American Journal of Animal and Veterinary Sciences

Original Research Paper

Assessment of Breeding Qualities of Kazakh White-Headed Bulls by Testing Their Productivity

[1]Aruzhan Nugmanova, [1]Aliya Akhmetaliyeva, [1]Yedige Nassambayev, [1]Alzhan Shamshidin, [2]Askar Nametov, [1]Aidana Doszhanova, [1]Rukhan Kulbayev and [1]Yerkingali Batyrgaliyev

[1]Higher School of Animal Husbandry and Bioresources, Zhangir Khan West Kazakhstan Agrarian Technical University, Uralsk, Kazakhstan
[2]Higher School of Veterinary Clinical Science, Zhangir Khan West Kazakhstan Agrarian Technical University, Uralsk, Kazakhstan

Article history
Received: 31-10-2023
Revised: 15-05-2024
Accepted: 01-06-2024

Corresponding Author:
Aliya Akhmetaliyeva
Higher School of Animal Husbandry and Bioresources, Zhangir Khan West Kazakhstan Agrarian Technical University, Uralsk, Kazakhstan
Email: aliyaakhmetaliyeva@mail.ru

Abstract: The purpose of the study was to quantify the breeding qualities of Kazakh White-Headed bulls by assessing their productivity metrics. The primary objectives were to analyze live weight dynamics, daily growth rates, feed conversion efficiency, and morphological meat quality and to employ "A" complex indices for evaluating the breeding potential. The study observed bulls aged 8-15 months at the Khafiza farm, located in the West Kazakhstan region. Parameters measured included monthly live weight, average daily growth, and feed cost per kilogram of gain. These data points were statistically analyzed to calculate "A" complex indices, which integrate multiple performance traits to evaluate overall breeding quality. It was found that 60% of bulls were represented by the upper classes, namely, the elite and the record-setting elite. The average daily growth and meat forms were the indicators with the best results in the comprehensive assessment of bulls. Very low point indicators were observed in the bulls in terms of live weight and feed costs per 1 kg of live weight gain. The largest number of bulls with high indicators of complex and breeding indices above 100% was observed in live weight (60%) and meat forms (60%) and the smallest number in feed costs (30%). The study results showed that 10% of the best bulls were selected according to the "A" complex index, their average live weight at the age of 15 months was in the range of 400-430 kg, the average daily gain was 804.76-852.38 g, meat forms equaled 55 points and the average "A" complex index for 10% of the best bulls was in the range from 100.17-104.44%. The application of "A" complex indices proved effective for categorizing bulls based on productivity and potential breeding value. The methodology facilitated a robust evaluation of phenotypic traits associated with meat production, providing a scalable approach for enhancing genetic selection practices in Kazakh White-Headed cattle.

Keywords: Productivity Test, Live Weight, Average Daily Gain, Feed Costs, Meat Forms, Bulls

Introduction

Increasing the production of premium beef is a significant challenge faced by Kazakhstan's agro-industrial sector. Premium meat can be obtained from animals of specialized meat breeds and their hybrids. Yet, the full and consistent exploitation of the growth potential of these specialized breeds remains a considerably unrealized opportunity across farms (Petrov *et al*., 2024; Nasambaev *et al*., 2019).

The analysis of the development of animal husbandry in the Republic of Kazakhstan shows that there are several unresolved problems in beef cattle breeding, among which one should note the lack of proper progress in increasing the number and proportion of breeding beef cattle and a very low level of artificial insemination in mating heifers. The outdated technology of animal exploitation, which does not meet the requirements of world standards, is still preserved in beef cattle breeding. One of the most important factors in accelerating breeding work is the widespread introduction of Kazakh and global achievements in the field of technology into production (Lapshin *et al*., 2023; Mussayeva *et al*., 2021; Beishova *et al*., 2024).

The agricultural sector in Kazakhstan heavily relies on the productivity of local beef cattle breeds, among which

the Kazakh White-Headed cattle hold significant potential. However, the optimization of these breeds through enhanced genetic qualities remains a critical challenge. This study aims to address this gap by quantitatively assessing the breeding qualities of Kazakh White-Headed bulls through several key performance indicators (Dushayeva *et al*., 2021; Nametov *et al*., 2022).

The selection and use of high-value bulls in breeding herds play a leading role in the intensification of selection and breeding work. One of the leading fields in breeding work in the creation of new genotypes and breeding of cattle with high genetic potential is the organization and performance of productivity testing on bulls. Methodological issues of testing young animals for their productivity are constantly covered in the specialized literature and interest in this issue is increasing and currently relevant. This is explained by the fact that in animal breeding to improve breeding and productive qualities, the crucial role is played by breeding bulls that have passed the test of productivity and received a high complex breeding index. Cattle breeding by growth intensity has shown its effectiveness all over the world since the evaluation and selection of bulls by their productivity is a very effective method of breeding work aimed at increasing the genetic potential of animal productivity (Buienbayeva *et al*., 2024; Cherekaev, 2010; Nassambaev *et al.*, 2019; Babich *et al*., 2022).

