

The first results of the use of the gene pool of the Kalmyk breed on the brown stock of Brown Swiss cattle

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Abstract. The given investigation is devoted to a comparative assessment of the growth, meat productivity and efficiency of beef production by bulls of different genotypes. It was formed 3 groups of bull calves, 15 heads in each on the 2nd-3rd days after birth: group first is brown Swiss calves, the second is Kalmyk breed, the third is crossbreeds obtained from crossing Brown Swiss cows and Kalmyk bulls. It has been established that to the age of 18 months, the advantage of Kalmyk bulls and their crossbreeds in terms of live weight over purebred animals of the Brown Swiss breed averaged 16.3-28.2 kg ($P>0.999$). According to the average daily increase in live weight for the entire production cycle, animals of the Kalmyk breed favorably differed among the analyzed genotypes of young animals, the superiority of which over their peers of different origin varied within 29-61 g ($P>0.999$). The difference between bulls of the Brown Swiss breed and crossbreeds was 32 g ($P>0.999$) in favor of the latter. From bull-calves of the Kalmyk breed and their crosses, in contrast to those of the Brown Swiss breed, heavier carcasses were obtained - by 24.8 ($P>0.99$) and 14.9 ($P>0.99$) kg, slaughter yield is by 2.4 ($P>0.99$) and 1.4 abs.%, respectively. Representatives of the Kalmyk breed and crossbred peers differed in the highest yield of pulp, whose superiority over bulls of the improved breed was 12.0 ($P>0.99$) and 7.5 ($P>0.99$) kg, respectively. A higher level of profitability at the level of 34.6-37.9% was characterized by the descendants of bulls of the Kalmyk breed versus 26.7% in the group of brown Swiss breed.

1 Introduction

Industrial crossbreeding of specialized beef breeds with cows of dairy and milk-meat productivity continues to be an important direction for increasing beef production in our

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country. Scientists and practitioners have proposed a lot of breed combination variants to contribute the volume increase in the meat raw materials. At the same time, the search for new, previously untested interbreed combinations is ensured productivity growth and improvement of product quality indicators in specific environmental conditions seems to be an urgent problem in the current conditions of import substitution of livestock products.

Interbreeding has been used for quite a long time and is effectively used in various sub-sectors of animal husbandry, which makes it possible to increase the productive qualities of animals in a relatively short time frame, as well as to breed new breeds and types of animals. A lot of research has been carried out in beef cattle breeding on hybrids obtained from industrial crossing of various breed combinations, which is reflected in foreign and domestic literature [1-7].

The effectiveness of the use of Kalmyk breed bulls in herds of cattle of different directions of productivity is evidenced by investigations carried out in different regions of our country, differing in climatic, economic, organizational and other conditions in respect of beef production.

In result of industrial crossing of cows of the Red Steppe breed with bulls of the Kalmyk and Aberdeen Angus breeds in Siberia, crossbreeds were obtained in those from 9 to 15 months of age, the superiority in live weight over their peers of the Red Steppe breed was 16.5-77.3 kg. The slaughter yield of Red Steppe × Hereford bulls was 58.6%, which is 1.8-1.9% higher than that of their peers from other groups [8].

In the Republic of Kalmykia, crossbred (Red steppe × Kalmyk) bulls of the first generation, exceeded purebred peers of the maternal breed in live weight by an average of 27.7 kg when grown and fattening up to 18 months,, crossbreeds of the second generation is by 15.2 kg, in terms of carcass weight is by 26.1 and 15.5 kg, respectively, meatiness coefficient is by 0.23 and 0.17 units. [9].

In Tverskaya region, a crossbred livestock was obtained with higher (by 15-20%) average daily gains than in young animals of the mother breed by crossing heifers and cows of the black-and-white breed with the producers of the Kazakh white-headed breed[10].

Gelunova et al. [11] found out that by the age of 18 months, the Kalmyk bulls reached the alive weight of 458.6 kg, which is 50.1-65.3 kg lower than their peers of the Kazakh white-headed breed and crossbreeds of these breeds. At the same time, in terms of slaughter yield, purebred Kalmyk and their crossbreeds exceeded the young growth of the Kazakh white-headed breed by an average of 0.4-0.6 abs.%.

