33	3262,42±16,48	116,54	3,57

According to the amount of feed consumed during the 49-day rearing of young ducks, the results obtained generally correspond to the norms of nutrient requirements.

Feeding the larvae of black soldier flies had a positive effect on the intensity of growth, so the live weight of ducklings of the experimental groups exceeded the control group by 49 days of age, males by 210-603,46g; females by 219,24-473,16g. The use of flour from larvae in ducklings' diets allowed to increase the absolute increase, during the period of drake cultivation by 6,74-17,12%; ducks by 7,29-14,50% compared to the control.

Table 6 – Average daily growth ($\bar{x}$±Sx, n=5)

Period, days	Control	I	II	III
	Drakes			
0-7	21,47±0,11	21,23±0,13	21,27±0,19	22,6±0,18
7-14	56,88±0,27	48,24±0,31	58,75±0,36	63,60±0,53
14-21	61,73±0,60	72,95±0,71	73,11±0,81	75,49±0,97
21-28	60,97±0,92	79,53±1,14	69,48±1,41	75,19±1,67
28-35	72,68±1,44	71,70±1,54	82,64±1,60	81,64±1,70
35-42	76,69±1,60	75,37±1,62	88,80±1,98	92,66±2,09
42-49	66,84±2,05	78,42±2,08	81,64±2,84	92,24±2,81
0-49	59,61±0,26	63,92±0,29	67,96±0,34	71,92±0,37
	Ducks			
0-7	19,96±0,12	20,69±0,13	21,51±0,14	22,24±0,26
7-14	42,58±0,23	46±0,32	54,18±0,33	59,26±0,54
14-21	71,27±0,51	73,83±0,55	67,98±0,69	72,41±0,91
21-28	62,73±0,83	70,85±0,93	74,94±1,25	76,67±1,14
28-35	65,50±1,08	71,52±1,15	71,67±1,52	81,21±1,72
35-42	76,09±1,52	73,66±1,37	72,38±1,65	75,10±1,91
42-49	60,33±1,83	73,23±2,07	79,17±2,59	79,17±2,88
0-49	56,92±0,25	61,40±0,27	63,12±0,30	66,58±0,34

The average daily increase prevails in the experimental groups, the highest indicator was in the III experimental group. On average, over the entire period, the average daily increase in the experimental groups was higher among drakes by 6,74%;12,29%; 17,12%, and ducks respectively by 6,30%; 9,82%;14,51%, with the introduction of 2,6% flour from black soldier fly larvae into the diet.

The high growth rate of ducklings of the experimental groups can be explained by an increase in feed consumption. This is probably caused by an improvement in taste and a positive change in the odors of experimental diets, due to the inclusion of flour from the larvae of black soldier flies in their composition, to which the ducks reacted sensitively.

These assumptions can be explained by an increase in the digestibility of experimental diets with an increase in the dose of the administered supplement and observations made during the experiment.

Thus, an increase in body weight gain. The birds that ate the tested additive are due to both the consumption of feed and its higher nutritional value.

By introducing 2-6% flour from larvae into the diet, the most optimal ratio of nutrients can be achieved that meet the physiological needs of ducklings. The different use of feed nutrients by ducklings with increased feed consumption, with an increase in the level of the tested additive in experimental diets, affected the payment for feed products.

Biochemical and morphological characteristics of blood occupy a special place and are very important both in assessing the physiological status of the body, which can be used to judge its protective, transport, regulatory, respiratory, thermoregulatory and other functions, and for modern diagnostics of pathological conditions.

The intensity of protein metabolism in the body can be judged by the change in the amount of total protein and its fractions in the blood.

The studies conducted during the growing process for the protein content in the blood of ducks of the studied groups showed that all of them were within the physiologically normal values.

Table 7–Morphobiochemical parameters at the beginning of the experiment, ($\bar{x}$±Sx, n=20)

Indicators	Control	I	II	III
	Drakes			
Redbloodcells, 10^{12}/l	2,5±0,03	2,51±0,04	2,49±0,07	2,52±0,05
Hemoglobin, g/l	110,16±0,50	113,02±1,16	109,83±0,58	109,69±0,82
Whitebloodcells, 10^{9}/l	21,14±0,30	22,28±0,44	21,10±0,47	23,09±0,68
Colorindicator, cu.	1,67±0,05	1,72±0,05	1,74±0,06	1,71±0,04
Alkalinereserve, mg%	714,52±6,90	726,44±7,47	718,64±8,24	722,52±5,54
Totalnitrogen, mg%	788,92±12,80	823,17±12,98	812,89±10,10	868,26±8,34
Totalprotein, g/l	52,62±0,73	54,52±1,02	54,1±1,12	53,45±1,52
Albumins, %	38,68±0,39	39,63±1,02	39,35±0,97	39,96±0,67
α-globulins	15,20±0,31	16,04±0,48	15,77±0,31	15,14±0,42
β- globulins	12,93±0,40	12,54±0,64	11,71±0,34	13,06±0,76
γ-globulins	45,01±0,51	44,66±0,27	45,12±0,51	43,87±0,44
A/G coefficient	0,53±0,02	0,54±0,01	0,54±0,03	0,55±0,02
Calcium, mmol/l	2,38±0,22	2,46±0,24	2,67±0,31	2,49±0,29
Phosphorus, mmol/l	2,03±0,14	2,23±0,27	2,32±0,19	2,42±0,25
	Ducks			
Redbloodcells, 10^{12}/l	2,47±0,02	2,48±0,05	2,50±0,06	2,36±0,06
Hemoglobin, g/l	108,72±0,40	108,81±0,89	110,50±0,94	112,51±0,98
Whitebloodcells, 10^{9}/l	22,11±0,47	22,78±0,46	22,53±0,56	22,64±0,58
Colorindicator, cu.	1,53±0,06	1,75±0,04	1,62±0,05	1,72±0,06
Alkalinereserve, mg%	729,26±6,05	720,12±6,86	712,28±7,82	724,38±6,80
Totalnitrogen, mg%	767,25±11,15	804,36±10,97	848,22±11,08	825,18±12,25
Totalprotein, g/l	53,31±0,37	53,76±0,91	54,76±1,37	54,40±1,03
Albumins, %	40,54±0,21	41,69±1,14	40,03±0,84	40,52±0,50
α-globulins	15,53±0,27	15,26±0,15	16,35±0,27	15,02±0,24
β- globulins	12,35±0,09	12,36±0,11	11,35±0,47	11,39±0,21
γ-globulins	44,58±0,33	44,54±0,22	44,23±0,54	44,36±0,47
A/G coefficient	0,56±0,04	0,58±0,02	0,56±0,01	0,57±0,03
Calcium, mmol/l	2,54±0,03	2,15±0,18	2,49±0,37	2,50±0,21
Phosphorus, mmol/l	2,13±0,21	2,19±0,17	2,24±0,24	2,14±0,16

The results of the blood serum analysis indicate that feeding flour from larvae had a stimulating effect on protein and mineral metabolism. The slightly increased content of it in ducklings of the experimental groups is probably due to the higher use of nitrogen. At the same time, the increased protein content in the blood serum of ducklings of 1-3 experimental groups compared with the control confirms a higher increase in body weight.

Table 8–Morphobiochemical parameters of ducks at the end of the experiment, ($\bar{x}$±Sx, n=20)

Indicators	Control	I	II	III
	Drakes			
1	2	3	4	5
Redbloodcells, 10^{12}/l	2,69±0,09	2,81±0,03	2,96±0,02	2,99±0,03
Hemoglobin, g/l	109,79±1,70	114,14±0,98	119,27±0,52	120,08±0,26
Whitebloodcells, 10^{9}/l	22,05±0,41	23,87±0,30	25,55±0,19	27,36±0,10

Colorindicator, cu.	1,59±0,06	1,73±0,07	1,76±0,03	1,81±0,01
1	2	3	4	5
Alkalinereserve, mg%	705,22±4,30	722,61±5,66	725,33±4,45	730,12±2,14
Totalnitrogen, mg%	762,39±5,61	845,69±3,28	856,61±4,01	911,17±1,93
Totalprotein, g/l	53,16±0,54	55,21±0,32	57,02±0,39	59,15±0,12
Albumins, %	39,48±0,29	42,03±0,11	43,28±0,14	46,21±0,09
α-globulins	14,27±0,33	16,47±0,28	17,54±0,20	17,91±0,11
β- globulins	11,09±0,28	11,98±0,33	12,28±0,19	13,69±0,08
γ-globulins	44,61±1,01	44,59±0,98	45,10±0,42	47,32±0,55
A/G coefficient	0,56±0,05	0,58±±0,03	0,58±0,04	0,59±0,02
Calcium, mmol/l	2,21±0,06	2,39±0,04	2,88±0,05	3,26±0,02
Phosphorus, mmol/l	1,90±0,13	2,21±0,96	2,49±0,61	2,39±0,20
	Ducks			
Redbloodcells, 10^{12}/l	2,72±0,10	2,75±0,05	2,88±0,01	2,89±0,04
Hemoglobin, g/l	109,5±2,10	110,28±1,87	116,73±1,48	118,11±1,01
Whitebloodcells, 10^{9}/l	21,96±0,39	23,51±0,21	24,32±0,28	26,02±0,15
Colorindicator, cu.	1,46±0,08	1,70±0,05	1,68±0,03	1,74±0,01
Alkalinereserve, mg%	711,34±3,60	721,66±4,22	726,07±2,18	728,18±1,39
Totalnitrogen, mg%	756,64±4,13	829,73±2,11	842,22±3,09	867,27±2,01
Totalprotein, g/l	54,22±0,51	54,28±0,35	56,60±0,24	58,48±0,19
Albumins, %	38,15±0,32	41,98±0,44	42,39±0,17	44,01±0,10
α-globulins	14,88±0,11	15,89±0,09	16,13±0,06	16,39±0,03
β- globulins	11,67±0,14	11,77±0,05	12,01±0,08	12,64±0,01
γ-globulins	43,08±0,94	44,29±0,38	44,93±0,29	45,27±1,03
A/G coefficient	0,55±0,08	0,58±0,06	0,58±0,04	0,59±0,03
Calcium, mmol/l	2,05±0,03	2,20±0,05	2,46±0,02	2,98±0,01
Phosphorus, mmol/l	1,87±0,04	2,06±0,03	2,33±0,01	2,27±0,02

In an increase in the albumin fraction in the blood serum of ducklings of the experimental groups, with a higher content (39,96%) in ducklings of group 3, there were no regular changes in the composition of alpha, beta and gamma globulin fractions of the blood serum of ducklings of the experimental groups.The level of calcium and phosphorus in the ducklings' blood serum was in the range of 2,38-2,67 mg% and 7,90-9,65 mg%, respectively, an increase in calcium content by 2,03-2,42 mg% in the blood serum of ducklings of experimental groups, which is due to the high availability of calcium compounds.

The quantity and quality of meat obtained from ducks depend on ensuring their nutritional needs, which is determined not only by their presence in the diet, but also by the degree of their assimilation by the body. The assessment of the compliance of experimental compound feeds with the nutritional needs of poultry can be carried out based on the analysis of data on their transformation in the body during digestion and assimilation. The difference in the release of nutrients from the litter with the same intake in the body of ducks allowed us to calculate the digestibility coefficients presented in the table.

Table 9– The coefficient of digestibility of nutrients ($\bar{x}$±Sx, n=5)

Indicators, %	**Experimentalgroups**							
	Control		**I**		**II**		**III**	
	Drakes	Ducks	Drakes	Ducks	Drakes	Ducks	Drakes	Ducks
1	2	3	4	5	6	7	8	9
	7-14 days							
Drymatter	59,4± 0,41	58,7± 0,52	60,2±0,47	59,8±0,38	62,1± 0,44	61,6± 0,63	62,8± 0,55	61,9± 0,42

Crude protein	72,1± 0,33	70,2± 0,50	74,3±0,43	73,1±0,59	76,2± 0,41	74,3± 0,60	75,3± 0,37	74,2± 0,45
1	2	3	4	5	6	7	8	9
Crudefat	76,1±0 ,48	75,4±0, 55	77,2±0,55	76,6±0,72	79,0±0, 85	78,8±0, 78	81,1±0 ,47	80,4±1 ,01
Crudefiber	20,2±0 ,15	19,1±0, 25	21,2±0,18	20,4±0,24	24,5±0, 17	22,1±0, 21	23,6±0 ,34	23,1±0 ,17
NES	81,0±3 ,92	80,3±4, 02	83,3±3,95	81,7±3,71	83,9±2, 98	82,4±3, 03	84,2±2 ,11	82,6±1 ,56
	35-42 days							
Drymatter	62,7±0 ,35	60,3±0, 41	62,9±0,28	61,5±0,30	65,3±0, 29	63,1±0, 43	67,5±0 ,32	66,6±0 ,25
Crude protein	76,2±1 ,19	75,9±2, 13	77,7±1,55	76,3±1,38	79,2±0, 88	78,8±0, 92	80,4±0 ,56	79,6±0 ,77
Crudefat	80,2±1 ,23	79,5±0, 98	83,5±0,85	82,4±0,77	84,8±0, 55	83,3±0, 61	86,6±0 ,44	85,7±0 ,36
Crudefiber	20,5±0 ,29	19,8±0, 41	22,3±0,35	21,3±0,24	25,1±0, 51	23,7±0, 35	25,5±0 ,25	24,3±0 ,19
NES	80,0±1 ,89	79,9±1, 61	83,8±1,56	82,1±1,44	84,2±1, 24	83,8±1, 32	86,1±1 ,01	85,3±1 ,20

The results of physiological studies conducted on ducklings of different ages indicate a high digestibility of feed nutrients, regardless of the growing period. The data obtained in physiological studies indicate the superiority of experienced ducklings in the digestibility of nutrients over their control peers.

Conclusion. Scientific research in recent years has significantly expanded our understanding of the nutritional needs and conditions of waterfowl. The results show that properly selected diets and optimal housing conditions can significantly increase productivity and improve the health of birds. The introduction of the latest feed additives and improvement of housingconditions should become priority areas for breeding waterfowl in the coming years.

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ТҮЙІН

Құс өнімдеріне әлемдік сұраныс артып келе жатқандықтан, құс шаруашылығы үлкен қиындықтарға да, жаңа мүмкіндіктерге де тап болады. Осылайша, бұл мақалада баламалы азыққа, дәл технологияға, қалдықтарды басқаруға және инновациялық азық көздеріне ерекше назар аударатын тұрақты құс шаруашылығына жан-жақты шолу және зерттеу берілген. Жануартектес ақуызына өсіп келе жатқан әлемдік сұраныс ақуыздың балама көздерін зерттеудің шұғыл қажеттілігін көрсетеді. Жаңа балама ақуыздардың азықтық қасиеттерін зерттеу азық өнеркәсібі үшін және оларды тұтынушылар мойындауы үшін өте маңызды. Бұл зерттеу химиялық талдауды және суда жүзетін құстардың негізгі азықтың амин қышқылдарының құрамының қолжетімділігін зерттеді. Қарасарбаз шыбын дернәсілдерінің көздерінен алынған балама ақуыздар амин қышқылдарының бай құрамын және ас қорытудың әртүрлі механизмдерін көрсетеді, бұл оларды болашақта қоректік азықтың құрамы ретінде

қолдану мүмкіндіктерін кеңейтеді, бұл жануарлар ағзасындағы ақуыз тапшылығының орнын толтыруға және балық ұнына уыстыруға ықпал етеді, нәтижесінде импорттық азық тәуелділіктің төмендеуіне әкеледі. Осыған байланысты ақуыздың балама көздеріне көшу шұғыл қажеттілікке айналды. Бұл зерттеудің мақсаты - бұл балама ақуыздарды жануартектес ақуыздардың өміршең алмастырғыштары ретінде бағалау, олардың азықтық қасиеттері мен болашақта азық қоспасы ретінде пайдалануды оңтайландыру әлеуетін атап көрсету.

РЕЗЮМЕ

Поскольку мировой спрос растет на продукцию птицеводства, птицеводческая промышленность сталкивается как с серьёзными проблемами, так и с новыми возможностями. Таким образом, в данной статье представлены всесторонний обзор и исследование устойчивого птицеводства, в котором особое внимание уделяется альтернативным кормам, точным технологиям, управления отходами и инновационным источникам корма. Растущий мировой спрос на животный белок подчеркивает острую необходимость изучения альтернативных источников белка. Изучение питательных свойств новых альтернативных белков имеет жизненно важное значение для кормовой промышленности и признания их потребителями. В этом исследовании изучались химический анализ и доступность аминокислотного состава основных кормов для водоплавающих птиц. Альтернативные белки из источников личинок мух черной львинки демонстрируют богатый аминокислотный состав и различные механизмы переваривания, что расширяет возможности их применения в качестве питательных пищевых ингредиентов в будущем, что способствует восполнения дефицита белка в организме животных, и замене рыбной муки, в следствие которого приведет к уменьшению зависимости от импортных кормов. В связи с этим переход к альтернативным источникам белка стал насущной необходимостью. Цель данного исследования - оценить эти альтернативные белки как жизнеспособные заменители белков животного происхождения, подчеркнув их питательные качества и потенциал для оптимизации использования в пищевых продуктах в будущем.

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EVALUATION OF GENOTYPE OF BREEDING BULLS BY PROGENY QUALITY

ANNOTATION

By examining the genealogical structure of the herd, lines with ancestors obtained through intra-line breeding were carefully chosen. The daughters of VISION-GEN MAURY-ET bull demonstrated the highest milk yield for 305 days of lactation, producing 7177.5 kg, which was 106.4 kg more than the average for all bulls. The daughters of HAMMER-CREEK OB KEYBOARD-ET excelled in protein-milk yield, surpassing other bulls by 0.44% and the breed standard by 0.54%. VISION-GEN MAURY-ET proved to be a significant milk yield improver, while LOCKER-LANE RW BANNING'S daughters excelled in fat-milking and HAMMER-CREEK OB KEYBOARD-ET's daughters were known for their protein-milking improvements. Studies have revealed that cows of the REFLECTION SOVEREIGN line demonstrated the highest milk production, yielding an average of 7409 kg of milk with a fat content of 3.62% and a protein content of 3.22%, while maintaining an average weight of 547 kg. The research also showed that as the live weight of cows increased, so did their milk yield, with a peak yield of 7774.8 kg achieved by cows weighing 562 kg in the REFLECTION SOVEREIGN line, surpassing their WIS BURKE IDEAL counterparts by 221.4 kg. Furthermore, the milk ratio of cows increased with their live weight, and the milk content coefficient of cows from the REFLECTION SOVEREIGN line was 1383.4 kg, exceeding that of the WIS BURKE IDEAL line by 2.6 kg.

