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Crossbreeding – the main method of increasing beef production in Kyrgyzstan

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Abstract. The relevance of this study is due to the need to increase the meat productivity of cattle in the Kyrgyz Republic, where the use of low-productive cows of Alatau breed prevails. Increasing the profitability of meat cattle breeding requires the introduction of effective selection and genetic methods, including interbreed crossbreeding using bulls of specialised meat breeds. The aim of this work was to identify the most productive genotype of crossbred animals obtained from crossing Alatau cows with bulls of meat breeds (Charolais, Kian and Aberdeen-Angus), taking into account their productive and adaptive qualities in different natural-climatic zones of Kyrgyzstan. In the course of the study, zootechnical and biometric methods of analysis were applied: live weight, growth rate, meat qualities, as well as resistance of animals to housing conditions were evaluated. In total, three groups of crossbred calves bred in plain and foothill areas were studied. The best results were obtained from crossing of Alatau breed with Aberdeen-Angus breed: by the age of six months calves of this group reached on average 215.3 kg, average daily gain was 890 g, slaughter yield of meat reached 58.2%. These animals also showed high adaptability to climatic fluctuations and rational use of forages. The practical significance of the work lies in the possibility of introducing the obtained data into beef cattle breeding programmes both at breeding enterprises and in farms. The results of research can be used at formation of arrays of beef cattle of new type and at development of regional programmes on increase of productivity of beef cattle direction

Keywords: breeds; crossbreds; slaughter yield; carcass weight; exterior; body indices; body measurements

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Introduction

The Kyrgyz Republic belongs to the typical mountainous countries with predominance of pasture lands. According to NSCKR (n.d.), in 2023 about 9.2 million hectares, or about 85% of all agricultural lands, were occupied by natural pastures with mixed grass composition. Due to natural-climatic and socio-economic conditions in the country, livestock breeding, especially small and cattle, including the Alatau breed, has historically prevailed. However, the existing number of cattle (1.84 million heads at the beginning of 2024) is mostly represented by dairy and combined breeds characterised by low meat indicators. The average slaughter weight is only 45-50% of live weight, and daily gain does not exceed 650-700 g. Taking into account the growing needs of the domestic market and export ambitions of the country, the creation of highly productive meat stock adapted to mountain conditions becomes an urgent task. One of the promising directions for solving this problem is interbreed industrial crossbreeding using bulls of specialised meat breeds such as Charolais, Kian and Aberdeen-Angus. Studies have shown the effectiveness of such approaches: meat crossbreds have accelerated growth, higher slaughter yield and better adaptation to extreme conditions (Dzhanibekov *et al.*, 2021; Arslan *et al.*, 2024). Thus, the study of V. Logunova & A. Marusich (2023) showed an increase in daily gain in young animals of Limousin bloodlines by +73 g compared to Aberdeen-Angus. A. Shevkhuzhev & V. Pogodaev (2023) found that Aberdeen-Angus hybrids × Simmental gave a gain of up to 711 g/day and an increase in slaughter yield of more than 1% and were superior to purebreds in slaughter yield and live weight. In turn, V. Iovenko & I. Hladii (2021) showed that the study of organism development taking into account genotype and environmental conditions allows to significantly accelerate the process of breed improvement, and the intensity of growth and development is of key importance for obtaining fast-growing young animals with lower feed consumption per unit of gain.

In Kyrgyzstan, individual experiments on industrial crossbreeding were carried out in the 1980-1990s, but there are no systematic approaches or consolidation of results in farms. Modern research in the republic is limited, which necessitates a comprehensive assessment of the efficiency and adaptability of different genotypes of meat crossbreds in the conditions of zonal farming. In the world practice the priority is given to the Aberdeen-Angus breed, which has high growth energy, calm temperament and adaptation to extensive housing technologies (FAOSTAT, n.d.). However, the zootechnical feasibility of using different breeds in specific agro-ecological zones of Kyrgyzstan – foothills, highlands and flat pastures of Chui, Talas and Naryn regions – remains an important issue. In addition, according to P. Greenwood (2021), sustainable beef production in countries with pasture-based livestock production requires taking into account not only genetic, but also environmental and economic factors. In this context, crossbreeding (interbreeding) is considered as a tool not only to increase productivity but also to improve animal adaptability. Thus, according to the study of M. McIntosh *et al.* (2023), in crossbreeding calves adapt faster to temperature fluctuations and are less susceptible to gastrointestinal diseases compared to purebred counterparts. And researchers J. Keele *et al.* (2024) found that traits measured in live animals (e.g. live weight, eye muscle area from ultrasound data) have a strong genetic correlation with economically important carcass characteristics after slaughter (such as marbling, eye muscle area, slaughter yield and hot carcass weight). This allows the effective use of live animal data for predicting meat quality and selecting breeding stock.

