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Estimation Of Meat Production Potential Of Kalmyk Cattle And Its Hybrids With Red Angus At Different Levels Of Feeding

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ABSTRACT

Meat cattle breeding in Russia has been using the breeding material of imported breeding to increase the genetic potential of domestic herds. Similar work is carried out in the Republic of Kalmykia, assuming the receipt of cross-breeding offspring from crossing Kalmyk cows and bulls-producers of the red Angus breed of American breeding. At present, the second generation of hybrids has already been obtained. The aim of the research was to study the influence of genetic and paratypic factors on the productivity potential of the Kalmyk bull calves and their hybrids with red angus of American breeding against a background of different levels of feeding. The experimental groups were made up of newborn young animals depending on their origin: group I - purebred Kalmyk bulls, group II - crosses of the 1st generation red Angus × Kalmyk breed, III group - crosses of the 2nd generation red Angus × Kalmyk breed. The organization of intensive feeding made it possible to maximize the productive potential of the bull-calves of the combined genotype, increasing the difference in live weight in the 15-month-old age to 35.4-47.3 kg. Against the background of a moderate intake of nutrients in the body of experimental animals, the improving effect of heterogeneous selection was 20.4-30.8 kg. The average daily increase over a period of 8-15 months with abundant feeding was characterized by a reliable intergroup difference at the level of 109.8-163.6 g in favor of hybrid animals. The test on the bulls' own production in the creation of a new genotype of beef cattle on the basis of the complementary interaction of the Kalmyk breed and the Red Angus showed a significant superiority of the F₂ offspring on the basis of selection criteria, regardless of feeding conditions. Ensuring a full-fledged level of feeding contributed to a more complete realization of the genetic potential of productivity, which is confirmed by the maximum differentiation of experimental animals according to certain parameters. On the contrary, against a background of a moderate diet there is some leveling of breeding indices between groups to the average population value.

Keywords: beef cattle, Kalmyk breed, red Angus, potential for productivity, influence of genotype, different level of feeding.

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INTRODUCTION

Meat cattle breeding in Russia has been using the breeding material of imported breeding to increase the genetic potential of domestic herds. This practice allows the creation of highly valuable and competitive herds in a short time, which often justifies the investment of considerable funds [11, 13, 14, and 17]. However, the diversity of ecological and climatic zones in which beef cattle are cultivated imposes certain requirements on the adaptability and adaptability of imported livestock and pedigree material. With insufficient expression of these qualities, the realization of high genetic potential will be hampered by limiting factors of the external environment [6, 15, and 22].

Domestic beef breeds lack the need for acclimatization; they differ in their unpretentiousness to the growing conditions and demonstrate excellent reproductive abilities at a fairly moderate level of productivity [2, 19]. Among the tribal resources of Russia, the Kalmyk breed is characterized by a number of unique qualities that predetermined its widespread distribution. At the same time, in terms of productive potential, it cannot fully compete with classic British and European continental counterparts. In this regard, it is advisable to combine the valuable properties of the local and imported genotype through interbreeding and create on the basis of complementarily a new hereditary complex capable of realizing the genetic potential of productivity in harsh growing conditions [11, 16].

Similar work is carried out in the Republic of Kalmykia, assuming the receipt of cross-breeding offspring from crossing Kalmyk cows and bulls-producers of the red Angus breed of American breeding. At present, the second generation of hybrids has already been obtained. The brood stock of the combined genotype perfectly feels on the natural pastures of the dry steppe zone, and reproductive qualities are not inferior to purebred analogues. However, the genetic potential of bull-calves on the basis of their own productivity testing has not yet been studied. At the same time, due to natural features, the Republic of Kalmykia is referred to regions with risky farming, which inevitably affects the stability of the forage reserve, which requires an additional assessment of the resistance of the obtained genotypes to conditions of different feed supply.

The aim of the research was to study the influence of genetic and paralytic factors on the productivity potential of the calves of the Kalmyk breed and its hybrids with the red Angus of American breeding against a background of different levels of feeding.