Key words: *Genotype, Breeding, Lactation period, fat, protein, milk*

Introduction. Cows of Holstein breed are mostly black and motley, with black marks. There are animals of black colour, with small marks on the lower part of the trunk, limbs, tail brush and head. Occasionally there are animals of red-and-variegated suit. Height at the withers in adult cows is on average 144 cm, two-year-olds are 143, bulls are 158-160 cm. Chest in cows is deep to 86cm, wide enough to 65cm; the posterior part of the trunk is long, straight and wide (the width of the task in mukluks is 63 cm). Height at the withers of heifers by the age of 15 months reaches an average of 123cm, by 18 months is approximately 126cm. The udders of the Holstein cows are mostly bath-shaped and cup-shaped, characterized by a large capacity. Its index is on average 45-46% (fluctuating 38.4-61.3%). For a day with a double milking from the cows receive 60-65kg of milk or more. The maximum milk yield varies from 3.21 to 3.51 kg per minute.

In his studies, V.F. Gridin, RS Tyagunov [1] compared the milk productivity of cows of German and Hungarian breeding in the Southern Urals for 3 lactations. Considered the milk yield for 100, 200 and 305 days of lactation, as well as the fat content of milk and the yield of milk fat. It is established that the dairy productivity of cows of German breeding is higher than that of their peers from Hungary.

G.P. Kovalyeva, N.V. Sulyga [2] note that in the new ecological conditions the cows of Holstein black-and-white breed of Hungarian breeding realized their potential at a sufficiently high level.

V.V. Lyashenko, I.V. Sitnikova [3] came to the conclusion that, in the conditions of the Penza region, with the adoption of the adopted intensive technology of keeping and feeding cattle on a modern dairy farm, the cows of the Holstein breed of different breeding receive high rates of milk productivity. The best indicators were animals of Dutch breeding.

When breeding Holstein, much attention is paid for testing and evaluation of bulls-producers on the quality of offspring and the maximum use of bulls-enhancers [4].

Due to its high quality Holstein cattle became world famous and widely imported to many countries of the world. The import of this livestock from the USA and Canada was particularly wide-spread since the late 1970s [5].

Breeding cattle along the genetic lines is an important element of pedigree work with cultivated breeds. This is the highest and most progressive form of conducting breeding work. The method is based on the established phenomenon of increased resistance in the transfer of hereditary qualities to individual animals in their offspring [6].

In dairy cattle breeding, livestock breeding along the lines pursues the solution of two tasks. The first is the transfer to several generations of offspring inherent in the ancestor of the makings of high milk productivity. Among the bulls tested for the quality of the offspring are comparatively rare, there are improvers, in which their daughters outperform their peers in milk or other characteristics by 15-20% or more. It is this manufacturer that can become the ancestor of a new line. The second task is to obtain in the commodity herds a positive effect from the use of bulls-improvers, and also to obtain

interlinear heterocyst, using the alternation of unrelated lines created in breeding plants. The factory line with the appropriate selection can exist for 4-5 generations, and then it translates into a genealogical line, because the influence of the ancestor practically disappears [7].

Breeding along the genetic lines is the main element of the advanced selection, the organizational measure of the necessary qualitative differentiation and genealogical structuring of the herd. Due to the isolation of individual genomes, representatives of different lines have a specific productivity [8]. Therefore, it is necessary to identify the most desirable genotype, which will ensure high dairy productivity of Holstein cattle and will not entail a decrease in the reproductive capacity of cows.

The highest form of breeding is line breeding, which is a selection and selection system that provides the creation of valuable groups of animals and their rational use for improving herds, arrays, and rocks [9].

In modern breeding of dairy cattle, great importance is attached to the development and improvement of methods for assessing the breeding value of bulls, since in conditions of widespread use of artificial insemination, the increase in milk productivity in populations largely depends on the genetic potential of the producers. The fullest idea of the genetic value of producers can be obtained only on the basis of their test for the quality of offspring. All other estimates are preliminary due to their low accuracy. One of the decisive conditions for qualitative improvement of dairy herds is the intensive use of high-value bulls-improvers [10].

According to M.M. Shepkin [11] pushes the breed forward not by the average producer, but by a specimen that stands out among the relatives, beating them either with their own forms and qualities, or with a special ability to give in the offspring animals overtaking the established average type. Lines come from such ancestors and are usually called by their name. They differ in that they are especially often found exclusively high-yielding animals.

I.N. Tuzov, A.A. Tsybulkina [12], having carried out research in the farm of the Kolos CJSC in the Kanevsky district of the city of Krasnodar on a herd of Holstein breed, reported that cows belonging to the Reflection Sovereign line grow and develop better than their peers belonging to the Wis Burke Aidial line. From the cows of the Reflection Sovereign line, a higher milk production was obtained.

M.A. Kokhanov, A.V. Ignatov [13], after analyzing the dairy productivity of Holstein cows in the conditions of the "Irrigated" breeding farm of the Sovetskiy district of Volgograd, concluded that the "line" factor had a significant effect on the milk yield of first-calf cows. At the same time, the maximum milk productivity in the herd was established in the cows of the Reflection Sovereign line.

K.K. Kulibekov [14], studying the dairy productivity of the Holstein breed of different lines, came to the conclusion that linearity has a significant effect on milk productivity and the physico-chemical parameters of milk.

According to TA. Kadiyeva, T.A. Chohataidi, A.N. Karapetyants, M.M. Khubaeva [15], the average milk yield for lactation in the cows of the Reflection Sovereign line exceeded animals from the Vis Vidal line by 299.6 kg of milk, or 4.1%, and from the Montvik Chiftein line by 357.4 kg, or 7.4%.

E.F. Liskun [16] noted that there is no breed that is not associated with several nicknames of outstanding producers, who, with their offspring, move forward the entire mass of animals of this breed.

When breeding along lines, there is a unity of such opposing methods as homogeneous and heterogeneous selection, as a result of which it becomes possible not only to retain in the offspring of the ancestor its valuable qualities, but also to create animals even more valuable than the ancestor himself. Well this thought was expressed by DA. Kislovsky: "The goal of breeding along the lines is to get the best, based on good enough" [17].

An important element of breeding work with any breed is breeding along lines, since each of them has its valuable qualities. Lines - a kind of tool of production, skillfully using which, you can correct those or other shortcomings and develop other characteristics of the herd and, ultimately, the entire breed.

Intensive use of Holstein bulls improved from the USA and Canada, as well as producers obtained through their own reproduction, made it possible to create a new, more productive type of dairy cattle in Germany in a relatively short time. Unlike the North American Holstein cows, this

cattle is characterized by a high fat content in milk (4%). Animals have acquired distinct features of specialized dairy breed, they have significantly increased milk yields, the form and functional properties of the udder have improved, limbs and hoof horn have been strengthened [18].

It should be noted that the Holstein breed has good acclimatization qualities and adaptive abilities, which is evidenced by the preservation of genetic variability and high milk productivity in various natural and climatic conditions of our country.

The ability of the body to maintain a certain level of resistance, that is, to be adapted to the action of various factors, including those of extreme nature, is determined, including by nonspecific resistance of the organism.

Adaptation is ability of the metabolism of an animal to adapt to the new conditions of its life. Adaptability of living beings to new conditions is very high. One way to identify the boundaries of life is to study the metabolism that determines the resistance of the organism to unusual environmental factors and the ability of animals to adapt to them.

As noted by D.M. Kolobkov, N.V. German, T.A. Shepeleva [19], B.P. Mokhov, E.P. Shabalin [20], Holstein cattle perfectly adapts in different natural and climatic conditions of the Russian Federation and near abroad. The good adaptability of Holstein cattle brought from Austria in the natural and climatic conditions of the Middle Volga region is indicated by B.P. Mokhov et al. [20].

Resistance is understood as the hereditary ability of an organism to resist the effects of unfavorable factors of the external and internal environment. It is determined by the physico-chemical state, the properties of biochemical systems and processes, the stability of proteins, enzymes and other substances, and the ability of the animal to change its functions.

Adaptive qualities and resistance of the organism of hybrid animals were evaluated by a number of authors by studying hematological and biochemical parameters of blood [21,22].

In 2011, the level of milkiness of Holstein's herds of Hungary exceeds 8700 kg of milk and according to the statistics of the international organization ICAR this result is the second in Europe. In 2011, 39 farms milked 10 000 kg of milk and more, including five more than 11 000 kg, three for more than 12 000 kg for 305 days of lactation. The average number of "ten-thousand" farms is 593 cows, only on five farms the size of cows is less than 100 head. A wide range of specialists know that the quantity of milk produced depends on the quantity and quality of the feed. Naturally, the best farms harvest excellent, high-grade fodders and feed dairy cattle on scientifically grounded recipes.

At the artificial insemination stations, bulls of modern lines are tested and evaluated for the quality of the offspring, many of them are estimated by Interbull to be a super elite of the world Holstein-Friesian cattle.

In Finland, the Holstein cattle breed was imported in the 1960s from Sweden and Denmark. Currently, the Holstein population is more than 40% of the country's dairy population. The average milk yield in 2014 was 9707 kg (9,689 kg of milk of basic protein and fat content - ECM). The fat content of milk averages 3.96% and protein 3.31%. The average weight of Holstein cattle is about 648 kg. As of mid-2015, 29 cows with a lifetime milk yield of more than 150 tons of milk have been registered in a special section of the Holstein Breeding Book.

The organization Interbul recognized the Holstein cattle of Finnish breeding as the best population due to its reproductive qualities. Holstein cows need only 1.8 inseminations for a safe pregnancy. For the Holstein breed of Finnish breeding, in comparison with the Holstein breed of other selections, light calving is characteristic. Cows of this breed are capable of calving without outside help and bringing a viable offspring. More than 95% of calves survive after birth.

About 40% of the insemination of the Holstein cows population is carried out by the seed of young producers to ensure testing of a large number of offspring with sufficient accuracy. Finland tests about 55 bulls of Holstein breed per year. The number of test doses is about 1,300 doses, which are used in dairy herds. Large groups of offspring are the basis for high accuracy in assessing the characteristics of the breed in terms of health and productivity. About 50% of cows are inseminated with the best bulls and cows that are unsuitable for dairy breeding are crossed with meat bulls to create crosses for effective meat production [23].

The analysis of literature sources shows that the potential of dairy productivity of the Holstein breed is widely and successfully sold abroad and in the economies of our country.

Materials and methods. The experimental part of the work was carried out with the data of 2017 to 2018 years by staging scientific and economic experiments on high-yielding cows in the conditions of breeding farm LLP «Bek +» Fedorovsky district of Kostanay region.

During the study period, the animals were under the same feeding and housing conditions. Feeding was carried out according to the rations accepted in the farm, made taking into account the lactation period, milk productivity, live weight and physiological state [24].

Information about animals is recorded in the animal identification system and presented in the information analytical system database. The farm keeps primary zootechnical records, has all supporting documents (pedigree certificates, pedigree cards), keeps a register of litter and growing of young animals, etc.

All numerical material will be processed biometrically using the methods of variation statistics by M. A. Plokhinsky (1980) and E. K. Merkurieva (1970) using Microsoft Excel spreadsheet editor. K. Merkurieva [1970] using Microsoft Excel spreadsheet editor (1970) [25].

Linearity of cows using the DairyBulls.com International Bull Evaluation System. The U.S. Department of Agriculture, the U.S. breed associations and the

«The Canadian Dairy Network (CDN [C-DN])» perform and publish genetic evaluations of dairy bulls for transmitted progeny performance and type three times a year in January, April and August. The same schedule is followed by the reports of the international bull evaluation service Interbull, which collects data from 22 countries to genetically evaluate bulls of six breeds: Ayrshire, Brown Schwyz, Gernsee, Jersey, Holstein and Simmental. In addition, Interbull coordinates the international type evaluation process for three breeds: Holstein, Jersey and Brown Schwyz. Interbull then provides each participating country with the breeding value indices (MACE [Mace] values) of each bull under the respective national genetic ranking system. The official Canadian and U.S. organizations, in turn, supply this data to DairyBulls.com. In this way, the father's stock name can be used to determine the lineage of the daughter.

Results and discussion. The research was conducted in the herd of Holstein cows of "Bek+" LLP. During the study period Alta Asia company presented the seed of 107 bulls-producers. All bulls-producers, seed of which is used in reproduction of breeding herd, are listed in the catalog of the international evaluation system DAIRY INTERBULLS.

The progeny of bulls were evaluated by comparing the productivity of their daughters with the productivity of daughters of other bulls. For this purpose, milk productivity of cow-daughters of 2 bulls of Holstein lines producers was studied: HAMMER - CREEK OB KEYBOARD-ET (501H10814) and LOCKER-LANE RW BANNING of ROSAFE SOVEREIGN SUPREME; PINE-TREE MARTHA SHOLTEN-ET and VISION-GEN MAURY-ET (USA 62555627) of Wis Burke Ideal, and ERBACRES DAMION and SOLLIEN GRANDVIEW-ET of Osborndale lvanhoe (Table 1).

Table 1 – Milk productivity of cows - daughters of individual bulls

Bull breeders	n	Milk yield, kg	Mass fraction, %	
			Protein	Fat
In 305 days of lactation				
ROSAFE SOVEREIGN SUPREME				
1	2	3	4	5
HAMMER-CREEK OB KEYBOARD- ET	26	6664,2	3,66±0,05	3,45±0,02
LOCKER-LANE RW BANNING	35	6952,4	3,22±0,03	3,67±0,06
WIS BURKE IDEAL				
VISION-GEN MAURY-ET	20	7177,75	3,17±0,05	3,42±0,03
PINE-TREE MARTHA SHOLTEN-ET	31	6834,4	3,15±0,02	3,45±0,07
OSBORNDALE IVANHOE				
ERBACRES DAMION	4	7012,2	2,96±0,04	3,61±0,04

SOLLIEN GRANDVIEW-ET	13	6418	3,18±0,08	3,54±0,05
In 100 days of lactation				
ROSAFE SOVEREIGN SUPREME				
1	2	3	4	5
HAMMER-CREEK OB KEYBOARD- ET	26	2184,59	3,66±0,07	3,45±0,06
LOCKER-LANE RW BANNING	31	2567,5	3,43±0,06	3,65±0,04
WIS BURKE IDEAL				
VISION-GEN MAURY-ET	29	2602,4	3,58±0,03	3,63±0,03
PINE-TREE MARTHA SHOLTEN-ET	27	2184,39	3,13±0,02	3,58±0,01
OSBORNDALE IVANHOE				
ERBACRES DAMION	4	2343,2	3,27±0,01	3,67±0,08
SOLLIEN GRANDVIEW-ET	13	2381,6	3,53±0,04	3,65±0,05

By milk yield for 305 days of lactation (Table 1) the best were the daughters of the bull VISION-GEN MAURY-ET, their productivity amounted to 7177.5 kg, which is 106.4 kg more compared to the average for all bulls.

The highest productivity of daughters for 100 days of lactation was characterized by the bull VISION-GEN MAURY-ET (2602.4 kg of milk), which exceeded the productivity of daughters of other bulls on average by 52 kg.

The daughters of HAMMER-CREEK OB KEYBOARD-ET (3.66%) were the best in protein-milk percentage for 305 days of lactation, which is 0.44% ($P<0.05$) more than the mass fraction of protein in milk of daughters of LOCKER-LANE RW BANNING, and 0.54% more than the average for all bulls. PINE-TREE MARTHA SHOLTEN-ET daughters also had the lowest percentage of protein in milk over 100 days at 3.13%.

It was found that daughters of the bull LOCKER-LANE RW BANNING were characterized by high fat milk yield in 305 days of lactation (3.67%), which exceeded the mass fraction of fat in milk of daughters of ERBACRES DAMION by 0.06%, and SOLLIEN GRANDVIEW-ET and PINE-TREE MARTHA SHOLTEN-ET by 0.13% and 0.22%.

A similar trend is observed in daughters of bulls ERBACRES DAMION and SOLLIEN GRANDVIEW-ET for 100 days of lactation were also characterized by high fat-milk yield (3.65-3.67 %), which significantly exceeded the mass fraction of fat in milk of daughters VISION-GEN MAURY-ET - by 0.04%, PINE-TREE MARTHA SHOLTEN-ET - by 0.09%.

If to arrange bulls - producers in the order of increasing fat yield of their daughters for 305 days of lactation, this order is also preserved in terms of protein content in milk. Although it is necessary to note the difference in milk protein content in progeny with equal fat content. For example, the mass fraction of fat in milk of HAMMER-CREEK OB KEYBOARD-ET and PINE-TREE MARTHA SHOLTEN-ET daughters is the same - 3,45 %, and the mass fraction of protein in HAMMER-CREEK OB KEYBOARD-ET daughters is higher by 0,51 %.

When evaluating the bull VISION-GEN MAURY-ET by the comparative method after analyzing the obtained data, it can be concluded that he is a milk yield improver in comparison with the breed standard and with analogues. The daughters of the bull LOCKER-LANE RW BANNING are fat milkers and the daughters of the bull HAMMER-CREEK OB KEYBOARD-ET are protein milkers.

The main direction of cattle breeding development is to increase the genetic potential of animal productivity and the degree of its implementation. Breeding work should be carried out in farms of all categories and go towards the creation of highly productive herds that ensure the profitability of the industry. Advances in dairy cattle breeding made it possible to obtain from the cow a quantity of milk that is several times higher than the required amount for calf feeding.

One of the most important conditions for increasing milk production and improving the efficiency of dairy cattle breeding in the country is the qualitative improvement of existing lines, increasing their genetic potential. Currently, this is achieved largely due to the widespread use of the best domestic breeds and resources of the world gene pool.