The productivity of animals is largely determined by the consumption of nutrients with feed and the ability to digest and assimilate them. It depends on many factors, the primary importance of which is adequate feeding, the structure of diets, the level of nutrition, physiological conditions, housing conditions, etc. Differing in the metabolism in the body, animals of different breeds and areas of productivity may treat feed differently and have different abilities to digest food (Kabylbekova *et al*., 2024; Gnezdilova *et al*., 2024; Korotkiy *et al*., 2024; Tkeshelashvili and Bobozhonova, 2024).

Young, developing animals can achieve significant weight gains efficiently, by using feed protein economically. Calves at a young age tend to gain weight effectively on diets rich in protein and low in fat. It is beneficial to leverage this biological trait by ensuring optimal conditions for their intensive growth. With age, the intensity of protein metabolism in animals decreases, together with the ability of organs and tissues to synthesize protein substances. The attractive side of the evaluation of bulls' productivity is that allows for testing a large number of bulls and selecting the most valuable of them for breeding. It is natural to expect that, on average, those animals whose individual productivity is significantly higher than other bulls in the group will have a higher breeding value (ХАЙНАЦКИЙ, 2022; Babich *et al*., 2022; Bissembayev *et al*., 2023).

Kazakhstan's beef cattle industry, pivotal to its agricultural economy, requires the advancement of genetic quality in local breeds such as the Kazakh White-Headed cattle. These breeds hold significant potential that remains untapped due to outdated breeding practices and suboptimal productivity levels. Addressing these challenges necessitates a detailed evaluation of breeding qualities that align with international cattle breeding standards.

The theoretical and practical basis of the method of evaluating and selecting stud bulls based on their productivity and the quality of offspring is the presence of a highly positive relationship between the energy of growth at a young age of the stud bull and his descendants. Therefore, the identification of stud bulls tested by productivity and their widespread use in breeding work should significantly increase the breeding efficiency (Il *et al*., 2024).

With properly organized breeding work and high intensity of selection, up to 70-80% of genetic progress can be achieved through the selection of bulls (Nassambaev *et al*., 2018; 2019; Nasambaev *et al*., 2020).

This leads to advancements in methods and the development of technology aimed at effectively managing the breeding process to conserve and enhance genetic resources in beef cattle breeding. Therefore, testing bulls on productivity and identifying the best genotypes on this basis is of important practical interest and is an urgent task of breeding work with the population of a particular breed.

The study aimed to evaluate the breeding qualities of Kazakh white-headed bulls by testing their productivity.

This study introduces significant innovations in the evaluation of Kazakh White-Headed bulls by developing and implementing 'A' complex indices, which represent a new integrated method for assessing breeding quality. These indices uniquely consolidate multiple productivity metrics such as live weight, daily growth, feed efficiency, and meat quality into a comprehensive evaluation tool. This approach not only enhances the specificity and accuracy of breeding assessments but also aligns them with economic outcomes important for sustainable cattle breeding.

Materials and Methods

The protocol of the study was discussed and approved at the meeting of the coordinating council of the Zhangir Khan West Kazakhstan Agrarian and Technical University (ZKATU). The test of Kazakh white-headed bulls on their productivity was carried out by the Instructions for the evaluation of stud bulls of meat breeds on their productivity and quality of offspring (Order of the Ministry of Agriculture of the Republic of Kazakhstan No. 456, 2010), as well as instructions on beef cattle evaluation (Order of the Ministry of Agriculture of the Republic of Kazakhstan No. 162, 2000).

The Khafiz farm, based in the village of Kyzyloba, Zhangaly district, West Kazakhstan region, specializes in breeding cattle of the Kazakh white-headed breed. Table 1

below shows the class composition of the herd of the Khafiz farm.

The class composition of the herd of the Khafiz farm is represented by animals of fairly high classes, in particular, the record-setting elite class (7.6%; 49 heads), elite (38.9%; 250 heads), and class I (51.0%; 328 heads). The number of cows belonging to the record-setting elite and elite classes, respectively, amounted to 5.0% (17 heads) and 32.3% (109 heads), which to a certain extent characterizes a herd with a fairly high-quality gene pool.

The object of the study was the bulls of the Kazakh white-headed from the Khafiz farm in the West Kazakhstan region. Bulls were selected based on several criteria designed to ensure the representativeness and relevance of the results: Age and health consistency, breed standard compliance, and genetic diversity.