The relevance of crossbreeding was also confirmed by UN food security policies, according to which the development of beef cattle breeding should be adapted to changing climatic conditions and rural poverty (FAO, 2022). In Kyrgyzstan, where a significant proportion of the population lives in rural areas and depends on livestock production, the introduction of adaptive beef cattle breeds is not only economically but also socially important. In addition to the genetic aspect, profitability of production remains an important factor. Introduction of meat crosses allows to shorten fattening periods, reduce feed costs and obtain marketable products of higher quality. According to the world statistics, breeds with mitostatin mutation (e.g. Belgian Blue) show about 20% higher muscle mass yield than gene-free breeds, which confirms the high efficiency of meat orientation (Squire, 2025). Thus, in conditions of deficit of specialised beef cattle, lack of scientifically based breeding programmes and limited budget for purchase of imported stock, the use of interbreed crossbreeding with targeted selection of the most effective combinations seems to be an actual and practically significant direction. This study was aimed at a comprehensive evaluation of the efficiency of industrial crossbreeding of Alatau cattle with the leading beef breeds, such as Charolais, Kian and Aberdeen-Angus, to determine the optimal genotypes adapted to the specific conditions of mountainous regions of Kyrgyzstan and possessing increased meat productivity.

Materials and Methods

The study was conducted from April 2023 to October 2025 on the basis of two livestock farms in the Kyrgyz Republic: breeding farm "Ala-Too" (Chui region, plain zone) and experimental site "Suusamyr" (Naryn region, foothill/highland zone), which allowed to evaluate the productive and adaptive qualities of animals in different natural and climatic conditions. In order to study productive and biological features of crossbred animals and to create a herd of beef cattle, crossbreeding of Alatau cows with the seed of bulls of specialised beef

breeds: Charolais, Aberdeen-Angus and Kian was carried out. 90 Alatau cows meeting the criteria of maturity and reproductive health were selected to obtain the studied young stock. Seed from three different breeding bulls for each of the beef breeds was used (one for each group of cows) to ensure genetic diversity within the experimental groups. During the study, four groups of young cows were formed based on birth results, totalling 84 head. These groups were distributed as follows: control group: 10 purebred Alatau bulls; Alatau × Charolais experimental group: 25 head, of which 13 steers and 12 heifers; experimental group Alatau × Kian: 12 head, all steers; experimental group Alatau × Aberdeen-Angus: 37 head, of which 19 steers and 18 heifers.

Ewes and the obtained crossbred young stock were bred under conditions of year-round pasture keeping. Feeding and housing conditions of experimental and control groups of animals were identical. Pasture keeping was carried out on natural grassy pastures with an average pasture load of 0.8 conventional animals per hectare. Pastures were rotated regularly every 14-20 days to ensure optimum herbage. During winter and early spring periods (December to April), they were given supplementary feeding of rough and concentrated forages. Feeding consisted of alfalfa hay (2-3 kg/head/day) and mixed fodder for young cattle (1-1.5 kg/head/day), including barley, corn and sunflower cake, with protein content not less than 16%.

Semen quality of bulls was evaluated by light microscopy at ×400 magnification using Micros Austria MCX100 microscope (Austria). Sperm activity, morphological integrity, ejaculate concentration and motility were analysed. The evaluation methodology was in accordance with GOST 27775-2014 (2015). Insemination seed was cryopreserved material delivered in YDS-3 brand Dewar containers (Xiangyuan, China) at −196°C. It was thawed at +37°C for 30 seconds before use. Insemination was performed by rectocervical method using a Cassou syringe catheter (France). Meat and fat samples were collected and transported immediately after slaughter. Samples of *m. longissimus dorsi* and internal fat, weighing 200-250 g each, were taken from each carcass. Samples were packed in sterile hermetic KipBio 500 ml containers, labelled and transported to the laboratory at +4 °C for no more than 2 hours, using Thermo-Pak-8 (Russia) thermocontainer with cooling elements.

The following parameters were studied in experimental animals: growth and development, live weight, meat qualities, milk productivity, milk composition, as well as clinical and haematological parameters. Assessment of resistance to temperature fluctuations was carried out by recording rectal temperature and respiration rate of animals twice a day (at 08:00 and 16:00) during summer and winter periods (July-August and January-February) at maximum and minimum daily air temperatures, respectively. Individual records of feed consumed and residues were recorded daily for

7 days in each season (spring, summer, autumn, winter) to determine feed digestibility. Exterior traits were measured at the age of 18 months using a zootechnical tape measure and a ZOOMED-150 height meter (Russia). The following were measured: height at the withers and rump, depth and girth of the chest, width of the chest, oblique length of the trunk, width in the maclocks, girth of the heel. Body build indices were calculated from these data:
- chest index = (chest girth / height at withers) × 100;
- stiffness index = (chest girth / torso length) × 100;
- stretch index = (torso length / withers height) × 100;
- boniness index = (heel girth / withers height) × 100;
- meatness index = (width in mamlocks / trunk length) × 100.

Live weight was determined individually using AXIS BDU1500 electronic scales (Poland) with an accuracy of 100 g. Measurements were taken at birth, at 6 months of age (weaning), at 12 and 18 months of age. Average daily gain was calculated according to formula (1):

$$P = \frac{JM_n - JM_i}{n}, \tag{1}$$

where JM_n – live weight at the age of n days, JM_i – live weight at the previous weighing, n – number of days between measurements.