Dairy productivity of cows is the main economic and breeding feature in the selection of cattle for further breeding and use. Milk production is characterized by the quantity and quality of milk produced over a period of time.

Dairy productivity of cows is due to many factors affecting the milk yield of cows. These factors may be hereditary or non-hereditary.

Table 2 – Milk productivity of breeding flock of LLP "Bek+" in lactattions

Indicators	Line		
	REFLECTION SOVEREIGN		
Number of animals, head	177	278	19
Milk yield for 305 days of lactation, kg	7462,8±102,9	7513,0±197,4	8140,8±174,37
Fat content, %	3,61±0,02	3,62±0,04	3,61±0,04
Protein content, %	3,21±0,01	3,24±0,02	3,22±0,02
Live weight, kg	547,03±4,01	544,48±6,39	552,21±7,04
Milking capacity coefficient, kg	1364,3±16,7	1381,2±21,4	1474,7±18,6
	WIS BURKE IDEAL		
Number of animals, head	88	223	14
Milk yield for 305 days of lactation, kg	7751,7±548,5	7627,8±250,6	7776,3±2243,9
Fat content, %	3,58±0,08	3,61±0,06	3,60±0,04
Protein content, %	3,28±0,08	3,19±0,02	3,17±0,03
Live weight, kg	528,42±23,4	537,19±8,1	544,96±7,1
Milking capacity coefficient, kg	1468,1±15,6	1420,4±12,7	1429,4±22,3
OSBORNDALE IVANHOE			
Number of animals, head	-	25	-
Milk yield for 305 days of lactation, kg	-	7500,7±270,07	-
Fat content, %	-	3,60±0,06	-
Protein content, %	-	3,18±0,02	-
Live weight, kg	-	539,42±9,5	-
Milking capacity coefficient, kg	-	1390,4±19,6	-

From the analysis of table 2, it can be seen that the highest productive peak is the age of the cow, which accounts for 3 lactation.

The main part of the breeding stock in bek+ llp belongs to the reflection sovereign line 474 heads or 57.5% of the total livestock.

The next largest line is wis burke ideal, the share of which is 39.4%.

And only a small part of the breeding stock of 3.1% accounted for the line mantic chieftain.

When analyzing the productive qualities of cows of different lines, it was found that cows of the reflection sovereign line had the best results in dairy production. From them, an average of 7409 kg of milk with a mass fraction of fat 3.62%, and a protein content of 3.22%, with a live weight of an average of 547 kg.

The main breeding characteristics of dairy productivity of cattle are the value of milk yield, fat and protein content in milk. Such features as milk yield, fat content and protein content of milk are important in the selection of dairy cattle, so the analysis of their relationship is not only theoretical, but also of great practical interest.

The study and use of the productivity potential of the world's best dairy breeds is one of the priorities. In recent years, our country has carried out mass Holstein cattle of domestic breeds, often without sufficient study of the effect of crossing on the quality of milk and dairy products.

The main indicator that characterizes the level of milk production of cows is the value of their milk yield, which largely determines the total production of the main components of milk produced by the cow for lactation.

According to many scientists, the level of milk production and composition of cattle milk depend on the following factors: origin, breed, age, physiological state, season, content and feeding.

The level of milk production and the chemical composition of milk depend on the lactation period and may vary depending on the season of the year, which falls on a particular period.

Features of production of cow's milk are characterized by lactation curve, which varies in different cows and is influenced by a set of factors (feeding conditions and method of maintenance, type of animal, its individual characteristics, physiological state, etc.). At the same time, the General dynamics of milk yield during lactation is such that in the first months of milk yield increases, and then, with the onset of pregnancy, they decrease, and this happens with different intensity in different individuals.

When considering the lactation change of milk yield is seen about a close trend in the dynamics of milk yield. This situation necessitates a more detailed analysis and evaluation of lactation changes in the value of milk yield in certain months of lactation.

The nature of the lactation curve depends on the maximum daily yield, the subsequent degree of its reduction and the duration of lactation. The figure shows the lactation curves of average indicators of milk yield of cows in the study groups.

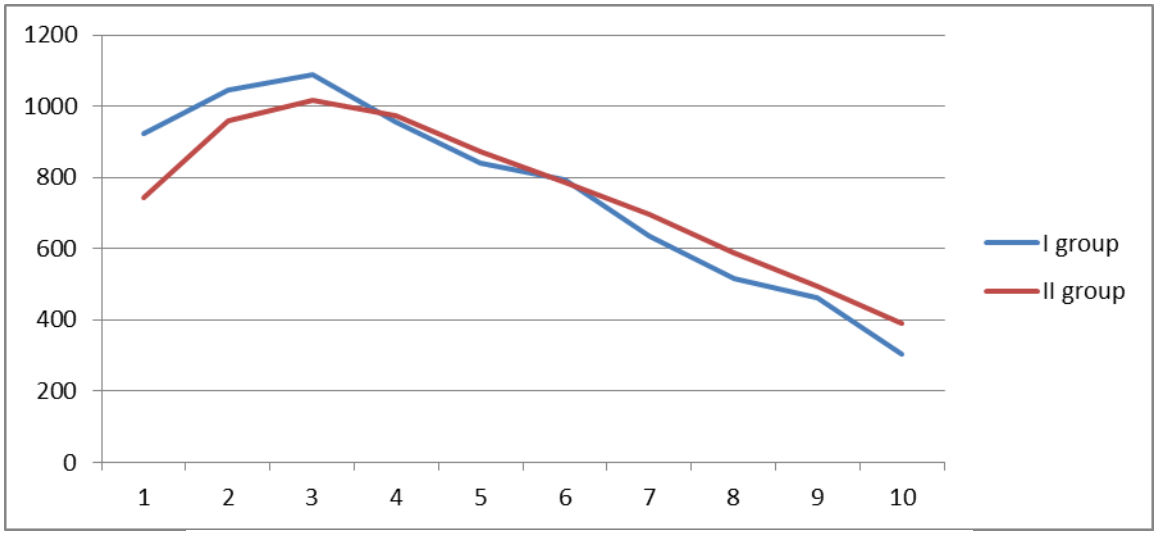

Figure 1 – Lactation curve of milk yield of cows in studied groups

In cows of group I in a significant part of the lactation months observed higher compared with cows of other groups of milk yield and more leveled lactation. Starting lactation with the highest in comparison with other groups of milk yield (543.8 kg in the first month of lactation), cows in this group, it increased to 716.2 kg in the third month of lactation, it rose during the first three months, after which it began a gradual decrease by the end of lactation. Such lactation dynamics of milk yield in cows of this group is most likely due to the fact that the first two-thirds of lactation occurred during periods, fodder and external conditions of which had a positive impact on the productivity of cows. After a period of separation they coincided with the spring and clearly manifested characteristic cows relatively high secretory activity of the breast in these months of mid-lactation, which led to high yields and a more uniform course of lactation. Cows of group II are uniformly increased yield in the first three mascapone calving, some time they are kept at a high level, and then begins to decrease: first — smooth, and with the onset of pregnancy and the end of lactation is more dramatic. The highest peak of lactation is observed in the third month of lactation

The rise in productivity for all groups of cows was observed in the pasture period-the peak falls on June-July. This is due to the more complete feeding provided by pasture grass. Further in the following month of lactation there is a sharp decline in milk yield. The decline in milk yield in the autumn, related to changes in the composition of the feed and the approaching end of lactation. As it

turned out, the highest monthly milk yield of cows of all studied lines reached in the second and third month of lactation, this is due to the manifestation of regularity - the increase in milk yield after calving.

For cows I and II groups characterized by high, uniform and stable lactation activity. They are characterized by a high level of milk yield and their long-term stability during lactation. The top of the lactation curve of cows of the I group was out of reach for other groups of animals. The most valuable animals are those with a leveled type of lactation and milk yield are kept at a fairly constant level for most of the lactation period. The tops of lactation curves of cows of lines Wis Burke Ideal and Reflection Sovereign are marked on the third month of lactation. At selection and selection preference is given to animals not only with a high daily yield, but also a stable lactation curve. They give a large lifetime milk yield and have a longer period of production use.

Transfer of dairy cattle breeding on an industrial basis requires significant improvement of selection and breeding work, which should be aimed at creating herds that meet the requirements of highly mechanized farms.

Table 3 – Milk productivity of cows of studied groups

Indicators	Line	
	Reflection Sovereign	Wis Burke Ideal
Milk yield for 305 days of lactation	7774,8±206,8	7553,4±194,6
Fat content , %	3,65 ±0,05	3,61±0,07
Milk fat, kg	234,7±9,3	252,8±11,2
Protein content , %	3,27±0,04	3,24±0,08
Milk protein, kg	270,3±5,5	248,6±6,8
Live weight, kg	562±14,5	547±13,1
Coefficient of milk yield, kg	1383,4±38,7	1380,8±42,9

An important factor affecting the protein and fat content in cow's milk is heredity, which is caused by breeding methods. The main method of creation of highly productive herds – the selection of the tribe of individual animals, the selection of producers with high content of fat and protein in milk.

Analysis of the fat content in the milk of cows of different lines showed that the highest fat content of milk was observed in cows of the line reflection sovereign (3.65%), which is 0.04% higher than analogues in fat content.

The highest content of the mass fraction of protein in milk was observed in cows of the reflection sovereign line-3,27%, which is 0,03% higher than this indicator of cows of the line vis beck ideal.

Thus, the mass fraction of fat and protein cows reflection sovereign line, superior to analogues of other groups.

Milk production of animals is significantly due to the influence of both genetic and paratypical factors, which largely depends on the live weight. Live weight-an indicator of overall development and expresses the degree of fatness of the animal.

In order to plan breeding work with the breed and the results of breeding work, it is important to establish the selection and genetic parameters as a whole for the breed and its structural units. The most important breeding characteristics of dairy cattle are: milk yield, mass fraction of fat and protein in milk, live weight.

In dairy cattle the most important is to clarify the nature and magnitude of the correlation between the level of milk yield and the mass fraction of fat in milk. According to some russian and foreign scientists, most breeds of cattle have a negative relationship between these features .

Milk productivity of a cow depends to a great extent on its live weight, as live weight is an indicator of general development and expresses the degree of fatness of the animal. High milk productivity of cows is associated with a large physiological stress of the whole body, so they must be well developed, able to eat a large amount of food and process it into milk, have a strong constitution and health.

In each breed, in each herd, the best part of the productivity of animals, as a rule, has a higher live weight than the average breed or herd. For more complete characteristics of milk production, determining the direction of productivity, the severity of the milk type, the effective use of animals, the coefficient of milk production was calculated. Our studies found that significant differences in live weight of cows depending on their origin were not revealed. At the same time, some advantage was observed in the group of cows of the Reflection Sovereign line.

From the data of the table it follows that all animals of the selected group meet the requirements of the Holstein breed standard for live weight. So animal lines Reflection Sovereign and Wis Burke Ideal live weight exceed the requirements of the standard by 14.6% and 11.6%, respectively.

Studies have shown that the milk yield of cows increased with increasing live weight and a maximum milk yield – kg 7774,8 obtained in the live weight of cows 562 kg in cows of Reflection Sovereign line that 221,4 kg of milk at the live weight of 547 kg exceeds peers Wis Burke Ideal.

As can be seen from the table with the increase in live weight of Holstein cows increases their relative yield or milk ratio. The coefficient of milk content in cows of the Reflection Sovereign line was (1383.4 kg), while in cows of the line of Wis Burke Ideal this figure was 2.6 kg less.

Relatively high indicators of the coefficient of milk yield indicate the level of their productivity and the severity of the milk type.

All used breeding bulls, even within a single line, differed significantly both in the level of milk production of daughters and in productive longevity, which is probably due to their individual and biological features.

Conclusion. As a result of effective selection and breeding work, the farm has created a highly productive herd of holstein breed, using bulls belonging to the lines of reflection sovereign-474 heads (54.2%), wis burke ideal 325 heads (37.1%), montvik chifteyn 25 heads (2.8%).

By analyzing the genealogical structure of the herd, the lines, the mother offspring of which ancestors were obtained by intra-line breeding, were selected. The daughters of VISION-GEN MAURY-ET bull were the best in milk yield for 305 days of lactation (Table 1), their productivity amounted to 7177,5 kg, which is 106,4 kg more in comparison with the average indicators for all bulls. Daughters of the bull HAMMER-CREEK OB KEYBOARD-ET (3.66 %) were the best in protein-milk yield for 305 days of lactation, which is 0.44 % ($P<0.05$) more than the mass fraction of protein in milk of daughters of the bull LOCKER-LANE RW BANNING, and by 0.54 % compared to the average for all bulls. When evaluating the bull VISION-GEN MAURY-ET by the comparative method after analyzing the data obtained, it can be concluded that he is a milk yield improver in comparison with the breed standard and with analogues. Daughters of the bull LOCKER-LANE RW BANNING are fat-milking improvers, and daughters of the bull HAMMER-CREEK OB KEYBOARD-ET are protein-milking improvers.

Studies have shown that the highest milk production was characterized by cow lines Reflection Sovereign. From them received an average of 7409 kg of milk with mass fraction of fat of 3.62 % and a protein content of 3.22 %, with a live weight equal to the average of 547 kg. Studies have shown that the milk yield of cows increased with increasing live weight and a maximum milk yield – kg 7774,8 obtained in the live weight of cows 562 kg in cows of Reflection Sovereign line that 221,4 kg of milk at the live weight of 547 kg exceeds peers of Wis Burke Ideal. With increasing live weight of cows increases their relative yield or milk ratio. The coefficient of milk content in cows of the Reflection Sovereign line was (1383.4 kg), while in cows of the line of Wis Burke Ideal this figure was 2.6 kg less.

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ТҮЙІН

Табынның генеалогиялық құрылымын зерттей отырып, генеологиялық тегімен мұқият іріктеліп алынды. VISION-GEN MAURY-ET бұқасының қыздары лактацияның 305 күніндегі ең жоғары сүттілікті көрсетті, 7177,5 кг өндірді, бұл барлық бұқалардың орташа көрсеткішінен

106,4 кг артық. HAMMER-CREEK OB KEYBOARD-ET ақуыз-сүт өнімділігі бойынша басқа құрдастарынан 0,44% және тұқым стандартынан 0,54% асып түсті. VISION-GEN MAURY-ET аталығының қыздарының сүттілігі едәуір артты, LOCKER-LANE RW BANNING'S қыздары сүттің майлылығы бойынша одан асып түсті, ал HAMMER-CREEK OB KEYBOARD-ET's қыздары сүттің ақуызының жоғарылығымен танымал болды. Зерттеулер көрсеткендей, REFLECTION SOVEREIGN сиырлары орташа салмағы 547 кг болатын 3,62% май және 3,22% ақуызы және орта есеппен 7409 кг сүт өндіретін ең жоғары сүт өнімділігін көрсетті. Зерттеу барысында сиырлардың тірі салмағының артуымен олардың сүттілігі де артқанын көрсетті: 7774,8 кг ең жоғары сүттілікке REFLECTION SOVEREIGN генотипіне 562 кг сиырларына тиесілі болып, бұл олардың құрдастарынан 221,4 кг артық болды. Сонымен қатар, сиырлардың сүттілік коэффициенті олардың тірі салмағы өскен сайын өсті, ал REFLECTION SOVEREIGN сиырларының сүттілік коэффициенті 1383,4 кг құрады, бұл WIS BURKE IDEAL аналықтарының көрсеткішінен 2,6 кг-ға асып түсті.

РЕЗЮМЕ

Изучив генеалогическую структуру стада, были тщательно отобраны линии с предками, полученными в результате внутрилинейного разведения. Дочери быка VISION-GEN MAURY-ET показали самый высокий удой за 305 дней лактации, произведя 7177,5 кг, что на 106,4 кг больше, чем в среднем по всем быкам. Дочери HAMMER-CREEK OB KEYBOARD-ET превзошли по белково-молочной продуктивности, превысив других быков на 0,44% и стандарт породы на 0,54%. VISION-GEN MAURY-ET значительно повысил удой, дочери LOCKER-LANE RW BANNING'S превосходили его по жировым удоям, а дочери HAMMER-CREEK OB KEYBOARD-ET's были известны своими улучшениями по белковым удоям. Исследования показали, что коровы REFLECTION SOVEREIGN демонстрировали самую высокую молочную продуктивность, давая в среднем 7409 кг молока с содержанием жира 3,62% и белка 3,22% при среднем весе 547 кг. Исследование также показало, что с увеличением живого веса коров увеличивался и их удой: пиковый удой в 7774,8 кг был достигнут коровами весом 562 кг в линии REFLECTION SOVEREIGN, что на 221,4 кг превосходило показатели их сверстниц из линии WIS BURKE IDEAL. Кроме того, коэффициент молочности коров увеличивался по мере роста их живой массы, а коэффициент молочности коров линии REFLECTION SOVEREIGN составил 1383,4 кг, превысив показатель линии WIS BURKE IDEAL на 2,6 кг.

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STATUS OF VEGETATION COVER OF RURAL PASTELANDS

IN TURKESTAN REGION

ANNOTATION

This article presents the impact of cattle grazing on the quantitative and qualitative indicators of the vegetation cover of pastures in the villages of the Kozhatogay rural district of the Turkestan region. As a result of statistical analysis and geobotanical observations carried out in 2022-2024, the reasons for the deterioration of the condition of pastures near the village were established. 58% of the villagers keep cattle. It was also found that the number of livestock in each household was not the same. Most families in the village of Kozhatogay have 1-2 cows, right-handed ones have 45-58, one family has 135, some households have 30-85 horses and 64-275 sheep. The total number of livestock is almost four times higher than the standard indicators of the area of pastures assigned to the village. As a result of a geobotanical survey of pastures near the village, the unevenness of vegetation, high concentration and excessive use of livestock affected the diversity of the plant community and reduced productivity. In the plant community, non-animal and weed plants include sedge, esemia, white wormwood, yellow sedge, and laxa. To improve the quality of pastures, it is necessary to regulate the livestock population, increase the area of fields, use distant pastures in the rotational grazing system, and carry out measures to plant pastures with desert-resistant forage plants.