MATERIAL AND METHODS

The test on its own productivity was carried out in LLC "Agrofirma Aduchi" of the Republic of Kalmykia in two organized experiments on three groups (40 goals each) of bull calves. The assortment of the experimental groups occurred from the newborn youngsters depending on the origin: group I - purebred Kalmyk bulls, group II - crossbreeds of the 1st generation red Angus Kalmyk breed, III group - crossbreeds of the 2nd generation red Angus Kalmyk breed. In this case, the bulls-producers of red Angus belonged to the American selection. The animals were placed on the control cultivation after weaning from the mothers at the age of 8 months. In the first experiment, a test on the bull's own productivity was carried out at an intensive feeding level. In the second experiment, the analogues of ancestry passed a pedigree evaluation with a moderate level of rations. The pedigree quality of young animals was studied at the end of the control cultivation (age 15 months) by live weight, in the lifetime evaluation of meat forms, scores in the exterior and body, and by the average daily gain from 8 to 15 months of age, in accordance with "Procedure and conditions for assessing bulls- producers of meat breeds by their own productivity and quality of offspring "[16]. Bulls of different origin were subdivided into subgroups when tested for their own productivity in accordance with different levels of diets. The first variant of the evaluation was carried out on 3 groups (n = 20 goals each) on an intensive diet, the second variant of evaluation - in 3 groups of analogical animals by origin (n = 20 goals each) with moderate feeding.

The composition of rations for bull-calves was balanced depending on the season of the year and the planned level of feeding from feeds of own production. The intensive level assumed feeding in the period of 8-12 months of hay mixed with 10 kg, straw 2 kg, concentrated feed 3 kg. The age period of 13-15 months coincided with the spring-summer season of the year. At this stage, the main food was the green mass of natural pastures with additional concentrates in the amount of 2 kg. With a moderate level of feeding, a

decrease in the nutrition of diets was achieved due to a limited inclusion of concentrates. In the period from 8 to 12 months the bulls were provided with a ration similar in composition to the first experiment, but the quantity of concentrates was reduced to 1.5 kg per head per day. In the spring-summer season the experimental juveniles of moderate feeding did not receive supplementary feeding with concentrated fodder, and the only food was green mass.

Influence of the feeding level on the development of breeding qualities of young animals of different genotypes was studied by dispersion analysis using the ANOVA procedure of Statistical 10.0 program according to the following model:

$$Y_{ij} = \mu + A_i + B_j + (AB)_{ij} + e_{ij}$$

Where:

Y_{ij} – value of the analyzed indicator,

μ - population value,

A_i – effect of the i -th genotype of animals (1, 2, 3),

B_j – effect of the j -th level of feeding (1, 2),

$(AB)_{ij}$ – interaction genotype \times level of feeding

e_{ij} – random error.

RESULTS AND DISCUSSION

When planting for control cultivation, the live mass of gobies of different breed groups was not the same due to the influence of bulls-producers of the red-angus breed on the weight growth of offspring in the suckling period (Table 1). The superiority of the hybrid youngster relative to purebred animals was 12.1-16.2 kg (6.12-8.29%, $P < 0.01-0.001$) in terms of the value of the indicator studied. The organization of intensive feeding made it possible to maximize the productive potential of the bull-calves of the combined genotype, increasing the difference in live weight in the 15-month-old to 35.4-47.3 kg (8.68-11.27%, $P < 0.001$). Against the background of a moderate intake of nutrients in the body of experimental animals, the improving effect of heterogeneous selection was 20.4-30.8 kg (5.47-8.26%, $P < 0.01-0.001$). The lesser effect of genetic superiority on the potential for weight growth of crooked bulls in conditions of limited feeding is associated with a different response of the organism to a fixed factor. At the same time, individuals with high genetic potential of productivity (crosses F_1 and F_2 of red angus) showed the most significant loss in weight gain with the organization of a moderate level of feeding - by 34.7-36.2 kg (8.83-8.97%; $P < 0.001$). The minimal modifying effect on the live weight was observed in Kalmyk bull-calves, which is 19.7 kg (5.29%, $P < 0.01$).