Control slaughter of animals was performed in the slaughterhouse of "TalasEt" farm, in compliance with ITS 43-2017 (2018). Samples of *m. g dorsi* (longest muscle of the back) and raw fat were taken from carcasses – 250 g each. The chemical composition of meat and fat was analysed in the laboratory of food chemistry of the Kyrgyz National Agrarian University named after K.I. Skryabin using the FoodScan™ 2 device (FOSS, Denmark). Mass fractions of moisture, protein, fat and ash were determined according to GOST 23042-2015 (2019), GOST 25011-2017 (2018). Clinical and haematological investigations included: counting the total number of erythrocytes and leukocytes in a Goryaev chamber; measuring haemoglobin by the Sali method; determining haematocrit and erythrocyte sedimentation rate. Mindray BC-30 Vet analyser (PRC) was used. The study of exterior features of crossbred young animals was carried out at the age of 18 months using linear measurements and morphological indices. The following parameters were measured: height at the withers and rump, chest width, chest depth, oblique trunk length, width at the maclocks, chest and heel girth. The evaluation was done using measuring tools like height gauge, centimetre tape and caliper.

It was also evaluated on a 5-point scale (with 1 point representing minimum expression of the trait and 5 points representing maximum or ideal expression) for the following traits: general body type, muscular development, meat form expression, limb placement, and conformity to breed type. This evaluation was carried out at the age of 18 months, in parallel with the main

linear measurements. The evaluation was carried out by two independent expert zootechnicians who were pre-calibrated in the evaluation methodology. The calibration consisted of a series of joint test evaluations on a group of control animals, followed by discussion of discrepancies and development of common criteria to minimise subjectivity. To comprehensively characterise the exterior, zootechnical indices were calculated: massiveness, meatiness, stretchiness, breast, boniness and knockdown indices. The involvement of experts was in accordance with the principles of the WMA Declaration of Helsinki (1964).

Compliance with ethical standards was confirmed by the decision of the Local Ethical Committee of KNAU No. 02-2023 dated 12 March 2023, in accordance with the International Convention for the Protection of Animals in Scientific Research (Directive 2010/63/EU, 2010). Statistical processing of data was performed by the method of variation statistics using MS Excel 2021 and Statistica 10.0 package. Mean values, standard deviations and confidence intervals were calculated. Differences between groups were evaluated by Student's criterion ($p < 0.05$).

Results and Discussion

Formation of meat productivity of animals is determined by the intensity of growth and development of physique, which, in turn, depends on genotype, housing conditions and nutrition. In the course of conducted researches it was established that crossbred calves obtained from crossing Alatau cows with bulls of Aberdeen-Angus breed surpassed their peers from other genotypic groups in most zootechnical indicators. Thus, the average live weight of these calves at the age of 6 months was 215.3 kg, which is 8.4% higher than in comparison with litters from the Kian breed and 11.6% higher than in litters with Charolais. Average daily gain in the Aberdeen-Angus group reached 890 g, compared to 812 g and 793 g in the other studied groups, respectively. At slaughter at 18 months of age, the slaughter yield was 58.2% and the muscle tissue in the carcass was 68.5%. Exterior evaluation revealed pronounced signs of meat type: increased width of the thorax (average girth – 198.4 cm), high depth of the trunk (84.1 cm), shortened heel and well-developed musculature. Calculation of index indices (massiveness, boniness, meatiness) confirmed the advantages of the Aberdeen-Angus group in all parameters. Adaptability indicators (resistance to temperature fluctuations, feed digestibility, clinical and haematological parameters) also indicated better adaptation of this genotypic group to the conditions of different natural and climatic zones of Kyrgyzstan. Table 1 shows the data of live weight of crossbred animals by periods of growth, obtained by crossing Alatau cows with bulls of meat breeds. From the presented data it is seen that comparatively higher live weight at birth had crossbred bulls and heifers of Alatau-Charolais and Alatau-Kian breeds. At the same time, the live weight of steers and heifers of Alatau-Aberdeen-Angus breed was the lowest among all obtained crossbred animals. Thus, at birth they had lower live weight by 9.9% than purebred and by 25.28%, respectively, than crossbred animals of Charolais and Kian breeds.

Table 1. Dynamics of live weight of young animals, kg

Sex of animals	Age, months							
	at birth		6		12		18	
	n	live weight	n	live weight	n	live weight	n	live weight
Alatau								
steers	10	27.4 + 1.10	9	134.3 + 1.91	8	295.0 + 3.21	6	320.0 + 13.9
Alatau x Charolais								
steers	13	38.0 + 0.10	10	236.8 + 3.74	9	320.0 + 3.31	4	417.5 + 17.3
heifers	12	36.9 + 0.12	9	214.3 + 4.60	7	303.3 + 4.32	7	404.3 + 6.90
Alatau x Kian								
steers	12	34.3 + 0.09	9	218.4 + 3.21	8	285.7 + 3.84	4	405.0 + 9.20
Alatau x Aberdeen Angus								
steers	19	24.7 + 0.02	17	200.3 + 7.41	15	265.0 + 8.38	4	361.2 + 20.8
heifers	18	24.1 + 0.03	12	191.7 + 2.15	9	256.3 + 9.62	8	356.3 + 10.4

Source: compiled by authors based on experimental data, 2023-2025

By 6 months of age, pomace bulls and heifers outperformed purebred bulls and heifers in terms of live weight. This superiority was 76.3% in Alatau-Charolais, 49.1% in Alatau-Aberdeen-Angus and 62.6% in Alatau-Kian. Further this superiority was maintained. Thus, at the age of 12 months, pomace bulls from the Charolais breed surpassed purebred Alatau bulls by 85 kg (36.2%); Aberdeen-Angus by 30.0 kg (12.8%) and Kian pomace by 50.7 kg (21.6%). The similar pattern of growth was observed at the age of 18 months. Thus, the live weight of Alatau-Charolais bulls was 97 kg (30.3%), Alatau-Aberdeen-Angus by 41.2 kg (12.8%) and Alatau-Kian bulls by 85 kg (26.6%). These indicators of live weight of crossbred animals testify to the manifes-

tation of biological regularity – heterosis. More visual representation about intensity of growth of young animals of different genotypes and sex and age groups is given by the indices of average daily gain (Table 2).