Key words: *rural pastures, social-economy, types of pastures, vegetation cover, recurrence, productivity.*

Introduction. In his address to the people of Kazakhstan on September 2, 2021, K. Tokayev noted that the main goal of the country's new economic policy will not change, stating: "Its essence is to improve the well-being of the people from a qualitative and inclusive point of view." point of view" [1]. This problem is very relevant for rural residents, one of whose sources of livelihood is cattle breeding.

Livestock farming is one of the leading sectors of the agro-industrial complex of the Turkestan region, developing rapidly. According to data from the beginning of 2023, the number of cattle amounted to 1032.6 thousand, sheep - 4530.1 thousand, horses - 385.3 thousand, camels - 31.8 thousand [2]. It is noteworthy that, according to the "Kazakhstan News" as of May 27, the number of sheep in the region reached 5.9 million, of which 48% belong to rural communities, 47% - to private entrepreneurs and farms [3].

The land fund of the region is 11,630.3 thousand hectares, of which 4,518.5 thousand hectares are used for agriculture, 3,020.7 thousand hectares are allocated for forestry, 2,592.4 thousand hectares are in reserve, and the number of pastures in the village is 1,034.5 thousand hectares. The total area of natural pastures in the region is about 8.9 million hectares. Due to uneven relief and historical and geological reasons, it is divided into highlands, mountains, foothills and slopes and plains. Most of them belong to the last two types of pastures and occupy 1.9 and 6.2 million hectares of land, respectively [4].

According to the data provided, natural pastures are the main source of feed for livestock. However, providing livestock with feed in the desert area of the region is a serious problem. The open nature of natural pastures in this region, frequent strong winds, lack of natural water sources, unstable and dry weather do not affect the diversity of crop yields and the quality of pastures. In addition, it is known that in recent years, inefficient use of pastures, failure to maintain a balanced ratio between their conservation and use, as well as excessive use of fields around large and small settlements lead to deterioration of pastures and sparseness of useful vegetation.

In Kazakhstan, the reason for the deterioration of pasture lands was the creation of many complex farms for the development of sheep breeding in desert and semi-desert regions and the use of natural pastures without taking into account the ecological system [5]. The first areas of deterioration appeared on the area of 2-3 km of wells, sheepfolds, villages and each year expanded to 5-7 km ^{2}. hectares [6].

Global climate change, annual increase in livestock, overuse of pastures, insufficient maintenance and improvement measures have accelerated the deterioration of pastures [7]. In 2000, the amount of degraded pasture lands was 25.6 million. per hectare, in the Turkestan region

1.3 million. amounted to 27.1 million hectares, in the Turkestan region - 2330.0 thousand hectares [8, 9].

Geobotanical expertise occupies a special place in determining the current economic condition of pasture lands and preparing measures to improve them and use them in the pasture rotation system. A comprehensive (phytotopoeological) approach is used for this purpose. The results of the first geobotanical studies conducted in this area by L.G. Ramensky, I.A. Tsatsenkin, O.I. Chizhikova, I.A. Antipov's work "Ecological Assessment of Feedlots Under Vegetation Cover" identified 10 degrees of pasture wear by vegetation cover [10].

As a source of livestock nutrition, the condition of natural pastures should be checked in order to implement measures aimed at not reducing the yield of pastures, a geobotanical examination should be carried out to determine the quantitative and qualitative condition of the fields, that is, a study of the vegetation associated with it. taking into account the features of the climate, topography, soils and economic use of the local environment [11]. To use natural pastures, it is necessary to take into account preliminary measures on the species composition of the vegetation cover, productivity, fertility of the soil layer and its properties, prevent wind and water erosion, since irregular grazing of livestock negatively affects these indicators, which leads to environmental damage [15].

The criteria and indices were used to determine the degradation process of pasture lands. At the same time, the researchers emphasized that global climate change in the next 20 years will complicate the process of land degradation, which has a negative impact on the life of society and the environment, especially in rural areas [16].

In Myqin County, China, 20 socio-economic factors were studied to determine the cause of pasture degradation. As a result, the main cause of desertification was the increase in the number of sheep per family. In this regard, it was proposed to regulate the livestock population depending on the productivity of the pasture, and it was also noted that it was necessary to remove overly worn-out pastures from the economic cycle and give them a rest [17]. In Iran, 9 criteria and 130 indices of quantitative and qualitative significance were introduced to assess the vulnerability of lands to desertification, including agricultural management [18].

In determining the level of pasture deterioration, it is important to take into account the level of vegetation covering the soil surface, the productivity of the plant community, and the methods of pasture use [19]. In our country, the study of the effect of grazing on the productivity of pastures began in the 1970s in the northern desert region. Early spring grazing of sagebrush, a colorful pasture, negatively affects the growth of valuable plant species in the field, and its use from mid-April increases their productivity, especially white sagebrush [20]. And, as a result of regular grazing in early spring for 7 years, the sagebrush-green pasture turned into a meadow-weed pasture [21]. Premature and excessive grazing of wet pastures in Manitoba, Canada, changed the species composition of plant communities and increased the number of weeds and other species. At the end of the season, moderate grazing maintained the diversity and viability of the plant community at a moderate level [22]. For the first time, quantitative and qualitative indicators of the stages of deterioration of the sagebrush association in a non-grazing system were established.

In connection with the ecological and economic changes in various ownership structures that have developed in animal husbandry, work was carried out in the direction of the efficient use of natural pastures, and the characteristics of the wear of pasture and field areas were determined [23, 24].

The obtained criteria for assessing the state of the vegetation cover of pasture lands are included in the Resolution of the Government of the Republic of Kazakhstan No. 653 "Criteria for assessing the ecological state of territories", approved in 2017 [25]. Due to the abundance of pastures in the country and the fact that the country occupies regions that differ greatly from each other in natural conditions, in the following years, intensive scientific work is being carried out aimed at determining the state of pastures in different regions [26, 27, 28].

There is no information on the ecological state of pastures near the villages of the Turkestan region, and therefore the identification of disturbed pasture lands near the village and the determination of the causes of the level of vegetation wear were carried out in accordance with the

project AP14871736 "Development of effective technologies for the use of degraded rural pastures in the desert region of the Turkestan region" budget document of the Ministry of Education and Science.

Research methodology and materials. Research work was carried out in 2022-2024 on pastures around the villages of Kozhatogay, Baitogay, Shogirli, Darbaza, Bulak, in the area of the village of Kozhatogay in the city of Arys in the Turkestan region. The stable social situation and the ecological state of stationary pastures in these villages were determined and analyzed.

To determine the social status of the rural community, data on the types and number of livestock in each household were obtained from statistical documents.

Field geobotanical studies were carried out to determine the state of pasture vegetation, and analysis and assessment were carried out using biological indicators in accordance with guidelines and regulatory documents [29,30].

Results and discussion. Kozhatogay rural district is located 150 km west of Shymkent and 60 km from Arys, occupying a desert valley facing east from the right bank of the Syr Darya River. The center of the district is the village of Kozhatogay, located along the Syr Darya River. The district includes the village of Chogirli, which is 15 kilometers north of the center, the village of Baitogay, which is 18 kilometers to the south, the village of Darbaza, which is 45 kilometers to the east, and the village of Bulak, which is 50 km to the southeast.

Livestock farming is one of the indicators that determine the social status of village residents. There are 126 households in Baitogay village, 50 of which keep livestock and poultry. In Bulak village - 14.7, in Darbaz - 11.7, in Kozhatogay - 318.182, in Chogirli - 124.58 respectively. In total, out of 593 households, 304, or 56.3 percent, keep livestock. According to the report for January 2024, there were 200 heads of cattle, 3,388 sheep, 157 horses in Baitogay village, 101, 2,878 sheep, 830 horses in Bulak village, 167, 1,367, 101 in Darbaz, 852, 520, 564, 12 goats in Kozhatogay. in Shugirli. The number of black cattle in the region is 1600 heads, sheep 13509, goats 145 and horses 1900 (Table 1).

Table 1 – Livestock population in the villages of the Kozhatogai rural district, heads (January 2024)

The village	**Cattle**	Including dairy cattle	**Sheep**	**Goats**	**Horses and**
Baitogai	200	287	3388	7	157
Bulak	101	296	2878	-	850
Dorbaza	107	307	1367	-	101
Kozhatogay	852	289	5201	126	564
Shogirli	280	294	675	12	248
Total:	**1600**	1473	**13509**	**145**	**1900**

According to data for 2023, the area of natural pastures of the Kozhatogay rural district is about 239 thousand hectares, including only 5745 hectares of approved pastures near the village, of which the village of Kozhatogay owns 2598 hectares, Baitogay - 1487 hectares, 199 to Shogirli, 811 to Darbaza, 650 to the village of Bulak.

According to the order of the Ministry of Agriculture dated April 28, 2017 No. 172, in the Kozhatogai rural district, 27 thousand hectares of pasture land will be required to maintain 13,505 sheep, an average of 2 hectares per sheep [31]. Thus, without taking into account other types of livestock, the current load on the total area of pastures in the village is more than 4 times higher than the permissible norm, that is, it cannot be denied that the use of the field beyond the ecologically safe limit plays a key role in the process of pasture degradation.

On September 3, 2021, K. Tokayev, in his address to the people of Kazakhstan, directly drew attention to the importance of providing villages with common pastures and noted that they should be accessible first and foremost to villagers [32].

When determining the number of livestock in each rural household, it turned out that this indicator is not uniform. When analyzing statistical data, it is clear that the number of livestock kept by residents is not uniform. For example, in the village of Kozhatogay, most families have 1-2 cows, about 10 families have from 45 to 58 cows, and one family has 133 cows. The number of horses in some farms ranged from 30 to 85, sheep - from 64 to 272. In Baitogay there are 20-30 cows, in the village of Bulak - 20-70 cows, in the village of Darbaza - 91 cows.

The conclusion from these indicators shows that the pasture near the village is not available for use by the villagers. In principle, this pasture is considered common to the villagers. After studying 20 socio-ecological factors to determine the cause of pasture deterioration during the Ming Dynasty in China, the main cause of desertification was the large number of sheep in each family. In this regard, it was proposed to regulate the livestock population depending on the productivity of the pasture. That is why he emphasized the need to withdraw worn-out pastures from agricultural use and leave them alone [33].

Therefore, it is necessary to solve this problem on a legislative basis, increase the number of pastures, motivate residents to engage in livestock breeding, take animals to remote pastures that are ecologically redundant, and organize infrastructure for this, as specified in the Law "On Pastures".

To solve the problem of preserving pastures, it is necessary to graze livestock in different fields with a rotational grazing system, create ecological fields in pasture areas and increase the income of residents, and the state must strengthen their control [34].

Geobotanical survey of pastures near the villages of the Kozhatogay rural district began in August-September 2022. According to the tests, sheep and goats mainly graze on pastures in rural areas under the supervision of shepherds.

The western part of the villages of Kozhatogay, Baitogay and Chogirli is located on the grove along the Syr Darya River. Pasture lands are located on the northern, eastern and southern sides. In the eastern part of the village of Kozhatogay, Shogirli wormwood-ephemeral, in the northern and southern parts of the Alkakol sandy region grass-shrub pastures, grass-shrub pastures on three sides of the village of Baitogay and around the villages of Darbaza, Bulak, sedge, sedge-wormwood pastures.

Wormwood (Artemisia diffusa) is a common plant in wormwood-green pastures on light clay gray soil on the eastern outskirts of the village of Kozhatogay (Table 2). Dry masses of herbs eaten by livestock were not found. In comparison, the main plant of wormwood is 43-57 cm high along the winding road together with colorful species such as blackberry. Among the other surviving plants are walnut (Alhagi pseudalhagi), eschemia (Goebelia pachycarpa), rare. Grass-shrub pasture on the northern side of the village is well ventilated in spring and summer. Vegetation species are common in open sierozems with sandy loams. In autumn, there are more plant species in the forest than in the previous pastures: sedge wormwood (Artemisia scoparia), ribbon-like tape, sedge (Astragalus unifoliolatus), white sedge (Halimodendron halodendron Pall.), sedge (Ceratocarpus arenarius), sedge (Stipa hohenackeriana) dominates, eschemia (Goebelia pachycarpa), walnut (Alhagi pseudalhagi). Wormwood (Artemisia diffusa) is rare, brown-headed (Poa bulbosa), dry stems of walnut, among the stems of cygraena. The roots of the seedlings are very swollen. White chervil increases every year. It turned out that 2-3-year-old plants grow around one of the bases, peganum harmala is also found.

On the southern side of the village, to the east, there is a meadow with wormwood on gray clay soil, and on the western side - with grassy-shrub soil. Common here are common cinquefoil, white wormwood - Artemisia leucodes, sand chrysophora (Chrozophora sabulosa).

In the green meadow with wormwood, only the main wormwood grows. Only 12-15 cm of the ground surface remains. The upper side is curved. Dry stems of the konyrbas are between the stems of the wormwood root, completely swollen in the space between the roots of the wormwood. Carex pahystyles - Mixed fields of Poa Bulbosa can be found in sandy areas.

On the grassy-shrubby meadows the butterfly tail, laksa (Cousinia), ribbon-like single-leaved, sedge (Astragalus unifoliolatus) prevail. Wormwood, black-cap are very rare. Near the road you can find the annual herbaceous plant chrozophora, donkey grass (Chrozophora sabulosa). The main wormwood is very rare and twisted like a single-leaved ribbon.

As a result of surveys conducted in the spring season of 2023, the number of the main wormwood per 1 ha of the field on the eastern outskirts of the village of Kozhatogay is 6500-7700 pieces of wormwood, the height of the plants is 35.2 ± 1.9 cm. Konyrbas is rare, the height of the plants preserved on the roadsides is 21.0 ± 1.3 cm. Bromus inermis is rare this year. The height of the surviving plants is 27.1 ± 1.1 cm. Eshemia, shingles are very rare, there are 2-4 pieces per 100 sq.m (Table 2).

Table 2 – Types and composition of vegetation on pastures near the villag

Village	Pasture and soil type	Plant species	Life form	According to the Drude scale	
				degree of participation	distribution
Kozhatogay	Wormwood-ephemeral, light loamy gray soil.	Artemisia	semish	sp^3	spr.
		Bluegrass bulbosa	prn.	sp^3	unspr.
		Sophora	prn.	sp^3	spr.
		Harmala vulgaris	prn.	sp^3	unspr.
		Carex pachystylis	prn.	sp^2	spr.
	herbaceous-shrubby (western part) Light sandy loam sierozem	Artemisia			
		Sophora	semish	sp^3	spr.
		Bromus tectorum	prn.	sp^3	unspr.
		Heliotrope	prn.	sp^3	unspr.
		argusium	prn.	sp^3	unspr.
		Astragalus	prn.	sp^3	unspr.
		monophyllus	prn.	sp	unspr.
		Sand Acacia	prn.	sp	unspr.
		Iri (sperm)	prn.	sp	unspr.
		Papáver	prn.	sp^3	unspr.
		Eremurus	eph.	sp^3	unspr.
		Sedge	prn.	sp^3	unspr.
		Deskurayniia	prn.	sp^3	unspr.
		Sofia			
	Herbaceous-bushy (northern part), light sandy loam soil.	Camel thorn	prn.	sp	unspr.
		Sophora	prn.	sp^3	unspr.
		Astragalus	prn.	sp	unspr.
		monophyllus			
		Harmala vulgaris	prn.	sp^3	unspr.
		Shengel silver	prn.	sp^3	unspr.
		Wormwood			
		spreading	prn.	sp^3	spr
		Bluegrass onions.	prn.	sp^3	unspr.
Shogirli	Wormwood-ephemeral, light loamy gray soil.	Ebelek (horned stag)	prn.	sp^3	unspr.
		Harmala vulgaris	eph.	sop^3	unspr.
Baitogay	Wormwood-ephemeral, light sandy loam sierozem.	Camel thorn	prn.	sp^2	unspr.
		Artemisia sibirica	prn.	sop^3	spr
		White wormwood	prn.	sop^3	unspr.
Dorbaza	Wormwood-ephemeral, light sandy loam sierozem.	Artemisia	prn.	sp^2	spr.
		santicina	prn.	sp^2	unspr.
		Kuzinia	eph.	sp^2	unspr.
		Bluegrass	prn.	sop^3	unspr.
		bulbosa.	prn.	sp^2	unspr.

		Camel thorn Harmala vulgaris			
Bulak	Wormwood-ephemeral, light sandy loam gray soil.	Artemisia santicina Bluegrass bulbosa.	prn. eph.	sp^2 sp^2	unspr. unspr.

Notes: eph.-ephemeral, prn.-perennial, semish.-semi-shrub, sp-rarely, sp^2 -very rare, sp^3 -intermediate, sop - abundant, sop^2 -very abundant, sop^3 -many, spr.-spread, unspr.-unspread.

Last year's species grow in sandy-gray soil on the northern side of the village. The frequency of the main plant wormwood is 700-1300 pcs. per hectare, sedge 200-700, ribbon-like single-leaf 1100-2000, esekmia 680-1100. The bark is rare, the upper part of the stem is thin. Konyrbas, kysilot is very rare, splenic.

In the southern part, wormwood is a colorful pasture, wormwood was 4300-5600 pieces per hectare. Iris longiscapa, Eremurus anisopterus, Eremurus anisopterus, Iris longiscapa, black-eyed bird, rare.

There are 11 species in the grass-shrub pasture. In addition to last year's species, the following were found: seed slug (Eremurus anisopterus), caterpillar (Iris longiscapa), cowtail (Descuraina Sophia), and warty argusia. However, the first two types are rare. The frequency of cowtail was 700-800, erysipelas 300-1100, and sedge 1100-1300 pcs/ha. The grass seeds are poisonous. Therefore, it cannot be used as hay. The total dry yield of the wormwood pasture was 2.5 t/ha.

80-90% of the area of the ephemeral pasture of the village of Chogirli with an area of 40 hectares is covered by 80-90% of the ephemeral pasture. In addition, the surface of the land is very uneven. A similar situation can be observed on the plain of the village of Kozhatogay towards Baitogay, here grow camel thorn and harmala.