In the above research works has been proved the expediency of crossing Kalmyk cows with bulls of specialized meat breeds, as well as the use of the gene pool of the Kalmyk breed on the breeding stock of dairy and combined breeds. At the same time, there are no data in the available literature of the use of Kalmyk sires in herds of brown Swiss cattle, which determines the relevance, scientific novelty and practical significance of the work. The research carried out in this direction is of great national economic importance in increasing the production of beef and can be used in herds of brown Swiss cattle to increase the meat qualities of bred animals. At the same time, the existing fears of scientists and practitioners about the possibility of reducing the adaptive abilities of crossbreeds with Kalmyk breed in the given work are minimized, since brown Swiss cattle in the North Caucasus Federal District, and in particular in the foothill and mountainous regions, are quite well adapted, which is confirmed by centuries of selection. Based on this, it is quite expected that the use of industrial crossing of these two breeds will increase not only the quantitative and qualitative indicators of productivity, but also will not reduce the resistance and strength of the hoof horn, which is relevant in the conditions of the technology of transhumance-mountain cattle keeping during the pasture period in the conditions of vertical zonality of the territory region.

As a result of strict selection, Kalmyk cattle acquired unique properties and characteristics that sharply distinguish it from other breeds. Animals relatively easily endure prolonged frosts (up to 35-40°C and below), and cold winds, and in summer heat up to +45°C and more) and other adverse natural and climatic conditions without damage to health [12].

The research was conducted by Karpova et al. [13] indicating the cultivation of Kalmyk bulls on year-round grazing, in contrast to the technology of intensive rearing and fattening on open feedlots, does not ensure the full realization of the genetic potential of productivity. Thus, the differences in live weight at 18 months of age amounted to 61.6 kg, and in the average daily gain in live weight is 130 g in favor of young animals kept according to intensive technology.

When lactating calves of the Kalmyk breed are fed during the pasture period with juicy and concentrated feeds, the live weight reaches 203 kg by the age of 7 months, and 440 kg by the age of 17 months, which is higher than that of their peers who did not receive additional feeding, by 12 and 35 kg, respectively [14].

Cattle in pasture systems are subject to environmental influences, therefore, in each natural and climatic habitat, it is necessary to select animals of specific genotypes that are better adapted to these conditions [15].

The available reports of a decrease in the growth and development of crossbred offspring relative to the paternal and maternal breeds involved in crossing are associated with a number of authors with biological breed characteristics of parental forms and the influence a number of environmental factors [16, 17].

The breeding of new breeds, the creation and increase in meat productivity of commercial meat herds, is carried out, as a rule, through the reproductive and industrial crossing of local cattle with foreign specialized breeds with high productivity. In this regard, the investigation carried out is distinguished by the fact that the crossed breeds are domestic ones, which does not imply any dependence on foreign genetic resources.

The analysis of the animal biodiversity in Russia indicates the need to preserve valuable, rare and endangered breeds characterized by high quality indicators of production, longevity, fertility, resistance to diseases, adaptive abilities to extreme environmental conditions, and the importance of this research is due to the absorption of Russian herds by foreign gene pool, which led to decrease in genetic diversity and the continuing trend of crowding out rare and endangered animal breeds and species [18].

It was carried out industrial crossing of Kalmyk bulls with Brown Swiss cows for the first time in the Russian Federation, as a result of which the growth rates and slaughter qualities of the resulting crosses were studied, as well as the profitability of beef production in conditions of distant-mountain content.

The purpose of the research is to give a comparative assessment of growth, meat productivity and efficiency of beef production of Brown Swiss bulls, Kalmyk breeds and crossbreeds obtained from crossing these breeds.

2 Materials and methods

To achieve the specified goal of the investigation was carried out in LLC "Dargan", located in the foothill zone of the Kabardino-Balkarian Republic.

On the 2nd-3rd days after birth, 3 groups of bull calves were formed, 15 heads in each: group 1 is brown Swiss calves, the second group was consisted of Kalmyk breed, the third one is from crossbreeds obtained from crossing Brown Swiss cows and Kalmyk bulls.

Growing results of experimental groups of bulls in the sucking period was carried out according to the technology of beef cattle breeding under cows-nurse, then - from 8 months of age - on growing, in the last two months of the production cycle - on the final fattening.

At 18 months, a control slaughter was carried out on 3 heads from each group. For the whole period of growing, rearing and fattening, 3350 energy feed units and 350 kg of digestible protein were given to the experimental livestock.

The calves of the February-March period of birth were kept on the farm till mid-May, then till mid-October is on high mountain pastures, after which they were transferred to rearing, in August-September - after reaching the age 16 months they were kept till final fattening.

Animals were weighed at birth, when they reached 3, 8, 15 and 18 months, and the average daily gain in live weight was calculated according to the formula generally accepted in zootechnics.