Table 2. Indicators of average daily gain in live weight of young animals, g

Breed and breedness	Sex of animals	Age, months		
		6	12	18
Alatau	steers	586	350	467
Alatau-Charolais	steers	1,092	486	536
	heifers	975	450	555
Alatau-Aberdeen-Angus	steers	965	472	528
	heifers	921	453	430
Alatau-Kian	steers	1,012	468	655
	heifers	904	510	514

Source: compiled by the authors based on experimental data, 2023-2025

The obtained data also indicate that young animals of all genotypic groups were characterised by well-developed bones and musculature, proportional body shapes, which is a consequence of genetic conditioning and adequate rearing conditions. However, individuals of different genotypes had certain differences in the indices of the main measurements. Comparative analysis of exterior parameters showed that the largest physique was characterised by the Alatau-Charolais and Alatau-Kian genotypes. Thus, in bulls of Alatau-Charolais group at the age of 18 months the average height at the withers was 134.6 cm, oblique length of the body – 160.3 cm, chest width – 43.2 cm, chest girth – 200.7 cm, heel girth – 19.8 cm. In Alatau-Kian crossbred animals similar parameters were somewhat lower, but also exceeded the parameters of animals of other groups: height at the withers – 132.4 cm, oblique length of the trunk – 158.9 cm, chest girth – 197.2 cm, heel girth – 19.4 cm. It is evident from the data of Table 1 that both at birth and during subsequent growing and fattening the Charolais, Aberdeen-Angus and Kian crossbred steers significantly surpassed their peers of the mother breed in terms of meatiness, massiveness and chest indices. During the period from birth to 18-months age, the meatiness index of both the Charolais crossbred animals increased by 20.1%, Aberdeen-Angus steers by 22.3% and Kian steers by 23.9%. In crossbred young bulls meat forms were better expressed than in peers of Alatau breed. They had well-developed back, loin and hind third of the torso. It should be noted that in the process of growing and fattening of mixed animals, there were significant changes in body build indices, especially in some indices characterising their meat productivity. According to numerous experimental studies in the field of beef cattle breeding, among which T. Lefler (2020), it is known that meat productivity of animals is characterised by quantitative and qualitative indices and depends on a number of genetic and paratypic factors. In this regard, a control slaughter of experimental animals was carried out, the data of which are given in Table 2.

During the period of growing and fattening, satisfactory live weight gain was obtained from young animals of all the above groups. At the same time, the pomace youngsters obtained from meat breeds from birth to 6-months depending on the type of crossbreeding had an average daily gain of 378-505 g; 6-12-months by 100-197 g and at the age of 12-18-months by 69-188 g, respectively, more than Alatau coevals. Many researchers note that the live weight index does not give a complete picture of the dynamics of shape and physique of animals with regard to age and breed (Guvenoglu, 2023). Therefore, the assessment of exterior and disclosure of linear growth features give a certain idea about the development of the animal, its direction and level of productivity.

During the study of exterior features during carcass inspection of animals, it was revealed that the deposition of fat watering in the dorsal and lumbar parts in Aberdeen-Angus crossbreds is significantly better than in Charolais, Kian crossbreds and purebred Alatau steers. Weak deposition in carcasses of crossbred Charolais and Kian steers is explained by the fact that these are hereditary features of animals of these breeds to obtain lean meat. The data of control slaughtering of animals showed that at slaughtering from crossbred bulls more heavy and full carcasses were obtained in comparison with Alatau bulls. Bulls of Charolais, Aberdeen-Angus and Kian breeds had carcass weight more by 28.7-59.0 kg, at the same time with good slaughter yield – by 0.74-2.08% more than Alatau bulls.

Bulls of all groups had relatively high internal fat values, which is explained by their breed affiliation. At the same time, Alatau-Charolais breed had lower internal fat index and was inferior to Alatau-Aberdeen-Angus by 0.27 kg (17.1%); Alatau-Kian by 0.12 kg (7.6%). Slaughter yield depending on the breed was: Alatau purebreds – 53.92%, Alatau-Charolais crossbred animals – 55.13%, Alatau-Kian – 54.77% and Alatau-Aberdeen-Angus – 55.5%. Comparatively high carcass weight contributed to the increase of slaughter weight of Alatau-Charolais steers, which were ahead of carcass

weight of Aberdeen-Angus breeds by 29.97 kg (15.5%), Alatau-Kian by 7.1 kg (3.3%). According to this indicator, experimental animals (crossbred) outperformed control animals of Alatau breed by 17.6-35.9%.