According to observations at the beginning of summer, the height of wormwood on wormwood pastures without grazing cattle is 16 cm. The yield in dry form was 4 t / ha. 0.2 t of which is a colorful herbaceous plant. The reason is that in the spring near the village there were many brown mosquitoes, which created problems for the cattle. Helpless cattle had to be taken to a remote pasture. So the wormwood pasture was preserved. On sandy pastures, the leaf tape is very windy. The nut is not eaten, the height is 43 cm.

In autumn the villages of Darbaza, Bulak and Baitogay were explored. The village of Darbaza is located in a depression 600-1000 meters wide. The slope on the western side is steep and on the eastern side it is smoothed out.

The pastures here are covered with Artemisia cina, camel thorn and Cousinia epectispina. About 3-4 kilometers before the village, Capparis spinosa and Psoralef drupacea plants were noticed growing mixed with wormwood. The density of Artemisia cina is 6000-7000 pcs/ha, height 43.0±1.57 cm, which is related to medicinal plants. Cattle eat this species in September, i.e. after the flowering phase, and in autumn and winter. Cousinia is a biennial plant. When assessing it, it turned out that this was the first year of its life, so it was possible to save 250-300 pieces per hectare. Near the village, harmala and camel thorns grow; on the eastern side, dry remains of cereals were visible.

The village of Bulak is located in a hilly area. The grass stand includes bluegrass and santonica wormwood. The occurrence of wormwood is 2500-3000 pcs/ha, height 32.6±3.02 cm. Of the other species, dry stems of stinking ferula (Ferula foetida) are found. The air-dry yield of santonica wormwood is 7.2-9.1 c/ha.

The pastures of the village of Baitogay are grassy and shrubby, located in the fixed sandy loam valley of Alkakum. Camel thorn thickets are widespread in the vicinity of the village.

In early April 2024, we explored a grassy-shrubby pasture on fixed sandy sierozem in the northern part of the village of Baitogay. Spring this year was warm and rainy. The vegetation is rich. Buttercup (Ranunculus polypyhllus) is in full bloom, tulips (Tulipa korolkovii) are also blooming, and sedge (Cazex pachystylis) is in the sowing stage.

The biennial plant of Artemisia lercheana is in the phase of 2-3 leaves. In 100 there are 132 individuals. The number of bluegrass per square meter reached 138, on iris 13, tape 8-14 pieces of

plants. The growth and development of single-leaf astragalus is very high 8-14 pieces of plants per 100 m2, the height of plants pieces per dry plant 33-50 cm, diameter 40-60 cm, stems 5-9 per root.

Conclusions. The results of geobotanical studies of the current state of the vegetation cover of pastures near the village are not available to residents using the pasture. The livestock population, which determines the socio-economic status of the village residents, is not uniform in each farm. Due to overloading and concentration of livestock on pastures near the village, the plant community has few plant species eaten by livestock and low productivity. In this regard, there is a need to legislatively regulate the livestock population depending on the productivity of pastures, increase the area of pastures and take measures to increase their productivity using valuable forage arid plants, motivate residents to breed livestock, remove ecologically surplus animals to distant pastures and organize infrastructure in accordance with the Law "On Pastures".

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ТҮЙІН

Бұл мақалада Түркістан облысы Қожатоғай ауылдық округінің ауылдарында қалыптасқан мал жаю тәсілдеріне байланысты жайылымдық жерлердің өсімдік жамылғысының сандық және сапалық көрсеткіштеріне әсері келтірілген. 2022-2024 жылдары жүргізілген статистикалық талдаулар мен геоботаникалық бақылаулар нәтижесінде ауыл маңындағы жайылымдардың тозу себептері анықталған. Ауыл тұрғындарының мал ұстайтындары 58% құрайды. Әр шаңырақтағы төрт түлік малдың саны да бір келкі еместігі де анықталды. Бір ғана Қожатоғай ауылындағы отбасылардың басым бөлігінеде 1-2 сиыр, оңшақты отбасында 45-58, бір отбасында 135 бас, ал жылқы саны кейбір шаңырақтарда 30-85 ге дейін, қой 64-275 бас тіркелген. Жалпы мал басының саны ауылға бекітілген жайылым көлемінен нормативтиктік көрсеткіштерден төрт есеге жуық жоғары. Ауыл маңындағы жайылымдық жерлерде геоботаникалық сараптама жүргізілген нәтижесінде өсімдік жамылғысының бірдей емес екендігі және малдың көп шоғырлануы мен шамадан тыс пайдалануы өсімдік қауымдастығының түрлілік өзгеруіне, өнімділігін төмендеуіне әсер еткен. Өсімдіктер қауымдастығында мал жемейтін және арам шөп өсімдіктер адыраспан, есемия, ақшыл жусан, сарғалдақ құңарлығы төмен шенгел, лақса. Жайылым шұрайлығын көтеру үшін мал басының саның реттеу, өріс көлемін ұлғайту, ауыспалы жайылым жүйесіне шалғай жайылымдарды пайдалану, шөлге төзімді мал азықтық өсімдіктерді пайдаланып екпе жайылым жасау іс-шараларын жүргізу қажет.

РЕЗЮМЕ

В данной статье представлено влияние выпаса скота на количественные и качественные показатели растительного покрова пастбищных угодий сел Кожатогайского сельского округа Туркестанской области. В результате статистических анализов и геоботанических наблюдений, проведенных в 2022-2024 годах, установлены причины ухудшения состояния пастбищ вблизи села. 58% жителей села держат скот. Также было обнаружено, что поголовье скота в каждом домохозяйстве было неодинаково. Большинство семей села Кожатогай имеют 1-2 коровы, в

праворуких 45-58, в одной семье 135, в некоторых хозяйствах 30-85 лошадей и 64-275 овец. Общее поголовье скота почти в четыре раза превышает нормативные показатели площади пастбищ, закрепленных за селом. В результате геоботанического обследования пастбищ вблизи села неравномерность растительности, большая концентрация и чрезмерное использование скота повлияли на разнообразие растительного сообщества и снизили продуктивность. В растительном сообществе к неживотным и сорным растениям относятся осока, эземия, полынь белая, осока желтая, лакса. Для повышения качества пастбищ необходимо регулировать поголовье скота, увеличивать площади полей, использовать в ротационной системе выпаса отгонные пастбища, проводить мероприятия по засадке пастбищ пустынноустойчивыми кормовыми растениями.

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EXTERIOR AND CONSTITUTIONAL FEATURES OF YOUNG KALMYK BREED OF DIFFERENT GENOTYPES

ANNOTATION

The task of increasing the production of high-quality beef is one of the most important and difficult problems to be solved by our country's agro-industrial complex in the coming years. In this regard, the problem of providing high-quality beef market can be solved by our native producers only through the development ofspecialized cattle-breeding.

The method widely used in the cattle breeding is the evaluation of animal meat on the constitution and exteriors, based on the existence of a definite connection between the external structure of the animal and its economic-useful signs. The exterior features that are most closely connected with the basic productivity are of the most importance during the selection process.

In this regard, changes in the characteristics and body size of young Calmyk imported cattle breeds of meat direction adapted to local weather conditions were studied.

As a result of our research, it was found that heifers and bulls originating from the Moryak - 12054 line, according to measurements and body indices, were significantly larger at the ages of 8 and 15 months than young animals originating from the Stroinyi -2520 line. Nevertheless, the studied indicators corresponded to the standard of the Kalmyk breed in descendants who descended from both lines.

It follows that for the further development and breeding of the Kalmyk breed in the northern region of the country, further acclimatization of young animals with a high genotype, originating from the lines Moryak - 12054 and Stroinyi -2520, is possible.

Key words: *exterior, body measurements, body indices, youngstock, Kalmyk breed, line*

Introduction. The Kalmyk breed of animals has unique adaptive properties in various natural and climatic zones, including extreme ones. A variety of environmental factors, as well as growing conditions with the active participation of humans, created favorable opportunities for dividing the

breed into separate structures, including factory and breed species, lines, related groups, and various crosses [1-5].

At the same time, each structural unit is characterized by economic-biological and acclimatization features, which are combined by methods of directed selection into new genetic complexes that surpass the parental genotypes [6-10]. Kalmyk cattle are a unique Russian breed, so the possibilities of improving their purebred breeding through heteroecological crossing are limited only to Russian population cattle located in neighboring countries. In this regard, the work on the release of new intrabreed structural elements and the preservation of the variability of biological and productive properties in herds is relevant for animal husbandry [11-16].

Live weight, of course, is an objective indicator of the overall development of the body, although it does not make it possible to fully establish the dynamics of growth of the physique and shape of animals, taking into account their age and pedigree. There are several signs for this, one of which is mastering the exterior. Full disclosure of the features of linear growth determines a specific proposal for the development of the animal, its orientation and level of productivity.

Objective. to study and master the exterior constitutional features of imported beef cattle breeds originating from various lines, in order to control the intensive growth of young animals.

Research material and methodology. Scientific and economic experimental studies were conducted on young Kalmyk breeds bred in the arid steppe zone of the North Kazakhstan region in the period from 2020 to 2023. The object of the study was bulls and heifers (15 heads in each group) aged 20-30 days, belonging to different lines: the first group - bulls originating from the line Moryak - 12054; the second group -heifers, originating from the line Moryak - 12054; the third group-bulls, originating from the line Stroinyi -2520; the fourth group – heifers originating from the Stroinyi -2520line. The calves were born earlyin the spring of 2021 and were kept together with the mother cow on pastures for up to 6-8 months and отъемакept in a box after weaning.

When conducting experimental studies, the technology of keeping farm animals used in meat cattle breeding was used. To obtain measurements of the physique of young использовалиanimals, a measuring stick, measuring tape, and measuring compasses were mainly used. Basic measurements of the physique of young animals: Heightat the withers,Heightin the sacrum, Obliquelength of the body, Chestdepth, ChestWidth, Pelvicwidth**,** Widthinmockups, Chestcircumference**,** Butt half-girth, The circumference of the pastern**.** Based on the obtained measurements,the following body indicesare calculated: long-legged, massive, downed, thoracic, pelvic, bony, stretched, overgrown, shilozadosti.

Research results. Mastering the exterior features of the young animals taken for the study made it possible to establish thatчchickens and heifers of all groups had harmonious and well-defined body shapes (Table 1, Fig.1).

Table 1 – Body measurements of young meat breeds, cm ($X \pm S_x$)

Measurements	Experienced group			
	Moryak - 12054		Stroinyi -2520	
	Bulls of the 1 group	Heifers of the 2 group	Bulls of the 3 group	Heifers of the 4 group
1	2	3	4	5
8 months				
Heightat the withers	106,9±0,95	105,5±0,88	106,7±1,35	103,4±0,84
Heightin the sacrum	110,0±0,95	108,6±1,34	109,8±0,95	106,7±0,69
Obliquelength of the body	117,1±1,22	109,2±1,26	108,4±2,19	112,4±1,27
Chestdepth	52,2±0,59	45,6±0,57	45,4±1,24	44,8±0,44
ChestWidth	32,7±0,33	27,4±0,97	26,9±0,74	28,5±0,34
Pelvicwidth	34,6±0,58	31,5±0,57	29,7±1,04	30,9±0,57
Widthinmockups	34,4±0,34	30,1±0,79	28,5±0,83	29,7±0,25

Chestcircumference	147,8±1,69	126,9±1,65*	125,3±1,27	126,5±1,86*
Butt half-girth	86,3±1,28	76,4±1,35	71,8±0,63	75,6±1,26
The circumference of the pastern	16,1±0,35	14,6±0,27	14,7±0,35	14,3±0,32
15 months				
Heightat the withers	123,4±0,93*	120,3±1,24	120,8±1,12*	116,2±2,18
Heightin the sacrum	128,8±0,94	122,2±0,72	123,6±1,18	118,7±2,32
Obliquelength of the body	138,6±1,05	127,7±1,07	123,0±1,85	127,6±1,27
1	2	3	4	5
Chestdepth,	64,1±0,48	56,6±0,54	56,5±0,56	54,4±0,96
ChestWidth	42,4±0,76	35,2±0,74	33,1±0,68	35,0±1,19
Pelvicwidth	42,0±0,58	39,3±0,33	35,9±0,89	38,5±1,04
Widthinmockups	41,9±0,55	38,5±0,92	35,4±1,04	37,9±1,37
Chestcircumference	185,2±1,29	160,2±1,83	153,6±2,30	158,7±2,19
Butt half-girth	112,7±0,96	95,7±1,08	89,4±0,84	95,6±1,52
The circumference of the pastern	19,2±0,33	17,8±0,27	17,9±0,42	17,2±0,27
*p>0,001				

An important factor in the viability and productivity of animals is the specificity of their physique. Judging by the exterior, one can speak not only about the state of health and pedigree, but also about the approximate price and productivity [17-20].

The results of the study showed that in the heifers of group 2, who descended from the Moryak-12054 lineage, the physique indicators at the age of 8 and 15 months exceeded the indicators of their peers of group 4, who descended from the Stroinyi -2520 line. Starting from the period of early ontogenesis, the chicks of the 2nd group were distinguished by a rather tall physique, chest girth and half-girth of the ass. While it was found that the females of the 4th group are somewhat behind in these indicators. At 15 months of age, heifers, descended from the Moryak – 12054 line were 4,1 cm or 3,4% larger than their peers in height at the withers, 3,5 cm or 2,9% in height at the sacrum**,** 2,2 cm or 3,7% in chestdepth**,** and 1,5 cm or 1,0% in chestcircumference**.** There were no significant advantages in other measurements of the bodystructure, they were at the same level. According to the measurements of the physique of heifers of the Moryak - 12054 and Stroinyi -2520 lines, they are not inferior to the general breed standard.

Figure 1 – Sampling of young Kalmyk cattle in “Moskovsky” LLP

From the results of the study on the exterior of the bulls of the experimental group taken for the study, it can be seen that they have some differences in body measurements. So, at the age of 8 months, the bulls of the 1st group, compared with their peers of the 3rd group, had 4,2 cm or 12,8% more in chest width, 4,7 cm or 4,0% in oblique body length, 21,2 cm or 14,4% in chest circumference and 10,7 cm or 12,4% more along the **butt** half-girth of the pelvis. Nevertheless, the rest of the bulls, originating from the Stroinyi -2520 line, were not inferior in size at the age of 8 months (Fig. 2).

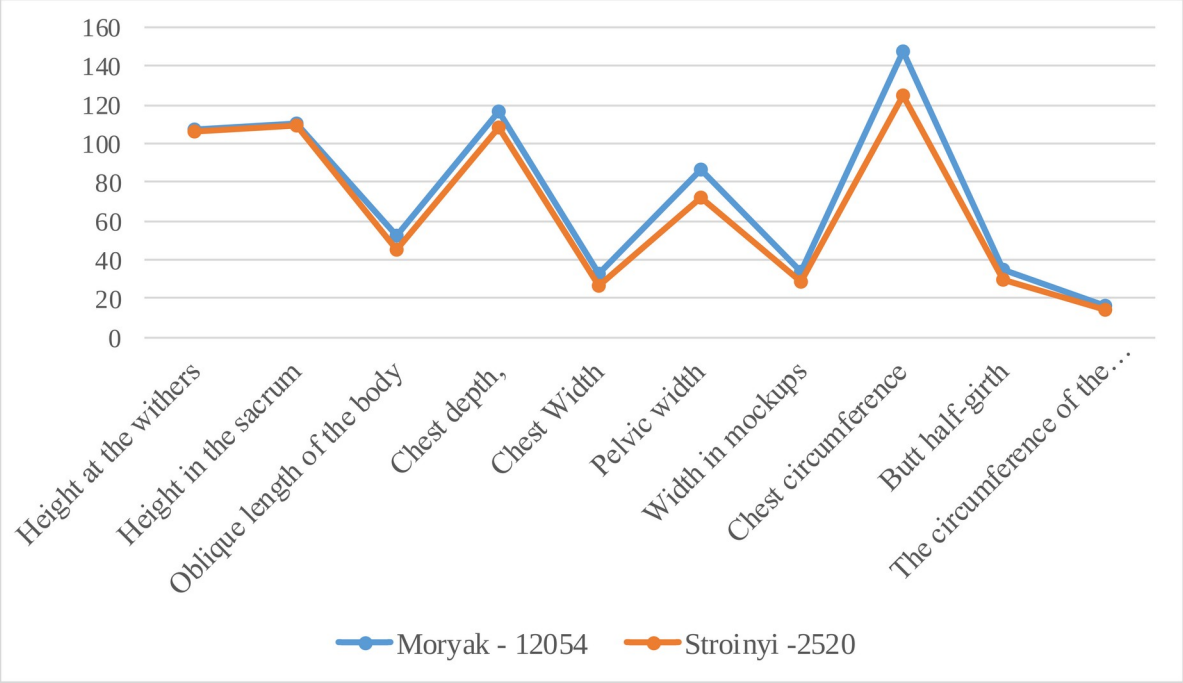

Figure 2 – Measurements of the physique of Kalmyk bull calves (8 months), cm

With age, the physique indicatorsof sideburns of different genotypes also began to change. The relative growth rate of body size was different. The maximum indicators at the age of 15 months were the oblique trunk length-138,6 cm, chest circumference-185.2 cm and pelvic girth-112,7 cm in bulls of the line Moryak -12054, respectively, from their peers, the Stroinyi -2520 line -11,0 cm or 7,9%, 26,5 cm or 14,3% and 17,1 cm or 15,2% was more. To supplement the exterior assessment of

experimental young animals, body composition indices were calculated, determined by the ratio of the natural-anatomical part of the body, which to a certain extent characterize the level of meat productivity of cattle (Table 2).