Table 1: Class composition of the herd of the Khafiz farm according to the evaluation data

	Khafiz farm			
	By herd		By cows	
Indicator	heads	%	heads	%
Record-setting elite	49	7.6	17	5.0
Elite	250	38.9	109	32.3
Class I	328	51.0	196	58.1
Total	627	100.0	322	100.0

Table 2: Feeding rations of bulls tested on productivity from 8 to 15 months of age

	Age, months			
Indicators	8-9	9-10	11-12	12-15
1	2	3	4	5
Hay	6.0	7.0	9.0	11.0
1	2	3	4	5
Concentrate	3.0	3.0	3.0	3.0
Diet contains				
Energetic feed units, feed unit	6.3	6.8	7.8	8.8
Metabolizable energy, MJ	61.8	66.5	75.9	85.3
Dry matter, kg	7.1	7.8	9.3	10.8
Crude protein, g	778.0	833.5	944.5	1,055.5
Digestible protein, g	482.5	511.0	568.0	625.0
Crude fiber, g	1,820.1	2,107.2	2,681.4	3,255.7
Crude fat, g	171.3	193.3	237.4	281.5
Sugar, g	135.1	150.5	181.3	212.1
Starch, g	1,615.0	1,621.3	1,633.9	1,646.5
Calcium, g	21.4	24.5	30.8	37.1
Phosphorus, g	19.1	20.8	24.2	27.6
Magnesium, g	14.2	15.5	18.2	20.8
Potassium, g	77.5	88.0	109.1	130.2
Iron, mg	1,039.5	1,212.6	1,558.8	1,905.0
Zinc, mg	92.7	95.4	100.6	105.9
Copper, mg	44.5	48.3	56.0	63.7
Cobalt, mg	4.1	4.7	6.0	7.2
Manganese, mg	244.6	267.0	311.9	356.9
Iodine, mg	2.0	2.0	2.0	2.0
Carotene, mg	78.6	91.7	117.9	144.1

Following the set goal, the bulls were tested for productivity at the age of 8-15 months. Bulls of one birth season, namely the spring birth season (March 2021), were put to the test of their productivity. The age difference in the group was no more than one month and the delivered live weight of the bulls met the requirements of the test instructions. After weaning from mothers at the age of 6 months and up to 8 months, the bulls underwent an adaptation period, during which they were accustomed to eating the feed indicated for subsequent age periods.

Bulls from 8-15 months were kept loose with free access to the paddock. The cow shed was used mainly in winter and rainy autumn and spring days. There were paddock yards adjacent to it, where the bulls were most of the time. On the paddock, each animal had 15 m^2 of area. Such paddocks contributed to the motor activity of bulls, as well as the possibility of recreation on elevated areas (hills). The remains of hay of low-value quality were used for bedding.

The structure of the diet mainly contained locally produced feed and the daily feed amount varied depending on the age and live weight of the bulls (Table 2).

According to Table 2, the feeding rations of bulls tested for their productivity from 8-15 months of age corresponded to the minimum feeding standards for young meat cattle. Each ration has been meticulously planned to meet the nutritional needs conducive to optimal growth and development, which are important for evaluating the bulls' genetic potential for meat production. The accounting of the feed eaten during the control feeding of the bulls of the Khafiz farm was determined using the method of accounting for group feeding, which is allowed by the test instructions.

The results of preliminary studies allowed us to establish that the live weight of breeding bulls at the age of 3 years was 628.4 kg and the live weight of cows aged 3, 5 years and older corresponded to the breed standard of the Kazakh white-headed breed and exceeded the requirements of the breed standard by 12 kg (2.7%) and 16.6 kg (3.0%), respectively.

The organization of the testing of bulls on their productivity began with the selection of 6-month-old bulls from the cow herd. The chosen animals showed no physical defects and met the breed standard requirements for live weight at their age. At 15 months old, the bulls were assessed using four key criteria: Their live weight, average daily growth from 8-15 months, meat conformation at 15 months and feed costs per kilogram of weight gain, with indices calculated relative to the average values of the evaluated group. The complex index, which is the arithmetic mean of the partial indices, reflected the relative genetic potential of the animal. According to this index, considering the exterior features, the selection of rearing bulls for reproduction was carried out.