The conducted research showed that the flesh content in carcasses of Alatau-Charolais bulls at the age of 18 months was 59.53 kg, Alatau-Aberdeen-Angus by 33.15 kg and Alatau-Kian bulls by 51.95 kg more compared to purebred Alatau bulls. At deboning it was found that Alatau-Charolais and Alatau-Kian steers had the highest carcass flesh content, their superiority over Alatau-Aberdeen-Angus steers was 26.37 kg (18.2%) and 7.58 kg (4.6%), respectively. Further, the effect of breed on the meat ratio was determined. It

was found that per 1 kg of bones in the carcass of Alatau-Charolais crossbreds at the age of 18 months there is 3.90 kg of flesh, in Alatau-Aberdeen-Angus 3.66 kg and in Alatau-Kian crossbreds 3.91 kg against 2.55 kg in purebred Alatau bulls. Meat quality is determined by different ratios of protein, fat, water and minerals (Lei *et al.*, 2020). In this regard, the effect of breed on the chemical composition and energy value of meat was studied, the data of which are summarised in Table 3. Analyses of the chemical composition of meat from purebred Alatau-Aberdeen-Angus and purebred Alatau steers reveal that the amount of dry matter in the meat of the crossbred steers was 2.4% higher than in the meat of Alatau steers.

Table 3. Indicators of chemical composition and energy value of meat by cuts in Alatau steers (at natural moisture content)

Name of cuts	Content, %					
	moisture	dry matter	mineral substances	fat	protein	energy value, J
neck	76.06	23.96	1.00	3.28	19.68	465.7
hip	74.07	25.93	0.99	8.39	16.55	611.0
dorsal-costal	77.15	22.85	0.91	3.97	17.97	463.1
thoracic	76.56	23.44	0.88	4.50	18.06	494.6
flank	77.58	22.42	0.90	3.60	17.92	448.1
hind shank	77.82	22.18	0.91	3.81	17.46	448.1
scapular	78.22	21.78	0.88	2.79	18.11	419.6
sacral	75.86	24.14	0.94	5.00	18.20	503.3
Total in carcass	**76.66**	**23.34**	**0.93**	**4.42**	**17.87**	**481.7**

Source: compiled by the authors based on experimental data, 2023-2025

When revealing the biological value of meat, the degree of "maturity" of meat was determined, which is defined as the ratio of water and fat content in it, and the lower this ratio, the more "mature" meat is considered to be. According to this indicator, no significant difference was found between litters and purebred animals. The ratio of protein and fat in the meat of purebred Alatau steers was 1:0.25, and in littermates 1:0.42. These data show that the meat obtained at slaughter ¼ Alatau ¾ of Aberdeen-Angus crossbred animals meets the requirements of modern consumers. At the same time, due to the high fat content in the meat of Aberdeen-Angus crossbred animals of the second generation is characterised by its higher energy value. Thus, at 18 months of age their superiority over purebreds on the studied index was 98.3 J or by 20.4%.

Change in live weight of crossbred steers and heifers during the period of growing and fattening was ahead of Alatau breed coevals by this indicator. So, at the age of 18 months this difference on the average for bulls and heifers was 91 kg (28.4%) for Alatau-Charolais breed, 38 kg (11.9%) for Aberdeen-Angus breed and 85 kg (26.5%) for Alatau-Kian breed. The study of exterior peculiarities of Alatau breed and crossbred steers allowed to establish that crossbred steers of Alatau-Charolais and Alatau-Kian breeds were already in

the early stage of ontogenesis taller, had deep chest, harmonious physique and well-defined meat forms. The analysis of changes in linear growth of experimental animals showed that from birth to 18-months of age the crossbred animals from different combinations of crossbreeding surpassed their Alatau breed counterparts in many measurements. These data of linear growth indicate good development of the crossbred animals. The results of control slaughter showed that bulls obtained from crossbreeding with bulls of meat breeds under intensive growing at the age of 18 months gave rather heavy carcasses. Thus, by carcass weight the Alatau-Charolais crossbred youngsters surpassed purebred Alatau by 59.0 kg (36.2%), Alatau-Aberdeen-Angus – 28.75 kg (17.8%) and Alatau-Kian by 51.6 kg (31.7%). The analysis of morphological composition of half carcasses indicated that the highest content of flesh in the carcasses of crossbred bulls of Charolais breed at the age of 18 months was 59.53 kg, Aberdeen-Angus breed by 33.15 kg and Kian breed by 51.95 kg more compared to purebred Alatau animals.

In beef cattle breeding one of the important tasks is to create animals with high growth energy, with good feed payment and naturally with better meat qualities. And in this direction good results were obtained from crossbred animals. The results of chemical

analysis of the average meat sample showed that at the age of 18 months the fat content in meat by cuts was 7.34% in pomace steers, while in Alatau steers it was 4.42% or 2.92% less.

Beef cattle breeding is a new direction in cattle breeding in Kyrgyzstan. Its development is conditioned by high market demand for beef meat, which differs from other types of meat by tenderness, juiciness and "marble" structure (Kruk & Ugnivenko, 2025). Meat cattle due to its biological features, such as precocity and high payment of feed by production, with good adaptation to mountainous conditions, better use of natural forage lands, which corresponds to the formation of meat productivity at lower costs. The problem of increasing livestock productivity and production of high-quality beef in Kyrgyzstan remains relevant, especially in conditions of limited fodder resources and predominance of low-productive dairy breeds. The effective solution of this problem largely depends on the use of breeding approaches, in particular, interbreed crossbreeding using specialised beef breeds (Patoo *et al.*, 2016; Mendonça *et al.*, 2019). According to the Ministry of Water Resources, Agriculture and Processing Industry of the Kyrgyz Republic (n.d.), as of 2024, the total number of cattle in the country was about 1.82 million heads, of which more than 830,000 were cows of predominantly Alatau breed with low productivity indicators: average milk yield – less than 2,000 kg per lactation, live weight – 420-450 kg. Comparison of the results obtained with the data of other researchers confirms the effectiveness of crossbreeding.