Table 2 – Body indices of young animals of different genotypes of Kalmyk breed, % (X±Sx)

Indexes	Experienced group			
	Moryak - 12054		Stroinyi -2520	
	Bulls of the 1 group	Heifers of the 2 group	Bulls of the 3 group	Heifers of the 4 group
1	2	3	4	5
8 months				
Leggy	51,2±0,46	56,8±0,64	57,5±0,36	56,7±0,51
Sprawl	109,5±0,70	103,5±1,92	101,6±1,68	108,7±2,31
Thoracic	62,7±0,27	60,1±0,73	58,3±0,54	63,6±0,82
Pelvic-thoracic	95,1±0,60	94,2±0,47	94,4±0,68	96,0±0,78
Knocks	126,2±0,55	115,7±2,40	115,6±2,13	112,5±1,86
Massiveness	138,2±0,79	119,6±1,41	117,4±2,07	122,3±1,78
Meat products	80,7±0,70	69,6 ± 1,06	67,3±2,01	73,1±1,23
Bone structure	15,1±0,24	13,8±0,19	13,8±0,35	13,8±0,26
Breadth	30,0±0,20	26,3±0,25	25,8±0,41	27,0±0,57
15 months				
Leggy	48,1±0,15	53,0±0,76	53,2±1,04	53,1±0,89
Sprawl	112,3±0,32	105,3±1,04	101,8±1,14	109,8±0,97
Thoracic	64,6±0,71	62,2±2,15	58,6±1,18	64,5±2,17
1	2	3	4	5
Pelvic-thoracic	98,8±0,73	93,9±1,37	93,5±1,14	92,3±1,57
Knocks	133,6±0,24	126,4±0,95	124,9±0,84	124,4±1,06
Massiveness	150,1±0,60	133,2±1,24	127,2±0,93	136,6±1,42
Meat products	91,3±0,34	78,7±0,68	74,0±1,25	82,3±0,84
Bone structure	15,6±0,19	14,8±0,24	14,8±0,23	14,7±0,17
Breadth	31,8±0,27	29,4±1,42	28,1±0,87	29,9±1,06

According to the research results of many scientists involved in the study of meat-oriented cattle breeds, at the end of fattening, the indices of massiveness, pelvic, thoracic, and downness should be at a high level, since these indices characterize the meat forms of animals and the yield of valuable organs.

In all experimental groups taken for the study, the body composition indices are relatively the same, although significant mutual differences are observed between bulls and heiferswith gender, age, and geneological specificity.

At the age of 8 months, the indicator of bulls on the Moryak-12054 massiveness index was 20,8% (138,2%) higher than that of the peers of the 3rd group. According to the indices of downfall and chest, the indicators of bulls that originated from the Moryak-12054 line were higher than those of bulls that originated from the Stroinyi -2520 line by 10,6% and 4,4%, respectively.

At the age of 8 months, the chicks also had indicators for the main body indices, depending on their origin. The chicks of the Slender-2520 line outperformed their peers in terms of thoracic, pelvic-thoracic and massiveness indices, respectively, by 3,5%, 1,8% and 2,7%, and in terms of downness, on the contrary, by 3,2% less.

There was no difference between the experimental groups in body indices calculated at the age of 15 months (Fig. 3).

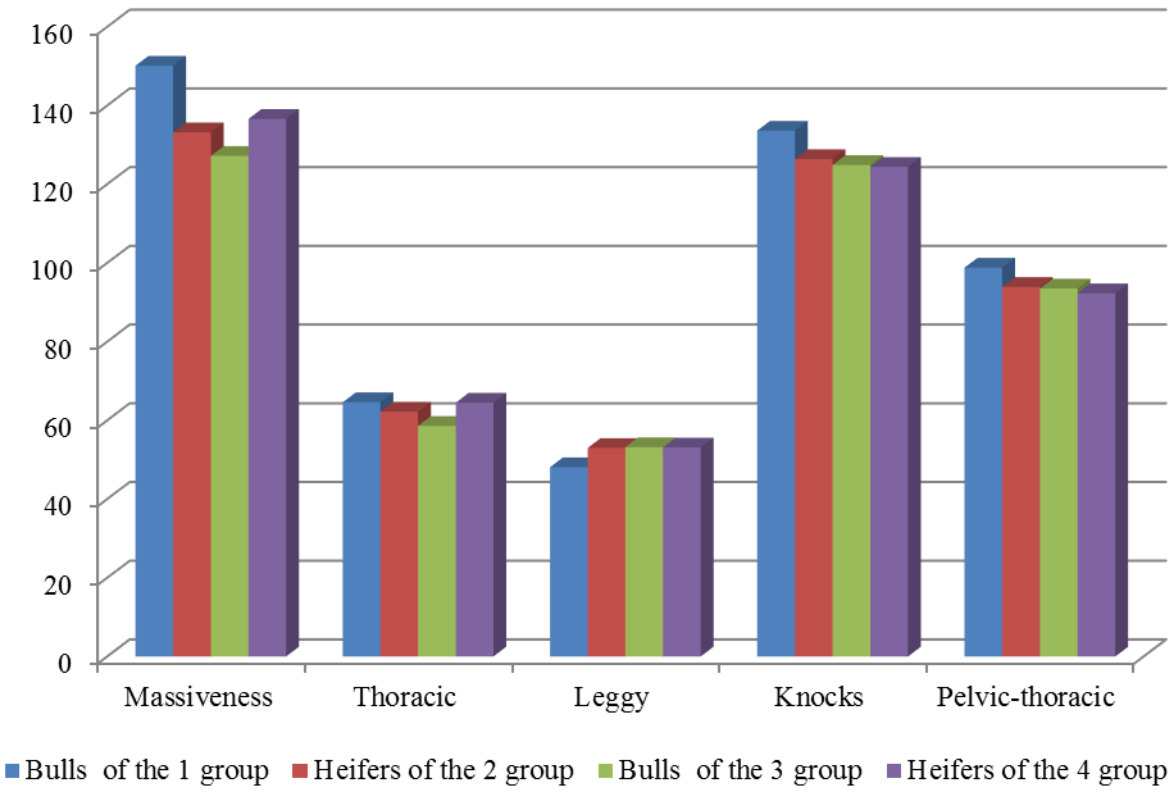

Figure 3 – Main indices of the physiqueof bulls and heifers aged 15 months, %

But, according to the main body indices of bulls originating from the Moryak-12054 line, the indicators are slightly higher than those of their peers, and in chicks, on the contrary, the offspring of the Stroinyi -2520 line has a good body shape, the indices are slightly higher.

Conclusion. An exterior assessment of the indices of the exterior and physique of the young Kalmyk breed showed that it is distinguished by a wide body, well-formed and deeply busty, good fleshy shape.

Since this is a fleshy breed, the main attention should be paid to ensuring that bulls adapt well, grow and mature intensively, have a harmonious physique, and form meat at a high level. That is, we are convinced that these qualities are possessed by bulls from the line Moryak-12054.

In general, young animals of all groups grew and formed in accordance with the patterns of individual development of cattle in the postnatal period of ontogenesis.

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ТҮЙІН

Жоғары сапалы сиыр етінің өндірісін жоғарылату мақсаты – алдағы жылдары еліміздің агроөнеркәсіптік кешендерімен шешілетін ең маңызды және қиын мәселелердің бірі болып табылады. Осыған байланысты отандың өндірушілер нарықты жоғары сапалы сиыр етімен қамтамасыз ету мәселесін тек арнайы етті ірі қара мал шаруашылығын дамыту жолымен ғана шеше алады.

Асылдандыру жұмысының тәжірибесінде малдардың сыртқы дене бітімі құрылысы мен олардың шаруашылықтық-пайдалы белгілері арасындағы нақты бйланыстың болуына негізделген етті малдарды конституциясы мен экстерьері бойынша бағалау кең түрде пайдаланып жатыр. Іріктеу кезінде негізгі өнімділік бағытымен тығыз байланысқан экстерьер мүшелері маңызды орын алады.

Осыған орай жергілікті ауа райы жағдайына бейімді, импортталған етті бағытындағы ірі қара мал қалмақ тұқым төлдерінің дене бітімінің ерекшеліктері мен дене өлшемдерінің өзгерісі менгерілді.

Жүргізілген зерттеулеріміздің нәтижесінде Моряк- 12054 аталық ізінен тараған ұрғашы баспақтары мен бұқашықтарының дене өлшемдері мен индекстері бойынша Стройный-2520 аталық ізінен тараған төлдерге қарағанда 8 және 15 айлық жастарында біршама артық болғаны анықталды. Дегенмен де, зерттелген көрсеткіштер екі аталық ізінен тараған төлдерде қалмақ тұқым стандартына сәйкес болды.

Осыдан шығатын қорытыныды, қалмақ тұқымын еліміздің солтүстік өңірінде одан әрі дамытып, өсіру үшін Моряк- 12054 және Стройный-2520 аталық іздерінен тараған генотипі жоғары төлдерді әрі қарай жерсіндіруге болады.

РЕЗЮМЕ

Задача увеличения производства высококачественной говядины – одна из наиболее важных и сложных проблем, которую в ближайшие годы предстоит решать агропромышленному комплексу нашей страны. В связи с этим проблему обеспечения рынка высококачественной говядиной отечественные производители могуть решить лишь путем развития специлизированного мясного скотоводства.

В практике племенной работы широко используется оценка мясных животных по конституции и экстерьеру, основанная на существовании определенной связи между внешним строением животного и его хозяйственно-полезными признаками. Большое значение при отборе имеют те стати экстерьера, которые наиболее тесно связаны с основной продуктивностью.

В связи с этим были изучены изменения особенностей и размеры телосложения молодняка импортной калмыцкой породы крупного рогатого скота мясного направления, приспособленных к местным погодным условиям.

В результате наших исследований было установлено, что телки и бычки, происходящие от линии Моряк - 12054, по промерам и индексам телосложения были значительно больше в возрасте 8 и 15 месяцев, чем молодняк, происходящие от линии Стройный -2520. Тем не менее, изученные показатели соответствовали стандарту калмыцкой породы у потомков, которые произошли от обоех линий.

Отсюда следует, что для дальнейшего развития и разведения калмыцкой породы в северном регионе страны возможно дальнейшее акклиматизация молодняка с высоким генотипом, происходящего от линий Моряк - 12054 и Стройный -2520.

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THE STUDY OF THE PRODUCTIVE QUALITIES OF THE KAZAKH BREED OF THE JABE TYPE, IDENTIFIED ON THE BASIS OF GENOTYPING WITH A WIDE GENOME COVERAGE

ANNOTATION

The article presents significant variations in the coding sequences of the genome associated with the productive qualities of the Kazakh breed of the jabe type, identified on the basis of genotyping with a wide genome coverage.

A genome-wide analysis of the association of SNP markers with measurements and live weight of a horse was performed for all animals with available phenotypic data, with the exception of horses under the age of three years and distant genotypes identified during the analysis of the genetic structure. The total number of selected animals was 1 533. To ensure that there is no influence of age as covariates in the study sample, all phenotypic variables were tested for Pearson's correlation with age. Standard measurements of physique, height at the withers and oblique body length showed no significant correlation at a threshold value of $p < 0.05$ (p-values 0.8388 and 0.4211, respectively). Only weak correlations were found for chest circumference (0.0841, p-value 0.000507), pastern circumference (0.1011, p-value $2.922 \cdot 10^{-5}$) and body weight (0.1121, p-value $3.496 \cdot 10^{-6}$). Four body measurements were combined into a single variable using PCA after normalization; the first main component, describing 81% of the total variation, was selected as the new size variable.

The results of the analysis of the genetic structure were taken into account when selecting samples for GWAS. The analysis of the connection was carried out by live weight and measurements. The Pearson correlation test was used to ensure the independence of phenotypic variables from age. The size variable was determined using measurements of height at the withers (HW), oblique body length (OBL), chest (CC) circumference, cannon bone circumference (CBC), and body weight (BW). These parameters were normalized by subtracting the average value and dividing by the standard deviation, then the analysis of the main components was carried out.

***Key words**: Kazakh breed, genotyping with wide genome coverage, horses, single nucleotide polymorphism, Equus caballus*

Introduction. Organized research on the horse genome started in 1995 [1]. The decoding of the reference genome has brought genomic research in horses to a new level [2]. The EquCab 2.0 reference horse genome contributed to the discovery of millions of polymorphisms in various horse breeds, which led to the development of three generations of SNP chips. In 2011, matrices for SNP genotyping of horses of the first and second generation became available [1]. With the help of these SNP arrays, a number of phenotypic signs and genetic diseases have been identified, including Lavender Foal Syndrome (LES), also known as a lethal defect of lightening the suit (Coat Color Dilutional Lethal) [3], gait [4], discoloration of the iris [5] and squamous cell carcinoma the eye [6]. SNP arrays were used to identify breed-specific selection features [7], which help to understand the mechanisms underlying the formation of productive qualities and other characteristics of horses [4, 8]. In 2017, a third-generation MNEc670k SNP array, Affymetrix, was developed [9]. The next version of the reference genome (EquCab3.0) has recently been released and a reference sequence for the Y chromosome has been created [10].

Advances in molecular genetics have contributed to population studies analyzing the history of the origin of mammalian species, the genetic composition and origin of animal breeds, as well as the molecular causes of the formation of various traits [11]. The number of publications on the population genetics of horses is growing, which include several fundamental studies covering various breeds [7, 12-14], as well as many studies on one breed or group of related breeds: the American Quarter horse

[15-18], Hanoverian and German warm-blooded breeds [19, 20], Arabic and related Middle Eastern breeds [21, 22], Chinese aboriginal horses [23], Japanese aboriginal horse [24], Yakut horse [25], Puerto Rican horse [26]. Despite the large number of studies of the genetic structure of horses, their conclusions are quite similar to each other, namely, that modern horse breeds are characterized by high interbreed and low intrabreed genetic diversity [12, 13].

Regions with signs of selective pressure have been identified in the genome of modern horses. The most notable are the MSTN gene, which controls the growth of muscle tissues in running breeds [7, 16], and the DMRT3 gene, one of whose alleles is associated with ambling [7]. The type of hair pigmentation is responsible for the locus localized on the third chromosome and controlling the synthesis of the melanocortin hormone receptor MC1R. A normally functioning dominant allele of the MC1R gene causes the formation of black pigment. The recessive allele "e", which arose as a result of point replacement, provides synthesis of the red-yellow pigment pheomelanin and in the homozygous state causes the appearance of red horses MC1R e/e [13].

Candidate genes that determine the racing and running potential of horses have been identified: COX4I2 [27] and PDK4 [28].

There is evidence of the contribution of some genes to the formation of the growth qualities of horses. Mak van diNe ad S. et al. Using an array of 50,000 SNPs, loci including the LCORL/NCAPG, HMGA2, FAT, and LASP1 genes were identified, causing most of the size differences between different breeds [29]. These genes also influence body size and height in other animal species [30-33]. Additional studies have confirmed the association of LCORL/NCAPG genes [34-37], ZFAT [34, 37] and HMGA2 [38] with growth in various other equine populations.

An important aspect of the modernization of horse breeding in Kazakhstan is the widespread introduction of modern methods of molecular genetics and genomics into breeding practice in order to better understand the genetic structures of horse lines and breeds, improve the classification and management of horse genotypes, promote breeding using molecular markers associated with valuable traits, etc. Commercial animal microchip genotyping panels contain tens or hundreds of thousands of SNP markers selected to reflect overall genetic variability, which helps scan genomes for potentially important polymorphisms without expensive whole genome sequencing. Previously, in Kazakhstan, genotyping of SNP microchips was used to describe the genetic structures of local sheep breeds, another animal of significant importance for the country [39, 40]. The EquineSNP50 panel has been developed for horses, which has proven its suitability for genome-wide association analysis and horse diversity studies [7, 13].

The purpose of this study is to identify significant variations in the coding sequences of the genome associated with their productive qualities.

Methods and materials. The object of the study was breeding horses, at least 2 years old, which are the most prominent representatives of the Kazakh breed of the jabe type.

Biological material of horses of the Kazakh breed of the jabe type was collected from 9 populations of different regions of the Republic of Kazakhstan. Hair was taken from the tails and/or manes of horses and stored at a temperature of +4 °C until further use; hair follicles were used to isolate DNA. DNA was isolated using a DNA-Extran-2 kit (Syntol LLC, Russian Federation) in accordance with the manufacturer's protocol and quantified using a Qubit 4 fluorescent device with a broad-spectrum reagent Qubit dsDNA (Thermo Fisher Scientific, USA) for subsequent SNP genotyping.

Qualitative assessment of the isolated DNA. Electrophoretic DNA analysis was performed using 1% agarose, while 0.5 g of agarose per 50 ml of 1 x TAE buffer was weighed, respectively. We used the method of horizontal electrophoresis to separate DNA fragments. The results of electrophoresis were recorded using the BIO-RAD gel documenting system, which has ultra-high sensitivity, including for fluorescence.

The concentration of double–stranded DNA in the studied samples ranged from 23.5 to 272.2 ng/µl, the OD260/OD280 ratio ranged from 1.77 to 2.12. The resulting DNA was characterized by a sufficiently high concentration and purity. The isolated DNA is sufficient to carry out all necessary types of genotyping.

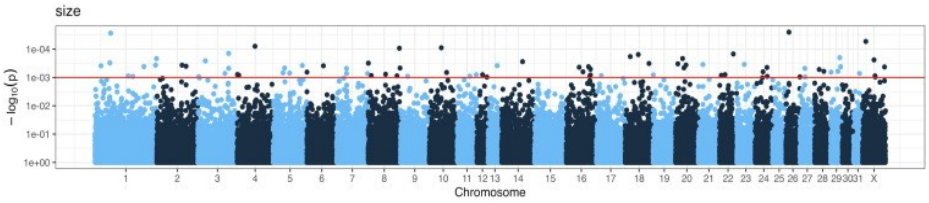
The collection of measurements from horses was carried out before sampling, while the following indicators were measured: height at the withers, oblique length of the trunk, chest circumference, pastern circumference and body weight.

The SNP genotyping data on the genetic diversity of foreign horse breeds [12] were obtained from the Open Science Foundation repository, with the permission of Dr. Jessica Petersen.