The slaughter of bulls was carried out according to the methodology of VASKHNIL, VIZH, VNIIMS (1997). Removable and pre-slaughter live weight, steam and chilled carcass weight, raw fat weight, slaughter weight and its yield were subject to accounting. The morphological composition of the carcasses was studied after their 24-hour cooling with the establishment of the absolute and relative yield of pulp, bone tissue and tendons, as well as the calculation of the meat index.

The nutrient intake was determined by groups of bulls on a monthly basis for two adjacent days according to the difference between the given feed and uneaten residues, on the pasture was done by the reverse calculation method.

We used the methods of variation statistics using the Microsoft Office software package while processing the experimental data, using the Excel program (Microsoft, USA) with data processing in Statistica 6.0 (StatSoftInc, USA).

3 Results and discussion

The biological effect of crossing is primarily expected by breeders in terms of growth intensity, in connection with which we studied the dynamics of the live weight of purebred brown Swiss, Kalmyk and crossbred bulls, the results of which are performed in table 1.

Table 1. Indicators of live weight of experimental groups of bulls, X±m_x

Age, months	Breed genotype		
	Brown Swiss	Kalmyk	BrownSwiss × Kalmyk
newborns	26,8±0,30	21,3±0,28	25,4±0,33
3	86,0±0,53	88,2±0,84	90,6±0,71
8	178,2±1,04	180,3±0,88	182,6±1,07
15	372,6±1,09	390,0±1,79	383,4±1,01
18	424,5±0,87	452,7±1,86	440,8±0,91
Live weight gain for the period at birth - 18 months: averagedaily, g	727±1,48	788±3,03	759±1,45
absolute, kg	397,7±0,81	431,4±1,67	415,4±0,79

The largest mass was characterized by newborn calves of the Brown Swiss breed, the smallest was of the Kalmyk breed, which is explained by breed characteristics. Differences between purebred groups of calves amounted to 5.5 kg (P>0.999), and the values obtained for the live weight of crossbreds were close to those of calves of the combined direction of productivity and were higher than those representatives of the beef breed by 4.1 kg (P>0.999).

By the age of 3 months, the differences between Brown Swiss and Kalmyk calves were relatively leveled and amounted by 2.2 kg ($P>0.95$), while the superiority of crossbreeds over individuals of the combined breed was 4.6 kg ($P>0.999$). Probably, a more intensive growth of crossbred calves is associated with the effect of heterosis, which manifested itself as a result of a successful combination of individuals of the crossed breeds. Later, by the end of the suckling period of rearing, a significant superiority in live weight was preserved in crossbred calves, whose superiority over individuals of the Brown Swiss breed was 4.4 kg ($P>0.99$).

Intergroup differences began to manifest themselves more clearly during the rearing period, according to the results of which the bulls of the Brown Swiss breed were inferior to their peers of the Kalmyk breed by an average of 17.4 kg ($P>0.999$), and to hybrids - by 10.8 kg ($P>0.999$).

The further technological stage of the production cycle showed a better fattening ability of Kalmyk and Brown Swiss cattle crossbred with it, associated with a greater fattening extent, So, by the age of 18 months, the advantage in live weight over purebred animals of the Brown Swiss breed averaged was 16.3-28.2 kg ($P>0.999$).

According to the average daily increase in live weight for the entire production cycle, animals of the Kalmyk breed favorably differed from the analyzed genotypes of young animals, the superiority of which over their peers of different origin varied within 29-61 g ($P>0.999$). The difference between bulls of the Brown Swiss breed and crossbreeds was 32 g ($P>0.999$) in favor of the latter. As expected, the differences in the absolute increase in live weight for the entire analyzed period were on the side of the Kalmyk and two-breed young animals.

The results of the control slaughter of bulls of different origin are presented in table 2.

Table 2. Indicators of control slaughter of experimental groups of bulls, $\bar{X}\pm m_x$

Indicator	Breed, genotype		
	Brown Swiss	Kalmyk	BrownSwiss × Kalmyk
Ante-mortemliveweight, kg	405,8±2,4	430,6±1,9	421,0±2,0
Steamcarcass: weight, kg	224,4±2,1	247,2±2,4	238,7±2,2
exit, %	55,3±0,2	57,4±0,3	56,7±0,3
Rawfat: weight, kg	10,1±0,55	12,1±0,86	10,7±1,30
exit, %	2,5±0,12	2,8±0,21	2,5±0,31
Slaughter weight, kg	234,5±2,60	259,3±1,99	249,4±3,44
Slaughteryield	57,8±0,28	60,2±0,24	59,2±0,56

From bulls of the Kalmyk breed and their breed crosses, in contrast to those of the Brown Swiss breed, heavier carcasses were obtained by 22.8 ($P>0.99$) and 14.3 ($P>0.99$) kg, respectively.