20 heads of the Kazakh white-headed breed were selected for the test on their productivity. The defining

signs of a lifetime assessment of breeding value during productivity testing were live weight at the age of 8 and 15 months, average daily live weight gain over 8-15 months, feed costs per 1 kg of live weight gain, and meat forms. A class and a breeding index were calculated for each trait and a class grade and a comprehensive breeding index were set for each bull. The bulls' live weight was measured monthly in the morning before they consumed feed or water. This assessment considered their live weights at 8 and 15 months of age, absolute weight gain, relative gain calculated using the Brody formula, and average daily gain. Feed costs were determined by monthly control feeding for 2 adjacent days and establishing the average of the feed consumed both in absolute value and nutritional value. Meat forms were determined by visual inspection according to the degree of manifestation on a 60-point scale at the age of 15 months. The exterior and constitutional features of bulls were determined by taking measurements and calculating the main body indices.

The results were processed using Microsoft Excel 2010 software (Microsoft Corp., USA) and Statistica 6.0 (StatSoft, Tulsa, USA).

Results

In beef cattle breeding, studying the physical conformation and overall constitution of animals is crucial during the selection process, particularly when evaluating bulls for their productivity (Table 3).

The bulls of the Khafiz farm were distinguished by an elongated, barrel-shaped body, with well-defined muscles. Table 3 illustrates the growth trajectory in terms of the physical dimensions of the bulls over key developmental stages. The increasing trend in measurements such as height at the withers and chest girth correlates with the bulls' genetic potential for physical growth, which is crucial for meat production.

The physique indices calculated based on a comparison of various measurements allow for characterizing the type of cattle physique and the proportionality of its development in more detail (Table 4).

Table 3: Measurements of Kazakh white-headed bulls tested on their productivity at the age of 8, 12, and 15 months, X ± Sx

	Age, month		
Indicators	8	12	15
Height at the withers	97.1±0.12	107.8±0.17	113.3±0.15
Height at the rump	101.8±0.24	110.4±0.25	116.3±0.24
Chest depth	46.2±0.21	54.6±0.34	62.3±0.31
The width of the chest behind the shoulder blades	31.6±0.17	34.4±0.19	41.2±0.37
Width of the hips	32.5±0.24	36.7±0.33	42.2±0.25
The oblique length of the trunk	102.5±0.16	121.3±0.25	131.7±0.14
Oblique quarters length	41.6±0.21	57.6±0.48	68.1±0.16
Chest girth	142.9±0.35	155.5±0.66	173.4±0.26
Metacarpus girth	16.5±0.12	18.1±0.14	19.0±0.14

Note: X is the arithmetic mean, Cx is the error of the arithmetic mean

The elongation index, pelvic and thoracic index, thoracic index, and blockiness and overgrowth indices characterize the bulls as animals of a pronounced meat type, so selective breeding for these indices can lead to improved meat production efficiencies in Kazakh White-Headed cattle.

An important indicator characterizing the growth of an animal is the live weight, the study of which in the process of growth allows an objective assessment of meat productivity during the life of the animal. Furthermore, according to researchers, under the same environmental conditions, the productive qualities of animals are determined by their genetic capabilities. Thus, to characterize the growth and development of experimental animals, we used the results of periodic weighing (Table 5).

Analysis of the study results showed that the live weight of the bulls when tested exceeded the breed standard by 29.6 kg (12.3%). This trend continued in subsequent periods of growth. Thus, at the ages of 9, 10, 11, 12, 13, 14, and 15 months, the excess was 32.3 (12.2%), 31.3 (12.2%), 35.6 (12.9%), 34.8 (11.6%), 38.7 (12.0%), 38.3 (11.1%) and 43.5 kg (11.9%), respectively.

Higher indicators of the coefficients of variability of the live weight of bulls at an older age to a certain extent indicate their high genetic heterogeneity. More visual representations of the development of bulls can be traced by the indicators of average daily and absolute weight gain (Table 6).

Table 4: Physique indices of Kazakh white-headed bulls that have passed the productivity test at the age of 8, 12, and 15 months, X ± Sx

Indicators	Age, months		
	8	12	15
Long legs	52.2±0.1	49.3±0.1	45.0±0.60
Elongation	105.8±0.2	112.6±0.3	116.2±0.50
Pelvic and thoracic	97.5±0.6	94.7±0.4	97.8±1.13
Thoracic	68.4±0.3	63.1±0.3	66,2±0,80
Blockiness	139.4±0.4	154.4±0.5	131.6±0.60
Overgrowth	105.1±0.2	102.8±0.3	102.6±0.10
Boniness	17.1±0.1	16.8±0.6	16.8±0.10

Table 5: Age dynamics of live weight of Kazakh white-headed bull calves during the period of productivity testing, X ± Sx