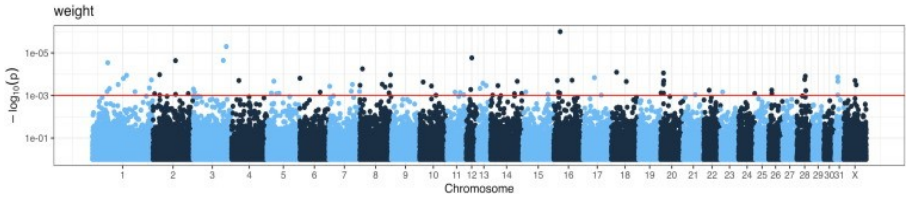
Genotyping was performed using the Equine80k SNP matrix with the iScan system (Illumina, USA) in accordance with the manufacturer's protocol. Genotype assignment and primary quality control were carried out using the genotyping module of the GenomeStudio (Illumina) software. The data was filtered using the following thresholds (primary quality control): call frequency ≥ 0.9, median GC score ≥ 0.8 for samples; call frequency ≥ 0.95 and GT score ≥ 0.7 for SNP. All data meeting these criteria were exported and converted to PIN text input files (.pad + .map) using common R data processing utilities [41]. PLINK1.9 [42, 43] was additionally used to exclude SNPs with an insignificant allele frequency < 0.05 and deviating from the Hardy-Weinberg equilibrium with a threshold value of p 1•10-10. The missing genotypes were calculated using BEAGLE [44].

Results and discussion. The associative analysis was performed using a linear regression algorithm implemented in the PLINK software, with adaptive correction of p-values based on the Monte Carlo permutation test. In order to visualize the distribution of statistically significant polymorphic sites and their distribution by chromosomes, Manhattan graphs (Manhattan plot) were constructed for each analyzed parameter. The values of the negative logarithm of the significance level for each polymorphic site (-log p) were postponed along the Y axis. Chromosomes in which polymorphic sites are localized were deposited along the X-axis. The lower the p value, the greater the significance level of the indicator and the higher it is relative to the origin of the coordinates along the Y axis.

Figure 1 shows graphs reflecting the nature of the distribution of significant SNPs by signs of body weight and measurements in horses of the jabe type.



А



Б

А – measurements, В – live weight. The X–axis is the horse's chromosome, the Y–axis is log10(p), the red line is p = 0.001

Figure 1 – Location of statistically significant polymorphic sites in chromosomes of Kazakh jabe–type horses

As can be seen from Figure 1, a total of 81 and 84 SNPs showed significant associations with the measurements and live weight of horses of the jabe type, with a significance level of p ≤ 0.001.

Table 1 – Summary of the phenotypic characteristics of Kazakh jabe-type horses

Trait	Average	Standard deviation	Median	Interquartile range
Body weight	409,57	38,16	400,00	45,00
Height at the withers	141,52	3,00	141,00	4,00
Oblique body length	146,24	3,82	146,00	6,00

Trait	Average	Standard deviation	Median	Interquartile range
Chest circumference	171,40	7,29	170,00	12,00
Cannon bone circumference	18,25	0,78	18,00	1,00

The conducted structural annotation made it possible to identify genes localized within the identified regions (Table 2).

Table 2 – Annotated candidate genes in horses of the Kazakh breed of the jabe type

Chromosome number	Region (Mb)	Genes
1	2	3
1	17.246-17.537	*ABLIM1*
	41.673-41.775	*ASAH2*
	77.820-78.252	*SLC35F3*
	115.104-115.197	*TUBGCP5*
	149.904-150.004	*EIF2AK4*
2	21.082-21.108	*OSCP1*
	69.758-69.872	*CPE*
	106.380-106.520	*TRPC3*
4	4.127-4.586	*RELN*
5	31.540-31.726	*DDR2*
	34.622-34.744	*AIM2*
1	2	*3*
6	46.360-46.360	*PIK3C2G*
7	26.761-26.796	*UBE4A*
	74.194-74.228	*RRM1*
8	9.363-9.388	*ZMAT5*
	10.204-10.801	*TTC28*
	68.384-68.494	*EPG5*
	76.382-76.726	*TCF4*
	92.496-92.932	*ZNF407*
9	19.405-19.407	*RRS1*
10	9.441-9.461	*DPF1*
11	42.848-42.869	*SPAG5*
12	10.967-11.003	*CREB3L1*
	17.079-17.080	*OR4C269P*
	29.516-29.556	*RELA*
	-	*SIPA1*
13	9.595-9.754	*COL26A1*
14	7.748-7.851	*ERGIC1*
16	18.863-18.912	*PPP4R2*
20	8.324-8.477	*BMP6*
	-	*OR12D2N*
21	13.456-14.494	*PDE4D*
22	5.199-5.422	*RIN2*
	15.084-15.753	*PLCB1*
24	44.646-44.773	*RCOR1*

26	41.496-41.633	*ADARB1*
28	26.649-26.659	*SYCP3*
	26.915-26.959	*WASHC3*
31	8.586-8.618	*SOD2*
	-	*ACAT2*

Of the 81 and 84 identified SNPs combined, 60 variants were associated with known horse genes using the VEP Ensembl server and with corresponding biological processes using DAVID (Table 2). Surprisingly, there was almost no overlap between the two sets of markers associated with the corresponding signs. Only two variants, BIEC2_117960 and BIE C 2-187196, showed significant association with both traits. While the first marker was associated with the OR4C269P gene, which had no available gene ontological annotation, the latter was identified in connection with the ecto-5'-nucleotidase (NT5E) gene involved in adenosine phosphate metabolism. In general, the identified genes play a regulatory or signaling role in a wide range of processes, from the cellular level to the whole organism. In our opinion, the most significant or basic terms of gene ontology for biological processes are listed in Table 2. The BMP6, DDR3 and CREB3L1 genes are involved in the development and metabolism of connective tissues, including bones. These genes were associated with SNPs significantly associated with weight. The BMP6 gene contained three linked SNPs, which was the highest number of all genes. A number of genes, DPF 1, GNAT 3, NEGR1, etc., have been annotated as being involved in the development of the nervous system. More specifically, the EGR1 gene was associated with eating and motor behavior, and the GNAT3 gene was associated with taste perception. The genes BMP 6, RELE 1, AIM 2, PDE4D and IGF 1R were associated, among other processes, with the regulation of the immune system. The EIF2AK4 gene has been linked to the cellular response to cold stress and protein starvation.

The absence of a genetic structure in the studied breeds and populations allowed us to combine all horses to analyze associations. To date, most studies of genome-wide associations in horses have focused on racing qualities and health [45, 46]. Signs related to the quality of horse feed have remained out of the field of view of equine genomics, since horse products, mainly meat, remain exotic or even marginal in many countries [47]. Thus, the study of the genetics of such traits is new not only for Kazakhstan. Here we tested a set of SNP markers for the connection with the most common parameters related to meat productivity, live weight and animal size. Sixty SNPs were found to be associated with either of these two traits and associated with functionally annotated horse genes. The set of identified genes included genes involved in various biological processes as regulatory and signaling factors. An interesting idea was that almost all significant annotations were related to size or weight independently, despite the obvious correlation between these features. Among all functionally annotated genes, it is possible to note some specific aspects of biological processes potentially related to the traits of interest. First, the development of connective tissues and the bone system, which are crucial for maintaining an animal's weight and size. Secondly, the development of the nervous system; the more specific effect of the GNAT3 and NEGR1 genes on horse feed preferences and, therefore, indirectly, on their growth could be an interesting topic for discussion in future studies. Thirdly, the regulation of immune processes that affect growth, affecting overall health. However, it should be borne in mind that gene annotations using gene oncology were based mainly on data on humans and model animals (mice, rats, etc.); thus, the true physiological role of the identified genes in horses may vary. In addition, possible associations of variants that remain unnamed require further clarification, taking into account updated annotation data for equine genomes.

Conclusion. Based on genotyping with a wide genome coverage, significant variations in the coding sequences of the genome associated with the productive qualities of the Kazakh breed of the jabe type were revealed. A genome-wide analysis of the association of SNP markers with horse body size and weight was performed for all animals with available phenotypic data, with the exception of horses under the age of 3 years and distant genotypes identified by genetic structure analysis. To ensure that there is no influence of age as covariates in the selected sample, all phenotypic variables were tested for Pearson's correlation with age. Standard measurements of physique, height at the withers and oblique body length showed no significant correlation at a threshold value of 0.05 (p-values 0.8388 and 0.4211, respectively). Only weak correlations were found for chest circumference

(0.0841, p-value 0.000507), cannon bone circumference (0.1011, p-value 2.922•10-5) and weight (0.1121, p-value 3.496•10-6). Four body measurements were combined into a single variable using PCA after normalization; the first main component, describing 81% of the total variation, was selected as the new size variable. As a result, a total of 81 and 84 SNPs showed significant associations with size and weight, respectively, at the selected significance level of 0.001;

Candidate genes in the regions of interest of the genome have been identified and SNP polymorphisms potentially involved in the formation of economically significant phenotypes and traits have been selected. Of the studied SNP sets, 60 variants were associated with known horse genes using the VEP Ensembl server and with the corresponding biological processes using DAVID. There was almost no overlap between the two sets of markers associated with the corresponding features. Only two variants, BIEC2_117960 and BIEC2-187196, showed significant association with both traits. While the first marker was associated with the OR4C269P gene, which had no available gene ontological annotation, the latter was identified in connection with the ecto-5'-nucleotidase (NT5E) gene involved in adenosine phosphate metabolism. In general, the identified genes play a regulatory or signaling role in a wide range of processes, from the cellular level to the whole organism. The BMP6, DDR3 and CREB3L1 genes are involved in the development and metabolism of connective tissues, including bones. These genes were associated with SNPs significantly associated with weight. The BMP6 gene contained three linked SNPs, which was the highest number among all genes. A number of genes, DPF1, GNAT3, NEGR1, etc., have been annotated as being involved in the development of the nervous system. More specifically, the NEGR1 gene was associated with eating and motor behavior, and the GNAT3 gene was associated with taste perception. The genes BMP6, RELA1, AIM2, PDE4D and IGF1R were associated, among other processes, with the regulation of the immune system. The EIF2AK4 gene has been linked to the cellular response to cold stress and protein starvation.

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ТҮЙІН

Мақалада геномның кең қамтуы бар генотиптеу негізінде анықталған джабе типті қазақ тұқымының өнімділік қасиеттерімен байланысты геномның кодтау тізбегіндегі Елеулі вариациялар келтірілген.

Үш жасқа дейінгі жылқыларды және генетикалық құрылымды талдау кезінде анықталған алыс генотиптерді қоспағанда, қол жетімді фенотиптік деректері бар барлық жануарлар үшін SNP маркерлерінің жылқы өлшемдерімен және тірі салмағымен байланысының толық геномдық талдауы жүргізілді. Іріктелген жануарлардың жалпы саны 1 533 құрады. Зерттелетін үлгідегі ковариат ретінде жас әсерінің жоқтығына көз жеткізу үшін барлық фенотиптік айнымалылар Пирсонның жасына байланысты корреляциясына тексерілді. Стандартты дене өлшемдері, биіктік және дененің қиғаш ұзындығы $p < 0,05$ шекті мәнінде маңызды корреляцияның жоқтығын көрсетті (сәйкесінше Р-0,8388 және 0,4211 мәндері). Кеуде шеңберінің (0,0841, р-мәні 0,000507), метакарпальды шеңбердің (0,1011, р-мәні $2,922 \cdot 10^{-5}$) және тірі массаның (0,1121, р-мәні $3,496 \cdot 1^{0-6}$) көрсеткіштері үшін тек әлсіз корреляциялар анықталды.

Дененің төрт өлшемі қалыпқа келтірілгеннен кейін PCA көмегімен бір айнымалыға біріктірілді; жалпы вариацияның 81% сипаттайтын бірінші негізгі компонент жаңа өлшемді айнымалы ретінде таңдалды.

GWAS үшін үлгілерді іріктеу кезінде генетикалық құрылымды талдау нәтижелері ескерілді. Байланыс талдауы тірі масса мен өлшемдер бойынша жүргізілді. Пирсонның корреляциялық сынағы фенотиптік айнымалылардың жасына тәуелсіздігін қамтамасыз ету үшін қолданылды. Өлшем айнымалысы биіктік өлшемдерін (Б), дененің қиғаш ұзындығы (ДҚҰ), кеуде шеңберін (КШ), метакарпальды шеңберді (МШ) қолдану арқылы анықталды. Бұл параметрлер орташа мәнді азайту және стандартты ауытқуға бөлу арқылы қалыпқа келтірілді, содан кейін негізгі компоненттерге талдау жасалды.

РЕЗЮМЕ

В статье представлены значимые вариации в кодирующих последовательностях генома, ассоциированные с продуктивными качествами казахской породы типа джабе, выявленные на основе генотипирования с широким покрытием генома.

Полногеномный анализ связи SNP-маркеров с промерами и живой массой лошади был проведен для всех животных с доступными фенотипическими данными, за исключением лошадей в возрасте до трех лет и отдаленных генотипов, выявленных при анализе генетической структуры. Общее количество отобранных животных составило 1 533. Чтобы убедиться в отсутствии влияния возраста как ковариаты в исследуемой выборке, все фенотипические переменные были протестированы на корреляцию Пирсона с возрастом. Стандартные измерения телосложения, высоты в холке и косой длины туловища, показали отсутствие значимой корреляции при пороговом значении $p < 0,05$ (p-значения 0,8388 и 0,4211 соответственно). Только слабые корреляции были выявлены для показателей обхвата груди (0,0841, p-значение 0,000507), обхвата пясти (0,1011, p-значение $2,922 \cdot 10^{-5}$) и живой массы (0,1121, p-значение $3,496 \cdot 10^{-6}$). Четыре измерения тела были объединены в единую переменную с использованием PCA после нормализации; первый основной компонент, описывающий 81% общей вариации, был выбран в качестве новой переменной размера.

Результаты анализа генетической структуры были приняты во внимание при отборе образцов для GWAS. Анализ связи был проведен по живой массе и промерам. Корреляционный тест Пирсона был использован для обеспечения независимости фенотипических переменных от возраста. Переменная размера была определена с использованием измерений высоты в холке (ВХ), косой длины туловища (КДТ), обхвата груди (ОГ), обхвата пясти (ОП). Эти параметры были нормализованы путем вычитания среднего значения и деления на стандартное отклонение, затем был проведен анализ основных компонентов.

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EFFICIENCY OF USING FEED ADDITIVES «SAL CARB DRY» AND «TOXFIN DRY» IN THE DIET OF MUSK DUCKLINGS

ANNOTATION

Duck farming is a lucrative livestock industry in the world for its eggs, meat and feathers. Like chickens, ducks are bred for their eggs and meat. Ducks can also be raised in combination with other forms of agriculture such as fish farming and/or rice farming. Ducks feed on insects, snails, kitchen scraps, rice grains, and weeds, which are food sources for ducks in addition to the food obtained by foraging. But for better production, additional feed additives are needed. The experiment was carried out with three groups of Muscovy ducks. Each group was divided into 50 males and 50 females. A total of 300 ducks were assessed. The birds were kept on litter indoors in 6 pens and fed a basic diet + premix, and the experimental groups were additionally supplemented with feed additives. “Sal CARB dry” and “TOXFIN dry” in various dosages depending on the age of waterfowl. The morphobiochemical blood parameters were studied in the experimental and control groups. The addition of feed additives helped to maximize the productivity of young animals and reduce feed costs for the products produced, and also significantly increased the content of red blood cells, platelets, hemoglobin levels in the blood and increased the number of neutrophils responsible for protecting the body from pathological microflora, which led to increased hematopoiesis and body stability to pathogens.

***Key words**: muscovy ducks, feed additive, live weight, morphobiochemical parameters, hematopoiesis.*

Introduction. In providing the population with high-quality livestock products, a special place is given to waterfowl meat, as one of the sources of biologically complete protein in human nutrition. Duck meat also has a favorable essential amino acid profile (including relatively high amounts of lysine) and the highest content of unsaturated fatty acids of any poultry species. It is a source of fat-soluble vitamins (mainly A and E) and water-soluble vitamins (B1, B2 and PP), and is a major source of readily available iron. It is superior to broiler chicken meat in terms of tenderness and juiciness. Its taste and aroma qualities are not without significance [7].

Currently, increasing the efficiency of agricultural production is given special importance, because Products that are competitive on the world market must ensure high quality, a wide range and low specific resource costs for production. Increasing the efficiency of agricultural production is especially important in the context of Kazakhstan’s membership in the World Trade Organization (WTO) [1].

Blood is the most specialized tissue of the body. Its composition mutually determines the nature of the biological processes occurring in the body and reflects the fluctuations in the external environment perceived by the body. The blood composition is very labile. The level of feeding of animals and especially its usefulness has a great influence on the composition of the blood. The blood picture is an indicator of the physiological state of the animal’s body. With its help, the constancy of the internal environment of the body is maintained. As a result of dysfunction of any organs or tissues, pathological indicators, poisoning and stress, the composition of the blood changes.

Material and methodology. The main studies were carried out in 2024. in the production conditions of the peasant farm "Menzhan-agro" of the West Kazakhstan region on musk ducklings raised for meat.

The object of the study was the feed additives “Sal CARB dry” and “TOXFIN dry”; their effective dosage in the diets of ducklings was determined. The material for the experiment was young ducks up to 11 weeks of age. For the scientific and economic experiment, 300 one-day-old musk ducklings were selected; three experimental groups were formed according to the principle of analogues (control and experimental groups I, II). The experiment scheme is presented in Table 1. Feed additives used: 1. Sal CARB dry - a feed additive to reduce the level of pathogenic microflora in feed raw materials and feed for farm animals, including birds, this is a balanced synergistic complex of

antibacterial compounds, as well as a wide range actions against pathogens; 2. TOXFIN dry is a feed additive for the adsorption of aflatoxin B1 in feed for farm animals, including birds, with characteristic adsorption of a wide range of mycotoxins, no negative impact on nutrient availability, no growth stimulator effect, positive effect on zootechnical performance, restoration of the status of mycotoxin target organs, excretion of mycotoxins in droppings, maintenance of immune status in the presence of mycotoxins in feed.

Ducklings were raised outdoors on deep litter; the technological indicators of all groups were identical and corresponded to the basic parameters of GOST 46 138-83 and the recommendations developed by VNITIP [3].