The average daily gain for the period of 8-15 months with abundant feeding was characterized by a reliable intergroup difference at the level of 109.8-163.6 g (12.02-17.91%, $P < 0.01-0.001$) in favor of the hybrid animals. Evaluation of the breeding value on a moderate diet significantly affected the range of variability between breed groups, while maintaining the rank of distribution of bulls. The superiority of heterogeneous genotypes was reduced to 34.5-68.6 g (4.15-8.25%, $P > 0.05$, $P < 0.05$). This is also due to the varying strength of the modifying effect of growing conditions on the realization of the productivity potential. The modifying effect on the weight growth rate varied depending on the rockiness in the range 81.5-176.5 g (9.80-19.60%, $P < 0.01-0.001$), with a minimum in purebred bulls and a maximum in the crosses F_2 red angus.

In addition to improving the genetic potential of productivity, the improvement of the exteriors and physique in domestic cattle, with an increase in the concentration of the gene for comminucleosis in the herd, was among the main goals of the organization of interbreeding with the participation of Kalmyk and Angus parents. The results attest to the reliable influence of the heredity of the red Angus of American origin on the formation of a harmonious physique of meat-typical meat, with well-developed musculature, especially in the posterior third of the trunk. However, the maximum manifestation of the improving effect was achieved against a background of copious feeding. While the restriction of the diet for nutrition levels the intergroup difference in the lifetime evaluation of meat forms.

Table 1: Characteristics of bull-calves in assessing their own productivity against a background of different levels of feeding

Sign of selection	Group		
	I	II	III
Intensive feeding level			
Live weight in 8 months	197,8±2,24 ^b	209,9±2,97 ^a	210,3±2,74 ^a
Live weight at 15 months	392,4±4,74 ^b	427,8±4,94 ^a	439,7±5,81 ^a
The average daily increase of 8-15 months	913,4±19,65 ^b	1023,2±18,51 ^a	1077,0±27,34 ^a
Intravital assessment of meat forms	51,2±0,55 ^b	54,0±0,66 ^a	56,1±0,91 ^a
Height in sacrum	121,1±0,55 ^b	123,2±0,78 ^{ab}	124,3±0,65 ^a
Exterior and body estimation	17,9±0,42	18,4±0,47	18,8±0,37
Comprehensive index	94,3±1,45 ^b	101,0±1,47 ^a	104,7±1,80 ^a
Mild level of feeding			
Live weight in 8 months	195,5±2,13 ^b	208,5±2,94 ^a	211,7±2,59 ^a
Live weight at 15 months	372,7±4,31 ^b	393,1±4,77 ^a	403,5±4,92 ^a
The average daily increase of 8-15 months	831,9±16,24 ^b	866,4±17,18 ^{ab}	900,5±21,84 ^a
Intravital assessment of meat forms	50,9±0,47	52,8±0,77	52,5±0,64
Height in sacrum	120,5±0,64 ^b	122,6±0,76 ^{ab}	123,9±0,62 ^a
Exterior and body estimation	17,2±0,62	18,3±0,41	18,0±0,40
Comprehensive index	96,6±1,68 ^b	101,3±1,48 ^{ab}	102,3±1,70 ^a

Note: the values in the lines with different upper indices differ P <0.05

The quantitative changes in the exterior were estimated from the size of the "height in the sacrum" measurement. Investigations recorded the enlargement of the phenotype in the combined genotypes by 2.1-3.2 cm (1.73-2.64%, P > 0.05, P <0.01) compared to purebred bulls. Moreover, the change in conditions in the organized factor (feeding) did not have a significant effect on the magnitude of the intergroup difference and the rank of the distribution of the studied genotypes. The linear growth of the peripheral part of the skeleton is more resistant to the impact of the paralytic factor in comparison with the variability of weight growth. Thus, the decrease in height in the sacrum was 0.4-0.6 cm (0.32-0.50%, P > 0.05) with respect to the test with full feeding.