	Live weight		
Age, months	X ± Sx	δ	Cv
8	239.6±2.1	8.9	3.7
9	262.3±2.2	9.4	3.9
10	286.3±2.5	10.9	4.5
11	310.6±2.8	12.1	5.0
12	334.8±3.0	13.1	5.4
13	358.7±3.2	13.9	5.8
14	383.3±3.5	15.0	6.2
15	408.5±3.8	16.4	6.8

Note: X is the arithmetic mean, Cx is the error of the arithmetic mean, δ and Cv are indicators of variability

Table 6: Absolute and average daily weight gain of Kazakh white-headed bulls during the productivity testing period, X ± Sx

Age period, months	Live weight indicators	
	Absolute weight gain, kg X ± Sx	Average daily weight gain, g X ± Sx
8-09	19.7±0.55	756.6±18.4
9-10	24.0±0.71	801.6±23.7
10-11	24.3±0.59	810.0±19.7
11-12	24.1±0.68	805.0±22.9
12-13	23.9±0.82	796.6±22.5
13-14	24.6±0.69	821.6±23.2
14-15	25.1±0.78	838.3±26.3
8-15	24.1±0.54	803.8±18.0

The results of the studies showed that the absolute weight gain in bulls aged from 8-15 months ranged from 19.7-25.1 kg. The average daily gain rate for all growth periods amounted to 803.3 g and ranged from 756.6-833.3 g, while the highest average daily gain rates fluctuated in the age periods of 13-14 months and 14-15 months, which to a certain extent gives reason to consider some methodological aspects of the instructions for testing bulls on their productivity.

The method of two-stage evaluation of bulls is based on the established positive correlation between the increase in live weight of bulls aged from 8-15 months (0.5-0.9), their live weight at 12-15-18 months of age (0.4-0.9), feed cost (0.3-0.4), body shape (0.3-0.4), on the one hand, and similar indicators of their offspring, on the other hand. This makes it possible to judge their breeding value with a certain reliability based on the data on the young bulls' productivity. Therefore, in beef cattle breeding, the most acceptable method of evaluating breeding bulls is based on the results of their productivity test, followed by an assessment of the quality of offspring. The class and index scores of bulls based on the results of their productivity tests were characterized by various indicators (Table 7).

According to Table 7, 60% of the bulls fall into the upper classes (elite and record-setting elite). The most impressive results in the comprehensive evaluation of bulls were achieved in average daily weight gain and meat conformation. Bulls scored significantly lower in categories such as live weight and feed costs per kilogram of weight gain. The highest percentages of bulls with superior complex and breeding indices, exceeding 100%, were found in live weight (60%) and meat conformation (60%), while the lowest percentages were observed in feed costs (30%). The correlation between high breeding indices and desirable traits such as low feed costs per kg of weight gain and high-quality meat forms underscores the effectiveness of the breeding strategy employed.

It is important to note that 50% of the bulls had mismatches of the class grade with the value of the complex breeding index. Those differences were noted in the bulls with a complex class I index (20%), where complex breeding indices were in the range from 100.17-104.44%, and 30% of bulls with high indicators of the complex index (elite, record-setting elite) where the complex breeding indices were in the range from 90.69-98.72%.

The data of the indicators of the complex and index evaluation of the breeding value of bulls tested for their productivity proved their incomplete coincidence, which should be taken into account when conducting breeding work with selected breeds of cattle.