Thus, according to FAO (2023), young Kazakh white-headed cattle on pasture fattening can reach an average daily live weight gain up to 800-900 g, and slaughter yield is 63-67%, which corresponds to the values found in this study when crossbred with bulls of meat breeds. Similar values were obtained when using Charolais bulls in an industrial crossbreeding system: according to the data of M. Ben Salem & H. Kélifa (2009), the carcass weight of local Charolais cattle crosses was 77 kg higher than the control group, with a 30% higher meat yield. These results are in agreement with observations on Alatau-Charolais littermates, where carcass weight exceeded the control group by 59 kg and meat yield reached 59.53%. Studies devoted to the use of Aberdeen-Angus bulls also confirm the revealed regularities. E. Nassambaev *et al.* (2018) found that Aberdeen-Angus littermates showed better meat characteristics, including an increase in the thickness of muscle and fat tissue, which positively affects the marbling and organoleptic properties of meat. In addition, the data of P. Shevchenko *et al.* (2024) on the introduction of the Aberdeen-Angus breed in the conditions of Northern Kazakhstan on the high adaptability of these animals to extreme climatic conditions, resistance to temperature fluctuations and high feed digestibility, which correlates with the observations on litters with this breed in this study.

Studies conducted on the study of meat productivity of Alatau cattle and its litters with beef breeds allowed to establish the features of growth, development and formation of meatiness in young cattle depending on sex, age, technology of growing, fattening and fattening, as well as to reveal the possibilities of management of these processes in order to increase beef production in the conditions of valley and mountain zones of Kyrgyzstan. Thus, the analysis of literary sources confirms the efficiency of interbreed crossbreeding of Alatau cows with bulls of specialised beef breeds. The obtained results demonstrate improved live weight, gain, meat productivity and morphological composition of carcasses in crossbred young cows. This makes such breeding practice promising for further implementation in farms of different zonality of Kyrgyzstan, taking into account natural-climatic conditions and market demand.

Conclusions

The conducted research allowed to theoretically justify and practically implement technological methods of formation of beef herd of cattle in conditions of high mountainous areas of the Kyrgyz Republic by industrial and absorptive crossing of Alatau breed with bulls of beef breeds of the world gene pool: Charolais, Kian and Aberdeen-Angus breeds. It was established that the best results on all key productive and adaptive indicators were obtained using Aberdeen-Angus bulls. Crossbred animals with blood on Aberdeen-Angus breed showed significantly higher intensity of growth and development. Thus, by 6 months of age, Alatau × Aberdeen-Angus bulls reached an average live weight of 200.3 kg, which was significantly higher than that of purebred Alatau bulls (134.3 kg) at the same age. By 18 months of age, this group maintained its superiority, reaching 361.2 kg live weight, indicating their high precocity throughout the fattening period.

In addition to outstanding growth qualities, the crossbred animals of this direction had high vitality, resistance to temperature fluctuations, good adaptation to pasture housing and stress resistance in high mountainous conditions. Their exterior evaluation confirmed the pronounced meat forms: compact, wide-bodied physique, well-developed musculature and high zootechnical indices (index of massiveness, knockdown, meatiness), exceeding indices of other experimental groups. The analysis of meat qualities showed that steers with ¾ blood on Aberdeen-Angus breed are characterised by high slaughter indices. The average carcass weight of such animals exceeded the similar index of purebred Alatau bulls by 36.2%, and slaughter yield reached 58.2%. The content of muscle tissue in the carcass was 68.5%, with a significantly higher content of protein, fat and energy value of meat. These results make crossbred

steers the most preferable from the economic and technological points of view for production of high-quality beef in the conditions of the republic.

Taking into account the obtained results, it is strongly recommended to implement a programme on crossing low-productive cows of Alatau breed with bulls of Aberdeen-Angus breed in order to increase meat productivity and improve the quality of beef in the Kyrgyz Republic. Prospects for further research are a comprehensive assessment of profitability of beef cattle breeding based on crossbred young stock in different natural and climatic zones of the country, as well as in-depth genetic selection of the most productive and adapted lines in the framework of sustainable livestock production in Kyrgyzstan.

References

[1] Arslan, E., Keskin, H., Garip, M., & Ozcan, C. (2024). The effect of crossbreeding with different breeds on slaughter and carcass characteristics and meat quality in Leghorn hens. *South African Journal of Animal Science*, 53(4), 573-581. doi: 10.4314/sajas.v53i4.11.

[2] Ben Salem, M., & Kélifa, H. (2009). Use of crossbreeding for increasing beef production in Tunisia. *Livestock Research for Rural Development*, 21, article number 181.

[3] Directive 2010/63/EU of the European Parliament and of the Council on the Protection of Animals Used for Scientific Purposes. (2010, September). Retrieved from https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:276:0033:0079:en:PDF.