Muscovy ducklings were fed with complete feed, corresponding to three growing periods: 1–21, 22–56 and 57–77 days. and met the recommendations of VNITIP (1999, 2006). In all experimental groups, ducklings were fed and watered ad libitum.

Based on the main limiting indicator of the tested product, the percentage of input of the feed additives “Sal CARB dry” and “TOXFIN dry” into the mixed feed was calculated [2, 4-6].

Table 1 – Scheme of scientific and economic experience, (n=50)

Group	Tested feed additive to the basic diet + premix		
	Age, week.	Source of calcium	Dosage
			By weight of diet, %
Control	1-11	basic diet + premix	1,0
I – experienced	1-3	Sal CARB dry	1,0
	4 8	Sal CARB dry	2,0
	9-11	Sal CARB dry	3,0
II – experienced	1-3	TOXFIN dry	1,0
	4 8	TOXFIN dry	2,0
	9-11	TOXFIN dry	3,0

To determine the optimal doses of the test components, the experimental diets were compiled on the basis of the main diet + premix with the inclusion of “Sal CARB dry” and “TOXFIN dry” according to the experimental design (Table 1).

The rational dose of “Sal CARB dry” and “TOXFIN dry” introduced into the compound feed was determined by a set of zootechnical indicators (absolute and relative growth, dynamics of live weight).

Results and discussion. We studied the dynamics of live weight of ducklings and blood parameters of musk ducklings. As studies have shown, the tested dosage had a significant effect on changes in metabolic processes, which in turn affected the growth rate of muscle and bone tissue (Table 2).

Table 2 – Dynamics of live weight of ducklings, g (n=50)

Indicators	Control	I – experienced	II – experienced
	♂		
Age	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
At birth	51±0,15	50,42±0,20	50,68±0,20
7 days	180,22±1,03	190,78±1,24	200,84±1,13
14	530,26±3,51	540,68±3,33	569,68±4,25
21	930,28±6,06	939,96±4,11	1020,28±7,67
28	1380,18±7,21	1440,58±6,42	1571,32±8,53
35	1830,82±7,1	1940,22±9,42	2142,36±10,80
42	2380,12±9,70	2490,82±15,96	2735,44±8,83
49	2770,56±12,3	3080,14±18,42	3372,44±24,06
56	3130,84±19,56	3538,44±36,55	3872,72±44,90

63	3380,06±22,9	3790,64±28,43	4165,54±26,49
70	3540,82±20,8	3939,44±35,76	4354,82±36,51
77	3603,38±30,01	4049,42±35,7	4470,72±54,76
Indicators	♀		
	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
At birth	49,6±1,88	49,92±0,26	50,84±0,24
7 days	150,22±1,82	161,96±1,93	159,76±1,57
14	250,98±2,59	360,74±2,41	379,34±2,75
21	430,98±4,17	609,96±5,18	647,6±7,92
28	645,58±7,19	910,54±5,75	960,54±7,31
35	940,16±6,85	1210±8,13	1310,98±10,52
42	1222,13±7,8	1559,52±7,50	1657,44±8,83
49	1488,42±8,77	1808,76±9,97	1968,7±8,35
56	1690,52±8,92	2010,8±10,4	2211,14±13,81
63	1840,22±10,17	2163,58±14,9	2409,74±18,05
70	1942,02±7,9	2258,14±17,73	2530,74±22,89
77	2030,9±18,2	2319,82±11,40	2609,94±30,66

When weighing the entire livestock weekly, it was found that at 7 days of age there was a difference in live weight between the ducklings of the control and experimental groups towards an increase in its values in the experimental groups. Further studies of live weight revealed its steady increase when ducklings were fed the feed additives “Sal CARB dry” and “TOXFIN dry” with the main diet + premix. So, young animals I, II gr. exceeded the live weight of male ducklings in the control group. at the age of 21 days. by 1.04-9.67%, 56 days. - by 13.02-23.7%, 77 days. - by 12.37-24.07%, as well as females aged 21 days. by 41.62-50.37%, 56 days. - by 18.95-30.8%, 77 days. - by 14.23-28.52%.

Analyzing the age-related dynamics of live weight of ducklings, it should be noted that at 21 days of age its change in relation to control values at different dosages of feed additives “Sal CARB dry” and “TOXFIN dry” was more significant. This indicates the highest growth energy of ducklings up to 21 days of age. The most significant and reliable increase in live weight was observed in ducklings of the 2nd experimental group, and by the end of the growing period it exceeded the indicator in the control group. was 12.37-24.07%, respectively, in males, 14.23-28.52% in females.

The main characteristic of growth is the growth rate indicator. The growth rate of the organism depends on the activity of cell division and an increase in cell mass, reflected in the average daily growth (Table 3).

Table 3 – Average daily increase in live weight of ducklings by growing period, g (n=50)

Indicators	Control	I – experienced	II – experienced
	♂		
Age	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
At birth	14,37±0,26	20,05±0,18	21,45±0,16
7 days	14,39±0,47	49,98±0,49	5,69±0,61
14	25,71±0,68	57,04±0,76	64,37±1,24
21	30,65±1,13	71,51±0,87	78,72±1,54
28	42,08±1,41	71,37±1,75	81,57±1,84
35	40,28±1,54	78,65±2,53	84,72±3,94
42	38,04±1,86	84,18±3,02	91±5,37
49	28,87±1,85	65,47±5,29	71,46±7,23
56	21,38±2,00	36,02±6,66	41,83±7,34
63	14,54±1,66	21,25±5,97	27,04±6,02

70	12,69±2,78	15,71±6,52	16,55±10,03
77	25,73±0,23	51,93±0,46	57,40±0,71
Indicators	♀		
	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
At birth	18,46±0,14	16,00±0,27	15,56±0,22
7 days	50,00±0,52	28,39±048	31,36±0,44
14	57,14±0,86	35,60±0,82	38,32±1,18
21	64,27±1,39	42,94±1,30	44,70±1,54
28	64,37±1,29	42,83±1,54	50,06±1,84
35	78,47±1,56	49,87±1,68	49,49±2,00
42	55,77±1,70	35,60±1,86	44,46±2,04
49	51,46±3,34	28,86±2,15	34,63±2,07
56	35,60±4,44	21,82±2,87	28,37±3,52
63	22,96±4,49	13,50±3,44	17,28±4,39
70	8,93±3,17	8,81±2,94	11,31±4,87
77	46,13±0,38	29,47±0,14	33,23±0,39

Indicators of average daily increase in live weight of ducklings I, II gr. exceeded the values in the control group. in the first period of growing in males by 40.86-48.07 g, in the second period - by 14.64-20.45 g and an average of 77 days. cultivation - by 26.2-31.67 g.

Analysis of age-related changes in average daily growth indicates that the greatest increases are observed in the first growing period.

The characteristics of growth intensity can be traced both by the absolute value of growth and by indicators of relative growth (Table 4).

Table 4 – Absolute increase in live weight of male and female musk ducklings by days of rearing, g (n=50)

Indicators	Control	I – experienced	II – e xperienced
	♂		
Age	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
At birth	129,22±1,02	140,36±1,30	150,16±1,16
7 days	350,04±3,64	349,9±3,43	368,84±4,31
14	400,02±6,02	399,28±5,34	450,6±8,74
21	449,9±9,74	500,63±6,15	551,04±10,82
28	450,64±9,03	499,64±12,25	571,04±12,90
35	549,3±10,95	550,6±17,71	593,08±27,60
42	390,44±11,94	589,32±21,18	637±37,65
49	360,28±23,43	458,3±37,06	500,28±50,63
56	249,22±31,09	252,2±46,65	292,82±51,40
63	160,76±31,46	148,8±41,81	189,28±42,14
70	62,56±22,25	109,98±45,65	115,9±70,23
77	3552,38±29,99	3999±35,74	4420,04±54,72
Indicators	♀		
	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
At birth	100,62±1,83	112,04±1,92	108,92±1,55
7 days	100,76±3,32	198,78±3,41	219,58±3,13
14	180±4,82	249,22±5,76	268,26±8,28
21	214,6±7,95	300,58±9,12	312,94±10,84

28	294,58±9,91	299,84±10,84	350,44±12,94
35	281,97±10,82	349,14±11,80	346,46±14,05
42	266,28±13,04	249,24±13,03	311,26±14,31
49	202,1±12,98	202,04±15,10	242,44±14,49
56	149,7±14,03	152,78±20,14	198,6±24,65
63	101,8±11,63	94,56±24,11	121±30,77
70	88,88±19,48	61,68±20,60	79,2±34,14
77	1981,3±18,18	2269,9±11,38	2559,1±30,69

Data on absolute and relative growth suggest that the combination of feed additives “Sal CARB dry” and “TOXFIN dry” has a positive effect on the growth rate of musk ducklings. Thus, the introduction into the diet of experimental groups I and II. The tested combination of additives made it possible to increase the absolute growth of birds during the growing period compared to analogues in the control group.

However, absolute growth does not sufficiently characterize the intensity of an animal’s growth, since it does not reflect the relationship between the amount of growing body weight and the rate of its growth. Indicators of the relative growth of ducklings at different age periods more fully reflect this process.

The relative growth rates of duckling’s decrease with age. This is a common pattern for experienced groups. The highest growth rate of ducklings was observed before 3 weeks of age. The young animals of experimental groups I and II showed the most intensive growth, surpassing their peers from the control group.

The viability of ducklings largely depends on the biological usefulness of the fed feed. During the experiment, the clinical condition of the animals was studied, hematological and biochemical blood parameters. For the study, blood from ducks was taken into vacuum tubes before morning feeding from the saphenous axillary vein, located on the inner surface of the wing. From each group, blood was taken from 20 ducks and 20 drakes for testing. Blood was taken on the day the groups were formed, 21 days from the start of the experiment and at the end of the experiment.

The data presented in Table 5 indicate that the inclusion of the feed additives “Sal CARB dry” and “TOXFIN dry” in the mixed feed contributed to an increase in the number of erythrocytes and platelets in the blood of ducks of the experimental groups, and also increased the number of lymphocytes responsible for immunological homeostasis. Thus, diets with the tested concentrations of additives contained all the necessary nutrients to maintain normal life activity and good health of ducklings.

Table 5 – Morphobiochemical parameters, (n=20)

Indicators	Control	I – experienced	II – experienced
	♂		
	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
Red blood cells, 10^{12}/ l	2,87±0,05	3,6±0,02	4,1±0,07
Hemoglobin, g/l	126±0,83	138±0,49	148±0,72
Leukocytes, 10^{9}/ l	24±0,44	26±0,35	27±0,83
Color indicator, c.u.	1,02±0,03	1,09±0,02	1,13±0,02
Alkaline reserve, mg%	24±0,79	723,4±2,23	719,3±1,07
Total nitrogen, mg%	813,5±0,98	859,2±0,94	919,2±0,77
Total protein, g/l	51,2±0,19	52,6±0,28	53,3±0,27
Albumin, %	38,6±0,14	39,9±0,36	42,7±0,21
α-globulins	11±0,21	13±0,27	14±0,24
β-globulins	10±0,18	11±0,17	12±0,25
γ-globulins	35±0,20	33±0,44	34±0,41
Atherogenic coefficient	0,77±0,01	0,80±0,03	0,87±0,04

Calcium, mmol/l	2,33±0,06	2,38±0,04	2,63±0,02
Phosphorus, mmol/l	2,01±0,05	2,19±0,03	2,27±0,05
Indicators	♀		
	$\bar{x}$±Sx	$\bar{x}$±Sx	$\bar{x}$±Sx
Red blood cells, 10^{12}/ l	2,50±0,07	3,2±0,10	3,9±0,29
Hemoglobin, g/l	110,58±2,20	109,7±1,48	119,1±2,52
Leukocytes, 10^{9}/ l	26,43±1,46	30,02±2,07	31,24±1,18
Color indicator, c.u.	1,02±0,22	1,13±0,05	1,33±0,08
Alkaline reserve, mg%	728,1±3,05	723,3±0,96	718,2±1,72
Total nitrogen, mg%	793,2±2,78	843,6±1,73	901,2±3,18
Total protein, g/l	52,1±2,14	53,4±2,28	54,1±2,14
Albumin, %	42,8±1,13	45,01±2,85	46,12±0,96
α-globulins	14,4±0,37	14,7±3,58	15,2±2,13
β-globulins	8,7±0,14	7,9±0,30	7,2±1,01
γ-globulins	34,1±0,78	30,15±3,42	32,5±0,99
Atherogenic coefficient	0,76±0,04	0,81±0,09	0,88±0,11
Calcium, mmol/l	2,17±0,09	2,23±0,23	2,44±0,17
Phosphorus, mmol/l	2,12±0,13	2,17±0,38	2,23±0,09

The given data on feed costs significantly complement the indicators of crude protein consumption and metabolic energy per 1 kg of duckling growth, which were higher in the control group. and gradually decreased in the experimental ones with an increase in the dose of feed additives “Sal CARB dry” and “TOXFIN dry” introduced into the diet.

Conclusion. Based on the research results, the following conclusions can be drawn: the optimal level of introduction of the feed additives “Sal CARB dry” and “TOXFIN dry” into the diet corresponded to the first experimental group. and II experimental gr. ducklings and contributed to maximizing the productivity of young animals, the safety of the livestock and reducing the cost of feed for the products produced.

Thus, the use of feed additives “Sal CARB dry” and “TOXFIN dry” with the Basic diet + premix in feeding ducks of the parent flock of Muscovy ducks significantly increased the content of red blood cells, platelets, hemoglobin level in the blood and increased the number of neutrophils responsible for protecting the body from pathological microflora, which led to increased hematopoiesis and the body's resistance to pathogens.

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РЕЗЮМЕ

Разведение уток является прибыльной отраслью животноводства в мире из-за яиц, мяса и перьев. Как и кур, уток разводят ради яиц и мяса. Уток также можно выращивать в сочетании с другими видами сельского хозяйства, такими как рыбоводство и/или выращивание риса. Утки питаются насекомыми, улитками, кухонными отходами, рисовыми зернами и сорняками, которые являются источниками пищи для уток в дополнение к корму, получаемому при поиске пищи. Но для лучшего производства необходимы дополнительные кормовые добавки. Эксперимент проводился с тремя группами мускусных уток. Каждая группа была разделена в каждой по 50 самцов и 50 самок. Всего было оценено 300 уток. Птицы содержались на подстилке в закрытом помещении в 6 загонах и питались основным рационом+премиксом, а также опытным группам дополнительно добавляли кормовые добавки «Сал КАРБ сухой» и «ТОКСФИН сухой» в различных дозировках в зависимости от возраста водоплавующих птиц. Исследовано морфобиохимические показатели крови в опытных и контрольной группе. Добавление кормовых добавок способствовало максимальному увеличению продуктивности молодняка и снижению затрат корма на производимую продукцию, а также достоверно повышало в крови содержание эритроцитов, тромбоцитов, уровень гемоглобина и увеличивало количество нейтрофилов, отвечающих за защиту организма от патологической микрофлоры,

что приводило к повышению гемопоэза и устойчивости организма к патогенам.

ТҮЙІН

Үйрек шаруашылығы жұмыртқасы, еті және қауырсыны бойынша дүние жүзінде табыс әкелетін мал шаруашылығы саласы. Тауықтар сияқты үйректер де жұмыртқасы мен еті үшін өсіріледі. Үйректерді балық өсіру және/немесе күріш өсіру сияқты ауыл шаруашылығының басқа түрлерімен бірге өсіруге болады. Үйректер жәндіктермен, ұлулармен, ас үй қалдықтарымен, күріш дәндерімен және арамшөптермен қоректенеді, бұл үйректер жем-шөппен алынған азықтан басқа, үйректер үшін қорек көзі болып табылады. Бірақ жақсы өнім алу үшін қосымша азық қоспалары қажет. Тәжірибе мускус үйректердің үш тобымен жүргізілді. Әр топ 50 аталық пен 50 аналық топқа бөлінді. Барлығы 300 үйрек бағаланды. Құстар алты жабық қорада ұсталды және негізгі рационмен азық қоспамен қоректендірілді, және тәжірибелік топтарға қосымша «Сал КАРБ құрғақ» және «ТОКСФИН құрғақ» суда жүзетін құстардың жасына байланысты әртүрлі мөлшерде азық қоспаларын қосып азықтандырылды. Қанның морфобиохимиялық көрсеткіштері эксперименттік және бақылау топтарында зерттелді. Жемдік қоспаларды қосу жас малдың өнімділігін арттыруға және өндірілген өнімге кететін азықтық шығындарды азайтуға көмектесті, сонымен қатар қандағы эритроциттердің, тромбоциттер құрамының, гемоглобин деңгейінің айтарлықтай артуына және ағзаны патологиялық микрофлорадан қорғауға жауапты нейтрофилдердің санын арттыруға көмектесті, бұл гемопоэздің жоғарылауына және ағазаның патогендерге тұрақтылығына әкелді.

CONTENT

ANIMAL HUSBANDRY

Rules for authors on the design of an article for publication

Scientific and practical journal «Ğylym jäne bilim» is a periodical of the West Kazakhstan Agrarian and Technical University named after Zhangir Khan K. The journal is published kuarterly and articles are published in Kazakh, Russian and English languages. The journal publishes scientific works on actual problems of fundamental and applied researches in the field of agricultural, veterinary, biological, technical, economic and socio-humanitarian sciences.

Subscription to the collection can be arranged through the catalogues of newspapers and magazines «Kazpost» JSC (index 76316).

Scientific, technical and industrial articles planned for publication in our journal undergo the procedure of unilateral blind review and approval by the editorial board. With a positive conclusion, the material is placed in the «portfolio» of the editorial board in the kueue for publication. The speed of publication depends on the relevance of the material and fullness of the «portfolio» of the editorial office on the given topic. In addition, due to the fact that according to the order of the Chairman of KKSON MES RK dated 12.06.2013 № 949 one of the conditions for inclusion of the journal in the list of editions recommended by the Committee for publication of the main results of scientific activity is the availability of publications in foreign languages, the right of extraordinary publication will be enjoyed by articles in English.

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