The complex index of valuation of breeding value in bull-calves varied depending on the breed and the conditions of cultivation. When organizing an intensive diet, the differences between the genotypes were 6.7-10.4% (P <0.05-0.001). The minimum score was established in the purebred young Kalmyk breed. Reduction of nutritional value of the diet was accompanied by some equalization of differences between the studied genotypes to 4.7-5.7% (P > 0.05, P <0.05).

Heredity was unequally manifested at different levels of feeding (Table 2). The influence of parents on the living weight when removing animals from control cultivation on an intensive diet is 15.92% higher compared to a moderate one. Even more (by 22.44%) the realization of heredity, depending on the level of feeding, differs by the average daily gain. At the same time, the influence of the genotype on the inter-group variability of weight gain is significant (P <0.05-0.001).

Table 2: Effect of heredity on the variability of the signs of selection at different levels of feeding,%

Sign of selection	Feeding level	
	intensive	mild
Live weight in 8 months.	19,80**	27,93***
Live weight in 15 months.	44,15***	28,23***
The average daily gain is 8-15 months.	33,10***	10,66*
Intravital assessment of meat forms	28,94***	8,63
Height in sacrum	17,59**	18,36**
Exterior and body estimation	3,81	4,18
Comprehensive index	28,03***	11,30*

In contrast, the variability of linear growth in experimental young animals was more stable due to changes in the level of feeding. Thus, the height in the sacrum was determined by 17.59-18.36% ($P < 0.01$) by the genotype of the parents.

The visual characteristics of the development of meat forms and physique depended heavily on the fatness of animals, the severity of which was determined by the saturation of rations. At the same time, the maximum intergroup differences due to the genotype were noted with abundant feeding.

The estimation of breeding qualities of bull-calves on a complex of attributes on 16,73% is more strongly determined by heredity on a background of high-grade feeding. However, it should be noted that the value of the complex index of young growth is significant ($P < 0.05-0.001$) formed under the influence of the animal genotype under different growing conditions.

Thus, the realization of the genetic potential against a background of different levels of feeding occurs with unequal force. At the same time, we found that the influence of growing conditions on the variability of the selection criteria on the bull-calves of different breed groups is affected to varying degrees (Table 3). Weight growth of hybrid genotypes underwent maximum variability in response to a change in the usefulness of rations. Thus, the variability of live weight at 15 months of age by 37.31-40.27% ($P < 0.001$) depended on the paralytic factor. The Kalmyk genotype is more unpretentious to the level of feeding.

Table 3: Influence of the feeding level on the variability of the selection characteristics in bull-calves of different genotypes,%

Sign of selection	Group		
	I	II	III
Live weight in 8 months	1,43	0,27	0,36
Live weight at 15 months	19,84**	40,27***	37,31***
The average daily increase of 8-15 months	21,24**	50,38***	40,08***
Intravital assessment of meat forms	0,53	3,57	21,69**
Height in sacrum	1,31	0,92	0,65
Exterior and body estimation	2,27	0,07	6,03
Comprehensive index	2,71	0,03	2,28

When analyzing the variability of the average daily growth, an analogous regularity was established: the genotype with a lower productivity potential was characterized by a lesser impact of feeding conditions on the phenotype.

The paralytic factor had a minimal effect on the linear growth in young animals of all breed groups. The magnitude of the determination of the height feeding factor in the sacrum ranged from 0.65 to 1.31%.

Thus, the influence of hereditary and paralytic factors has been established on the formation of selection criteria in the test of their own productivity. At the same time, their share in the total variability of the individual selectable features is different (Table 4).