[4] Dzhanibekov, A.S., Muratova, R.T., Abdurasulov, A.Kh., & Kubatbekov, T.S. (2021). Efficiency of beef production using imported breeds and local resources of cattle of Kyrgyzstan. *Bulletin of the Orenburg State Agrarian University*, 4(90), 240-244. doi: 10.37670/2073-0853-2021-90-4-240-244.

[5] FAO. (2022). *The state of food and agriculture 2022. Leveraging automation in agriculture for transforming agrifood systems*. Rome: FAO. doi: 10.4060/cb9479en.

[6] FAO. (2023). *Animal genetic resources of the USSR*. Retrieved from https://www.fao.org/4/ah759e/AH759E08.htm?utm.

[7] FAOSTAT. (n.d.). Retrieved from https://www.fao.org/faostat/en/#data/QA.

[8] GOST 23042-2015. (2019). *Meat and meat products. Method for determination of mass fraction of moisture*. Retrieved from https://meganorm.ru/Data2/1/4293756/4293756023.pdf.

[9] GOST 25011-2017. (2018). *Meat and meat products. Methods for determining protein*. Retrieved from https://meganorm.ru/Data/651/65113.pdf.

[10] GOST 27775-2014. (2015). *Artificial insemination of farm animals. Terms and definitions*. Retrieved from https://meganorm.ru/Data2/1/4293768/4293768718.pdf.

[11] Greenwood, P.L. (2021). Review: An overview of beef production from pasture and feedlot globally, as demand for beef and the need for sustainable practices increase. *Animal*, 15(1), article number 100295. doi: 10.1016/j.animal.2021.100295.

[12] Guvenoglu, E. (2023). Determination of the live weight of farm animals with deep learning and semantic segmentation techniques. *Applied Sciences*, 13(12), article number 6944. doi: 10.3390/app13126944.

[13] Iovenko, V., & Hladii, I. (2021). Characteristics of growth, development and meat qualities of young sheep of different genotypes. *Ukrainian Black Sea Region Agrarian Science*, 25(1), 69-76. doi: 10.31521/2313-092X/2021-1(109)-9.

[14] ITS 43-2017. (2018). *Slaughter of animals in meat processing plants, slaughterhouses, by-products of animal husbandry*. Retrieved from https://meganorm.ru/Index2/1/4293740/4293740282.htm.

[15] Keele, J.W., Foraker, B.A., Boldt, R., Kemp, C., Kuehn, L.A., & Woerner, D.R. (2024). Genetic parameters for carcass traits of progeny of beef bulls mated to dairy cows. *Journal of Animal Science*, 102, article number skae075. doi: 10.1093/jas/skae075.

[16] Kruk, O., & Ugnivenko, A. (2025). Characteristics of beef traits in crossbred bulls with different degrees of its marbling. *Animal Science and Food Technology*, 16(1), 26-37. doi: 10.31548/animal.1.2025.26.

[17] Lefler, T.F. (2020). The influence of mothers on the formation of the productivity of descendants. *Bulletin of KrasGAU*, 5(158), 106-110.

[18] Lei, H., *et al.* (2020). Genetic parameter estimation for sensory traits in longissimus muscle and their association with pH and intramuscular fat in pork chops. *Livestock Science*, 238, article number 104080. doi: 10.1016/j.livsci.2020.104080.

[19] Logunova, V., & Marusich, A. (2023). *Meat productivity of young cattle of Aberdeen Angus and Limousin breeds*. Vitebsk: Vitebsk State Academy of Veterinary Medicine.

[20] McIntosh, M., Spiegal, S.A., McIntosh, S.Z., Sanchez, J.C., Estell, R.E., Steele, C.M., Elias, E.H., Bailey, D.W., Brown, J.R., & Cibils, A.F. (2023). Matching beef cattle breeds to the environment for desired outcomes in a changing climate: A systematic review. *Journal of Arid Environments*, 211, article number 104905. doi: 10.1016/j.jaridenv.2022.104905.

[21] Mendonça, F.C., MacNeil, M.D., Leal, W.S., Azambuja, R.C., Rodrigues, P.F., & Cardoso, F.F. (2019). Crossbreeding effects on growth and efficiency in beef cow-calf systems: Evaluation of Angus, Caracu, Hereford and Nelore breed direct, maternal and heterosis effects. *Translational Animal Science*, 3(4), 1286-1295. doi: 10.1093/tas/txz096.

[22] Ministry of Water Resources, Agriculture and Processing Industry of the Kyrgyz Republic. (n.d.). Retrieved from https://agro.gov.kg/.

[23] Nassambaev, E., Akhmetalieva, A.B., Nugmanova, A.E., & Zhumaeva, A.K. (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.

[24] National Statistical Committee of the Kyrgyz Republic (NSCKR). (n.d.). Retrieved from https://stat.gov.kg/en.

[25] Patoo, R.A., Singh, D.V., Singh, S.K., Chaudhari, B.K., Singh, A.K., Singh, M.K., & Kaushal, S. (2016). Comparative study on some morphological and performance traits of Hill cattle, Sahiwal and crossbred cattle. *Indian Journal of Animal Research*, 50(2), 148-151. doi: 10.18805/ijar.6705.