Table 7: Test results of Kazakh white-headed bull calves of the Khafiz farm

No.	Individual number	Date of birth	Live weight at 8 months kg	Live weight 15 kg	Breeding index %	Average daily gain g	%	Feed costs feed units	%	Meat forms points	%	Total score	Class index	Complex breeding index
1	KZL101309975	10.03.2021	234.0	401.00	98.31	795.24	98.88	7.50	82.49	55.0	100.46	40.0	*elite*	95.03
2	KZL101309927	10.03.2021	238.0	409.00	100.27	814.29	101.24	8.96	98.60	56.0	102.28	40.0	*elite*	100.60
3	KZL101310009	10.03.2021	248.0	407.00	99.78	757.14	94.14	7.50	82.49	55.0	100.46	40.0	*elite*	94.22
4	KZL101310097	13.03.2021	235.0	408.00	100.03	823.81	102.43	8.86	97.46	52.0	94.98	40.0	*elite*	98.72
5	KZL101309963	15.03.2021	251.0	415.00	101.74	780.95	97.10	9.05	99.54	56.0	102.28	35.0	*Class I*	100.17
6	KZL101309959	15.03.2021	244.0	423.00	103.70	852.38	105.98	9.62	105.81	56.0	102.28	32.0	*Class I*	104.44
7	KZL101309939	16.03.2021	232.0	381.00	93.41	709.52	88.22	7.50	82.49	54.0	98.63	41.0	*record-setting elite*	90.69
8	KZL101310101	17.03.2021	243.0	404.00	99.05	766.67	95.32	9.65	106.16	55.0	100.46	43.0	*record-setting elite*	100.25
9	KZL101309979	18.03.2021	250.0	429.00	105.17	852.38	105.98	8.45	92.91	55.0	100.46	42.0	*elite*	101.13
10	KZL101310061	19.03.2021	240.0	418.00	102.48	847.62	105.39	8.61	94.73	53.0	96.80	37.0	*Class I*	99.85
11	KZL101310063	21.03.2021	244.0	413.00	101.25	804.76	100.06	8.50	93.49	54.0	98.63	38.0	*Class I*	98.36
12	KZL101309987	23.03.2021	247.0	413.00	101.25	790.48	98.28	9.36	102.97	56.0	102.28	40.0	*elite*	101.20
13	KZL101310065	23.03.2021	250.0	442.00	108.36	914.29	113.68	8.31	91.43	54.0	98.63	39.0	*Class I*	103.02
14	KZL101309947	23.03.2021	223.0	377.00	92.43	733.33	91.18	9.68	106.49	55.0	100.46	41.0	*record-setting elite*	97.64
15	KZL101310025	24.03.2021	249.0	413.00	101.25	780.95	97.10	9.73	107.04	56.0	102.28	40.0	*elite*	101.92
16	KZL101309945	25.03.2021	234.0	413.00	101.25	852.38	105.98	8.80	96.78	56.0	102.28	43.0	*record-setting elite*	101.57
17	KZL101310109	26.03.2021	223.0	403.00	98.80	857.14	106.57	8.63	94.96	54.0	98.63	37.0	*Class I*	99.74
18	KZL101310069	27.03.2021	232.0	389.00	95.37	747.62	92.95	8.50	93.49	54.0	98.63	38.0	*elite*	95.11
19	KZL101309981	16.03.2021	237.0	392.00	96.10	738.10	91.77	9.62	105.80	55.0	100.46	35.0	*Class I*	98.53
20	KZL101309973	16.03.2021	238.0	420.00	102.97	866.67	107.76	8.77	96.45	54.0	98.63	37.0	*Class I*	101.45
			239.6	407.89	100.15	804.29	100.00	9.09	96.59	54.75	100.00	38.9		99.18

Discussion

Summarizing the results of the test of bulls' productivity, it should be noted that for a complete reliable assessment of the breeding value, the complex breeding index should be considered as an indicator reflecting the relative magnitude of the traits and independent of the conditions of feeding and housing.

As the results of our study showed, with a large number of bulls with the highest indicators of the complex class, the number of bulls with complex indices decreased, which indicates that the class assessment depends on external factors. Thus, the results of the test of bulls' productivity were characterized by various qualitative and quantitative indicators of class and index assessments, which necessitates improving the methodology for organizing the testing of beef bulls' productivity (Bissembayev *et al*., 2023).

The limiting factor for a reliable assessment of the breeding value of bulls during their productivity testing is the age at which the bulls were tested (Babich *et al*., 2022). As a rule, many farms sell young stud bulls at the age of 11-12 months, which coincides with the time of their productivity tests, which, according to the methodology, should be continued up to the age of 15 months.

In addition, not all farms have the opportunity to provide adequate feeding of bulls during the period of productivity testing. These factors are also the subject of study and development of the specified methodology for organizing the testing of bulls' productivity and evaluation of stud bulls based on the quality of offspring. Some studies (Aitzhanova *et al*., 2022) have shown that variations in feeding practices can also influence the composition and quality of meat produced by bulls. Differences in nutrient intake during the testing period may result in variations in fat deposition, muscle development, and overall meat quality, which can ultimately impact the profitability and competitiveness of beef production systems.

As a suggestion, farms engaged in testing bulls for their productivity should provide adequate feeding during the test period, including grain and legume hay, haylage or corn silage, concentrated feed, table salt, and in case of insufficient nutritional value of forage crops, use appropriate feed additives, which will allow for determining the genetic potential of the herd more objectively.

Conclusion

The study results indicated that after selecting the top 10% of bulls at Khafiz farm based on the "A" complex index, their average live weight at 15 months ranged from 400-430 kg. They also showed an average daily gain of 804.76-852.38 g, with a meat conformation score of 55 points. The average "A" complex index for these top bulls ranged from 100.17-104.44%.

This demonstrates that selecting bulls based on the "A" complex index allows for an assessment of their breeding value and ranks them accordingly. It ensures that the most valuable animals, with high productivity indicators, are retained for reproduction purposes.