According to the absolute yield of raw internal fat, the differences between the compared groups of bulls are not significant.

As a result, the slaughter weight of bulls of meat breed and crossbred genotype differed significantly from their peers of the combined breed, the differences reached by 14.9-24.8 kg ($P>0.95-0.99$), and in terms of slaughter yield was 1.4-2,4 abs.% (the superiority of the Kalmyk breed $P>0.99$).

The output of the pulp, bones, cartilage and tendons can be judged by the morphological compositions, which are presented in table 3.

The highest indicators of the chilled half-carcases mass were characterized by Kalmyk bulls was 123.4 kg, the lowest was by the Brown Swiss breed - 110.8 kg, and the crosses occupied an intermediate position between the extreme values of the trait, approaching the representatives of the improving breed according to the obtained values.

Table 3. Morphological composition of half carcasses of experimental groups of bulls, $\bar{X} \pm m_x$.

Indicator	Breed, genotype		
	Brown Swiss	Kalmyk	BrownSwiss × Kalmyk
Weight of chilled half carcass, kg	110,8±1,77	123,4±1,25	118,3±1,07
Pulpweight, kg	86,7±0,65	98,7±1,67	94,2±0,88
Pulp yield, %	78,2±0,71	80,0±0,57	79,6±0,12
Bonemass, kg	18,9±0,90	20,5±0,71	19,9±0,14
Bone yield, %	17,1±0,55	16,6±0,78	16,8±0,18
Weight of cartilage and tendons, kg	5,2±0,25	4,2±0,28	4,2±0,14
Cartilage and tendon yield, %	4,7±0,16	3,4±0,21	3,5±0,11
Meatinesscoefficient	4,59±0,20	4,82±0,25	4,73±0,05

Expectedly, representatives of the Kalmyk breed and crossbred peers differed from the highest yield of pulp, which superiority over bulls of the improved breed was 12.0 (P>0.99) and 7.5 (P>0.99) kg, respectively.

According to bone yield analysis it was not reveal significant intergroup differences both in absolute and relative terms, which suggests a better ratio of pulp and bone tissue in the offspring of Kalmyk bulls, as can be seen from the obtained results.

It can be judged the effectiveness of the conducted investigations on the basis of the calculated feed costs per unit of live weight gain and economic indicators, the data on which are shown in table 4.

Table 4. Efficiency of growing and fattening bull-calves of different origin (per 1 head, taking into account the cost of a cow keeping)

Indicator	Breed, genotype		
	Brown Swiss	Kalmyk	BrownSwiss × Kalmyk
Feed consumption:			
EFU, kg.	3326	3304	3301
DP,gr.	352,0	349,7	349,2
Costs per 1 kg. of live weight gain:			
EFU, kg.	8,36	7,66	7,95
DP,gr.	885	811	841
Cost of 1 kg of alive weight gain, rub.	221	203	208
Productioncosts, rub.	87891,7	87574,2	86403,2
Realization price of 1 kg of alive weight, rub.	280	280	280
Salesproceeds, rub	111356	120792	116312
Profit (loss), + (-)	+23464,3	+33217,8	+29908,8
Profitability, %	26,7	37,9	34,6

As a result practically the same intake of nutrients in the rations was slightly inferior to them. Differences between the offspring of Kalmyk and Brown Swiss bulls ranged from 0.41-0.7 energy feed units and 44-74 g of digestible protein, the Kalmyk bull-calves

differed in the lowest cost of energy feed units (7.66 kg) and digestible protein (811 g), and their crossbred peers.

Differences in the absolute increase in live weight and the cost per unit of gain led to unequal production costs, which ultimately affected the profit received from the experimental groups of bulls. Thus, groups of bulls of Kalmyk origin were characterized by higher profits (by 6444.5-9753.5 rubles), which ensured their achievement of a higher profitability degree at the level of 34.6-37.9% on the con of 26.7% - in the group of brown Swiss breeds.

4 Conclusion

The use of interbreed crossing of domestic populations - brown Swiss and Kalmyk cattle - made it possible to obtain a new genotype of animals in the conditions of the North Caucasian region of Russia, which is superior in growth intensity, slaughter and meat qualities in young animals of the combined direction of productivity. The profitability of rearing and fattening the offspring of the Kalmyk breed bulls turned out to be 7.9-11.2% higher than that of the Brown Swiss breed with lower costs of feed per unit of live weight gain.

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