[26] Shevchenko, P., Miciński, J., & Brel-Kisseleva, I. (2024). Evaluation of Aberdeen Angus breeding bulls in the Northern Region of the Republic of Kazakhstan. *Animals*, 14(6), article number 894. doi: 10.3390/ani14060894.

[27] Shevkhuzhev, A., & Pogodaev, V. (2023). Meat productivity of bulls of the Simmental breed and crossbreeds with blood relationship (1/2 Simmental + 1/2 Aberdeen-Angus), (1/2 Simmental + 1/2 Kalmyk). *The Agrarian Scientific Journal*, 4, 92-99. doi: 10.28983/asj.y2023i4pp92-99.

[28] Squire, M. (2025). *Unlocking profit potential: Beef-on-dairy is gaining momentum*. Retrieved from https://www.agriculture.com/unlocking-profit-potential-beef-on-dairy-is-gaining-momentum-11729439?utm.

[29] WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Participants. (1964, June). Retrieved from https://www.wma.net/policies-post/wma-declaration-of-helsinki/.

Аргындаштыруу – Кыргызстанда уй этин өндүрүүнү көбөйтүүнүн негизги ыкмасы

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Аннотация. Бул изилдөөнүн актуалдуулугу алатоо породасындагы аз продуктивдүү уйларды пайдаланууда басымдуулук кылган Кыргыз Республикасынын шарттарында ири мүйүздүү малдын эт азыктуулугун жогорулатуу зарылдыгы менен шартталган. Эт мал чарбасынын рентабелдүүлүгүн жогорулатуу натыйжалуу селекциялык-генетикалык методдорду анын ичинде адистештирилген эт породаларынын букаларын пайдалануу менен тукум аралык аргындаштырууну киргизүүнү талап кылат. Бул иштин максаты Кыргызстандын ар кандай жаратылыш-климаттык зоналарында Алатоо уйларын эт породасындагы букалар (Шаролай, Киан жана Абердин-ангус) менен аргындаштыруудан алынган аргындаштырылган жаныбарлардын кыйла продуктивдүү генотипин табуу болгон. Изилдөөнүн жүрүшүндө анализдин зоотехникалык жана биометрикалык методдору колдонулган: массага, өсүү темпине, эттин сапатына, ошондой эле жаныбарлардын кармоо шарттарына туруктуулугуна баа берүү жүргүзүлгөн. Жалпысынан түздүктө жана тоо этектеринде өстүрүлгөн аргындаштырылган музоолордун үч тобу изилденген. Алатоо породасын абердин-ангус породасы менен аргындаштыруудан эң жакшы натыйжалар алынды: алты айлык кезинде бул топтогу музоолор орточо 215,3 кг, орточо суткалык өсүшү 890 г, союлган эт 58,2 %га жеткен. Бул жаныбарлар ошондой эле климаттын өзгөрүшүнө жана тоютту башкарууга жогорку ыңгайлуулугун көрсөтүшкөн. Иштин практикалык мааниси асыл тукум ишканаларда да, фермердик чарбаларда да эт багытындагы мал чарбачылык программаларына маалыматтарды киргизүү мүмкүндүгүндө жатат. Изилдөөнүн жыйынтыктары жаңы типтеги эт багытындагы малдын массивдерин түзүүдө жана бодо малдын эт багытындагы азыктуулугун жогорулатуу боюнча региондук программаларды иштеп чыгууда колдонулушу мүмкүн

Негизги сөздөр: породалар; кроссбреддер; союу түшүмдүүлүгү; өлүктүн массасы; конформация; дене индекстери; промендер

Скрещивание – основной метод увеличения производства говядины в Кыргызстане

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Аннотация. Актуальность настоящего исследования обусловлена необходимостью повышения мясной продуктивности крупного рогатого скота в условиях Кыргызской Республики, где преобладает использование низкопродуктивных коров алатауской породы. Повышение рентабельности мясного животноводства требует внедрения эффективных селекционно-генетических методов, в том числе межпородного скрещивания с использованием быков специализированных мясных пород. Целью настоящей работы было выявление наиболее продуктивного генотипа помесных животных, полученных от скрещивания алатауских коров с быками мясных пород (шароле, кианская и абердино-ангусская), с учетом их продуктивных и адаптивных качеств в различных природно-климатических зонах Кыргызстана. В ходе исследования были применены зоотехнические и биометрические методы анализа: проводилась оценка живой массы, темпов прироста, мясных качеств, а также устойчивости животных к условиям содержания. Всего было исследовано три группы помесных телят, выращенных в равнинных и предгорных районах. Наилучшие результаты были получены от скрещивания алатауской породы с абердино-ангусской: к шестимесячному возрасту телята этой группы достигали в среднем 215,3 кг, среднесуточный прирост составлял 890 г, убойный выход мяса достигал 58,2 %. Эти животные также демонстрировали высокую приспособленность к климатическим колебаниям и рациональному использованию кормов. Практическая значимость работы заключается в возможности внедрения полученных данных в программы мясного скотоводства как на племенных предприятиях, так и в фермерских хозяйствах. Результаты исследования могут быть использованы при формировании массивов мясного скота нового типа и при разработке региональных программ по повышению продуктивности мясного направления КРС

Ключевые слова: породы; помеси; убойный выход; масса туши; экстерьер; индексы телосложения; промеры