We believe that the evaluation of bulls by their productivity more objectively reflects the breeding value of animals and should not only be widely used in production but also be one of the main methods of selecting breeding bulls when improving breeding work to enhance the economically useful characteristics of beef cattle.

Moreover, the adoption of productivity-based selection methods contributes to the improvement of genetic resources within beef cattle breeds. By focusing on traits relevant to productivity and meat quality, breeders can selectively propagate desirable genetic traits, thereby enhancing the overall genetic diversity and resilience of the population.

Acknowledgment

The study was carried out within the framework of applied scientific research in the field of Agro-Industrial Complex (AIC) for 2021-2023 included in the research and technical program "development of technologies for effective management of the breeding process of conservation and improvement of genetic resources in beef cattle breeding" focusing on the "scientific and economic justification of methods for improving cattle breeds (Kazakh white-headed, Auliekolskaya, Hereford, Angus) with the development of programs to improve breeding work and the formation of the necessary gene pool".

Funding Information

The authors have not received any financial support or funding to report.

Author’s Contributions

All authors contributed equally to this study.

Ethics

The article presents original content that has not been published elsewhere. The corresponding author confirms that all co-authors have reviewed the manuscript and that it does not raise any ethical concerns.

References

Aitzhanova, I. N., Shaikamal, G. I., Seleuova, L. A., Gabdullin, Sh. S., & Bekbolatova, A. T. (2022). Comparative Assessment of Meat Qualities of Purebred and Crossbred Kalmyk Bulls. *OnLine Journal of Biological Sciences*, *22*(3), 395–403. https://doi.org/10.3844/ojbsci.2022.395.403

Babich, E. A., Aryngaziev, B. S., Ovchinnikova, L. Y., & Ovchinnikov, A. A. (2022). Features of Growth and Development in Heifers of Holstein and Black-and-White Breeds. *OnLine Journal of Biological Sciences*, *22*(4), 529–538. https://doi.org/10.3844/ojbsci.2022.529.538

Beishova, I., Nametov, A., Shamshidin, A., Belaya, A., Ulyanova, T., Kovalchuk, A., Tegza, I., Traisov, B., Yuldashbaev, Y., Akhmetaliyeva, A., Abylgazinova, A., Beishov, R. & Batyrgaliyev, Y. (2024). Effectiveness of the Use of Genetic Markers of Meat Productivity in the Kazakh White-Headed Breed Identified Using Genome-Wide Association Study. *OnLine Journal of Biological Sciences*, *24*(4), 624-632. https://doi.org/10.3844/ojbsci.2024.624.632

Bissembayev, A. T., Baimukanov, D. A., Trukhachev, V. I., Nazarbekov, A. B., Zhali, S. T., Abylgazinova, A. T., & Chindaliyev, A. E. (2023). Estimated Breeding Value of Kazakh White-Headed Cattle Breed. *American Journal of Animal and Veterinary Sciences*, *18*(2), 81–88. https://doi.org/10.3844/ajavsp.2023.81.88

Buienbayeva, Z. K., Latypova, Z. A., Issakulova, B. Z., Bakiyeva, F. A., Namet, A. M., & Valdovska, A. (2024). Development of veterinary and sanitary measures for the prevention of pasteurellosis infection in cattle: The case of the Republic of Kazakhstan. *International Journal of Veterinary Science*, *13*(2), 164-171. https://doi.org/10.47278/journal.ijvs/2023.085

Cherekaev, A. V. (2010). *Myasnoe skotovodstvo: Porody, tekhnologii, upravlenie stadom [Beef cattle breeding: breeds, technologies, herd management*. Moscow. Academy of Veterinary Medicine.

Dushayeva, L. Z., Nametov, A. M., Beishova, I. S., Belaya, A. V., Ulyanova, T. V., Kovalchuk, A. M., Tagirov, K. K., & Yuldashbayev, Y. A. (2021). Marking of Meat Productivity Features in Pairs of bGH, bGHR and bIGF-1 Polymorphic Genes in Aberdeen-Angus Cattle. *OnLine Journal of Biological Sciences*, *21*(2), 334–345. https://doi.org/10.3844/ojbsci.2021.334.345

Gnezdilova, L., Laga, V., Marzanova, S., Yarygina, E., Pozyabin, S., & Selina, M. (2024). Molecular genetic assessment of nodular dermatitis virus in cattle herds. *Advances in Life Sciences*, *11*(1), 125-129. http://dx.doi.org/10.62940/als.v11i1.2533

Il, Y., Il, D., Zabolotnykh, M., Savenkova, I., Nurzhanova, K., Zhantleuov, D., Kozhebayev, B., Akhmetova, B., Satiyeva, K., & Kurmangali, L. (2024). Changes in blood biochemical parameters in highly productive cows with ketosis. *Veterinary World*, *17*(5), 1130–1138.