Table 4: Influence of factors of heredity and feeding on the variability of signs of selection of beef cattle,%

Sign of selection	Factor			
	genotype	feeding	genotype × feeding	random
Live weight in 8 months	23,56***	0,08	0,36	76,00
Live weight at 15 months	27,66***	23,40***	1,44	47,50
The average daily increase of 8-15 months	14,81***	30,97***	2,71	51,52
Intravital assessment of meat forms	15,96***	6,13**	4,02*	73,89
Height in sacrum	17,85***	0,79	0,00	81,45
Exterior and body estimation	3,32	1,81	0,63	94,24
Comprehensive index	18,92***	0,00	1,45	79,63

Weighted growth was subjected to the most significant determination of organized factors, which was accompanied by a minimal effect of random (non-fixed) impacts on its variability. Thus, the level of feeding significantly ($P < 0.001$) determined the variability of the live weight at the age of 15 months by 23.40% and the average daily growth for the period of 8-15 months by 30.97%.

Statistically significant determination ($P < 0.01$) from the intake of nutrients and energy into the body was established by a lifetime evaluation of meat forms - 6.13%. In addition, the combined influence of organized factors (4.02%, $P < 0.05$) on the formation of the exteriors was established, which was associated with a change in the rank of the distribution of experimental animals according to the evaluation parameter studied.

However, the analysis of the obtained data shows that increasing the genetic potential by combining heredity can have a more significant effect on the productive qualities of animals. Thus, the share of hereditary variability in most of the signs of selection of bull calves in assessing their own productivity was highly reliable ($P < 0.001$). In particular, the minimum determination by the genotype of the average daily gain (14.81%) is explained by a significant slowdown in the rate of weight growth with a reduction in the nutritional value of the diet. At the same time, the value of live weight at 8 and 15 months of age is maximally determined by the heredity of animals - by 23.56-27.66%. The effect of the genotype on linear growth of young animals also takes a significant share (17.85%) in the overall phenotypic variability of the trait, and, given the low variability in height in the sacrum under the influence of paralytic factors, it is advisable to orient the size of the measurement as one of the main evaluation criteria for testing young animals on their own productivity.

Due to the fact that the calculation of the complex index is carried out against the background of comparing the index of individual development of an individual in comparison with peers under specific growing conditions, the studied selection parameter does not depend on the feeding system. However, the influence of the origin of young animals on the value of the studied indicator is large enough and amounts to 18.92% ($P < 0.001$).

The calculation of breeding indexes based on the selection of young beef cattle indicates a significant intergroup difference in their magnitude (Fig. 1). However, the greatest differentiation of the genotypes

studied by the selection parameters was achieved only against the background of an intensive diet. With moderate feeding of test bulls, the average values of breeding indices tended to the average population (100%). Such a distribution of genotypes significantly restricts the selection of individuals with a high potential for productivity.