Kabylbekova, D., Assanbayev, T. S., Kassymbekova, S., & Kantanen, J. (2024). Genetic studies and breed diversity of Kazakh native horses: A comprehensive review. *Advances in Life Sciences*, *11*(1), 18-27.

Korotkiy, V., Skornyakova, O., Leukhina, V., Sadykov, E., & Ryzhov, V. (2024). Evaluation of the effectiveness of coniferous-phytogenic feed additives in case of eimeriosis infestation in calves. *Advances in Life Sciences*, *11*(2), 380-385. http://dx.doi.org/10.62940/als.v11i2.2379

Lapshin, R., Maksimova, N., Lipskiy, V., Ryzhov, V., Korotky, V., & Mukhina, I. (2023). Assessment of the safety of pine tree feed additives. *Advancements in Life Sciences*, *10*(3), 406-411. http://dx.doi.org/10.62940/als.v10i3.1771

Mussayeva, A., Yegorova, N., Yerishov, M., Dossanova, A., Suchshikh, V., Namet, A., Siyabekov, S., Nussupova, S., & Yespembetov, B. (2021). Molecular-biological properties of the attenuated strain of salmonella abortus-equi E-841, used in the creation of a vaccine against abortion of mares. *American Journal of Animal and Veterinary Sciences*, *16*(2), 144–150. https://doi.org/10.3844/ajavsp.2021.144.150

Nametov, A. M., Beishova, I. S., Belaya, A. V., Ulyanova, T. V., Kovalchuk, A. M., Nassambayev, Y., Abylgazinova, A. T., Batyrgaliev, Y. A., Murzabayev, K. E., Dushayeva, L. Z., & Ginayatov, N. S. (2022). Determination of Diplotypes Associated with Meat Productivity in Cattle Breeds Common in the Territory of the Republic of Kazakhstan. *OnLine Journal of Biological Sciences*, *22*(3), 287–298. https://doi.org/10.3844/ojbsci.2022.287.298

Nasambaev, E. G., West Kazakhstan Agrarian Technical University named after Zhangir Khan, Kayumov, F. G., Dzhulamanov, K. M., Akhmetalieva, A. B., Nugmanova, A. Ye., A.O. Doszhanova, A. O. (2019). Weight growth of young Kazakh white-headed cattle of different genotypes. *Animal Husbandry and Fodder Production*, *102*(1), 88–95. https://doi.org/10.33284/2658-3135-102-1-88

Nasambaev, E., Akhmetalieva, A. B., Nugmanova, A. E., Bertileu, L. Sh., & Doszhanova, A. O. (2020). Assessment of the Breeding Qualities of Kazakh White-headed Calves Using the Method of Testing Own Productivity. *Journal of Advanced Research in Dynamical and Control Systems*, *12*(7), 476–481. https://doi.org/10.5373/jardcs/v12sp7/20202130

Nassambaev, E., Akhmetalieva, A. B., & Nugmanova, A. E. (2018). Pure breeding of the Kazakh white-headed cattle by lines as the main method of improving the hereditary qualities. *Journal of Pharmaceutical Sciences and Research*, *10*(12), 3254–3256.

Nassambaev, E., Akhmetalieva, A. B., & Nugmanova, A. E. (2019). Reproductive indicators of stud bulls and bull calves of the Kazakh white breed of various genotypes. *Advances in Animal and Veterinary Sciences*, *7*(1), 85–87.

Order of the Ministry of Agriculture of the Republic of Kazakhstan No. 162. (2000). https://online.zakon.kz/Document/?doc_id=1019495

Order of the Ministry of Agriculture of the Republic of Kazakhstan No. 456. (2010). https://adilet.zan.kz/rus/docs/V100006400_

Petrov, A. F., Bogdanova, O. V., Narozhnykh, K. N., Kamaldinov, E. V., Shatokhin, K. S., Gart, V. V., Kulikova, S. G., & Zhigulin, T. A. (2024). Clustering of countries based on dairy productivity characteristics of Holstein cattle for breeding material selection. *Veterinary World*, 17(5), 1108–1118.

Tkeshelashvili, M., & Bobozhonova, G. (2024). Enhancing gerodietic nutrition: Innovative technology for developing health-promoting feed. *Advances in Life Sciences*, *11*(1), 112-118. http://dx.doi.org/10.62940/als.v11i1.2381

ХАЙНАЦКИЙ, В. Ю. (2022). Beef Cattle Breeding Infractructure. *Molochnoe i Miasnoe Skotovodstvo*, *5*, 3–8. https://doi.org/10.33943/mms.2022.65.86.001