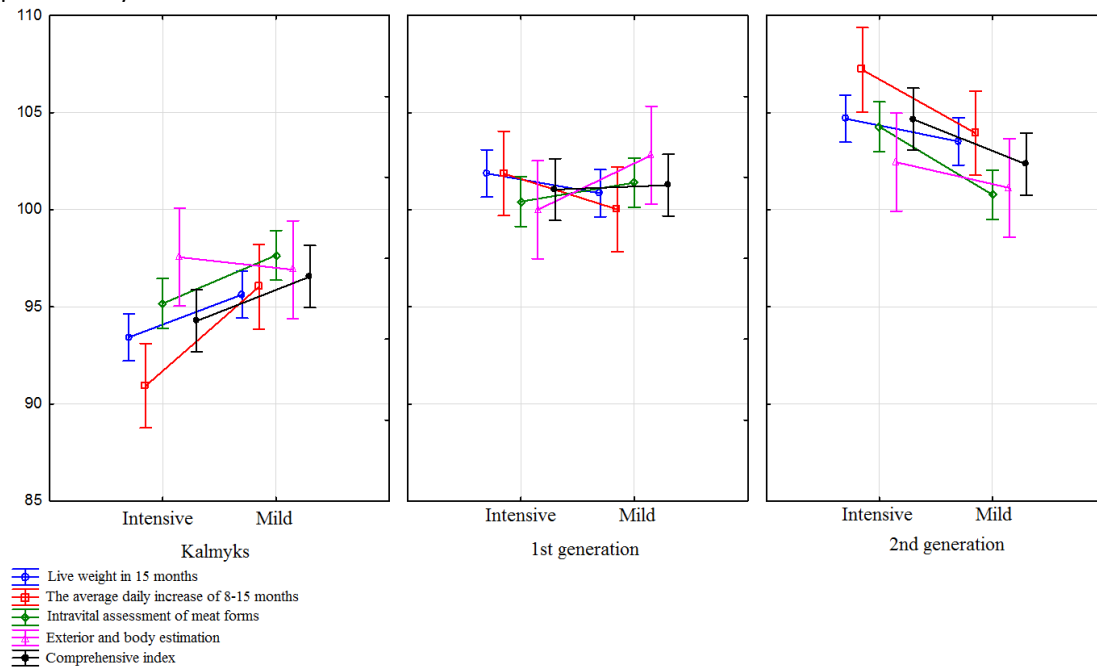


Figure 1: Variability of breeding indices in bull-calves of different genotypes under the influence of feeding conditions

Studying the numerous factors of non-genetic nature that determine the realization of the genetic potential of beef cattle, the main role is assigned to the level and quality of feeding [7, 20, and 21]. The growth, development and functional activity of tissues and organs of the body are the result of the intake of nutrients and energy with the diet. In addition, the unequal use of feed substances by animals differing in the genetic potential of productivity is proved, which is due to the peculiarities of metabolic processes in their organism [9].

To increase the accuracy of the assessment of the breeding value of purebred Kalmyk bull-calves and crossbreeds from bulls-producers of Red and Angus breeds of the first and second generations, a test was conducted on their own productivity against a background of different levels of feeding. The task was to scientifically use the unpretentiousness to breeding conditions inherent in Kalmyk animals and the genetic potential of meat production of red angus in a new hereditary complex in individuals of the genotype being created on the basis of complementary inheritance from parental forms. Similar experience and results were obtained by domestic breeders when breeding Russian breeds of clod. The developed scheme of the absorbing crossing of the Kalmyk livestock by the Aberdeen-Angus breed to the fourth generation made it possible to obtain animals that exceed the purebred peers of the initial genotypes by 10-15% and 6-8%, respectively. At the same time young growth of the Russian clod of breed is well adapted to the most diverse zones of our country [1].

An additional argument of our working hypothesis is the experience of breeding Kazakh white-headed breed, which is a classic example of a combination of the gene pool of aboriginal animals by means of absorbent crossing with highly productive specialized meat for improving acclimatization qualities [12]. In addition, foreign researchers actively use adaptive abilities to the hot tropical climate of Brahmin cattle in the system of interbreeding [23, 24, and 25].

Analysis of the results of the assessment of own productivity indicates a significant ($P < 0,01-0,001$) superiority of crosses of the second generation of red angus relative to purebred peers in the development of the selected characteristics (with the exception of the assessment of the exterior and physique), regardless of

the level of feeding. At the same time, the descendants of bulls-producers of American breeding inherited a valuable technological sign - the honeysuckle.

Dispersion analysis revealed that the feeding factor varies in different ways with different selection criteria. Reliable influence ($P < 0,01-0,001$) variant of the diet had on the variability of live weight, average daily gain and lifetime evaluation of meat forms. The genotype with a high level of statistical significance determined intergroup differences in most selection parameters. The results attest to the possibility of successful breeding and breeding work aimed at increasing the genetic potential of beef cattle productivity [3, 4, 5, and 8].

CONCLUSION

The test on the bulls' own production in the creation of a new genotype of beef cattle on the basis of the complementary interaction of the Kalmyk breed and the Red Angus has shown a significant superiority in F_2 fatigue on the grounds of selection, regardless of feeding conditions. Ensuring a full-fledged level of feeding contributed to a more complete realization of the genetic potential of productivity, which is confirmed by the maximum differentiation of experimental animals according to certain parameters. On the contrary, against a background of a moderate diet there is some leveling of breeding indices between groups to the average population value.

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