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ANIMAL HUSBANDRY

Adaptive Capacities and Beef Productivity of Calves of Different Breeds Depending on Breeding Technology

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Abstract—The expediency of raising of bull calves of Kazakh white-headed and Simmental breeds within the winter period in the feedlot, and black-and-white bull calves indoors is defined. During raising in the feedlot, the lysozyme and bactericidal activity of blood increases and the state of the animal hair improves. Furthermore, the intensity of growth of the Kazakh white-headed bull calves reduced to a smaller degree and the bull calves of the black-and white breed reduced to a greater degree. However, while growing indoors, the absolute and average daily gain in all animals was higher. The highest level of profitability of beef production was in the bull calves of the Kazakh white-headed and Simmental breeds while growing in the feedlot.

Keywords: bull calves, breed, adaptation, beef productivity, economic indicators

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INTRODUCTION

The dozens of domestic and foreign breeds of cattle stock of dairy, combined, and meat directions of productivity (differing not only by the genetic potential of products manufacturing but also adaptation capacities to environment conditions, weather, and technological factors) are distributed by zones in the Russia Federation. The latter is often not taken into account while completing the fattening plants, especially feedlots with young stock. In this respect, deficiency of the expected products and low efficiency of beef production take place [1–6].

The purposes of these surveys are to study adaptation capacities and beef productivity of bull calves of different breeds zoned in the Southern Urals as well as economic indicators of beef production.

MATERIALS AND METHODS

The scientific and economic experiment was carried out in September–April at Gorniy farm, Orenburg oblast, on the bull calves of the Kazakh white-headed (groups I and II), black-and-white (groups III and IV) and Simmental (groups V and VI) breeds at the age of 10–17 months. The young stock of groups I, III, and V was kept in the standard free stall house, and that of groups II, IV, and VI was kept in the feedlot combined with the room of the light type with feeding and watering in the loafing-feeding yard.

The rations were made according to the detailed feeding norms [7]. The results of surveys were processed using the method of variation statistics according to N.A. Plokhinskiy [8].

RESULTS AND DISCUSSION

In total for the experiment period (210 days), consumption of fodders, respectively, by groups I–VI made: 1852, 1873, 1819, 1849, 1872, and 1896 fodder units, which included 18811, 19071, 18476, 18807, 19058 and 19326 MJ of metabolic energy and 196.8, 199.0, 193.4, 196.5, 198.8 and 201 kg of digestible protein.

It was defined that the animals of the Kazakh white-headed breed have the best natural resistance of the organism, and then go the Simmental and low black-and-white breed. According to the bactericidal activity, the bull calves of I group exceeded the herdmates of III and V group by 2.73 ($P < 0.01$) and 0.66% respectively, and according to the lysozyme activity they exceeded by 15.7 ($P < 0.001$) and 2.86%. An increase of indicators of nonspecific immunity was specified in the animals kept in the feedlot. In particular in the young stock of groups II, IV, VI as compared to the uniform-breed herdmates of groups I, III, and V; the bactericidal activity of the blood serum was higher by 1.13 ($P > 0.01$), 0.43 ($P < 0.05$), and 0.87% ($P < 0.05$) respectively; the lysozyme activity was higher by 12.1 ($P < 0,01$), 10.4 ($P < 0.05$), and 9.10% ($P < 0.05$).

The state of the body hair of experimental animals depended both on their breed affiliation and conditions of growing. While keeping the bull calves in the feedlot, the thickness of their hair per 1 cm^2 of skin increased by 37.4–44.4%, their mass increased by 2.1–2.3 times, and length increased by 2.0–2.1 times. In the structure of the body hair, the content of over hair decreased by 27.9–28.6% and intermediate hair

Table 1. Live weight and its gain in the experimental animals

Group	Live weight (kg) at the age of, months		Live weigh gain		Relative growth rate, %
	10	17	absolute, kg	average daily, g	
I	272.7 ± 0.73	470.7 ± 2.61	198.0 ± 1.96	943 ± 9.29	53.27
II	274.0 ± 0.76	466.8 ± 3.53	192.8 ± 2.86	918 ± 13.65	52.05
III	268.9 ± 0.60	455.2 ± 2.88	186.3 ± 2.51	887 ± 11.14	50.36
IV	267.3 ± 0.70	439.7 ± 2.93	172.4 ± 2.30	821 ± 10.99	48.77
V	284.6 ± 0.77	491.2 ± 2.77	206.6 ± 2.08	984 ± 9.93	53.26
VI	285.1 ± 0.80	483.7 ± 3.34	198.6 ± 2.68	945 ± 11.59	51.66

decreased by 1.3–3.8%, but the specific weight of wool increased by 27.8–31.6%. Independently of the method of keeping of animals, the young stock of the Kazakh white-headed breed had the most favorable indicators of the body hair for winter conditions.

The ethology of the bull calves kept indoors did not change significantly upon the change of weather conditions. Depending on the breed, they spent 30.7–32.0% of the daily time for eating, 56.6–57.3% for rest, and 10.6–12.6% for walking. In case of keeping of the animals in the feedlot, the duration of eating was prolonged, on average, by 5.5%, walking by 10.1%, and physical activity (number of steps) by 16.7%. It was stated that the wind but not the low temperature mainly affects the behavior of the animals, especially of the black-and-white breed. At the temperature –27°C and wind speed 12.2 m/s, as compared to the indicator –29°C and 0.5 m/s, the duration of eating the fodder was reduced from 478 to 389 min/day, walking was reduced from 201 to 121 min/day, and rest time, especially standing, increased from 761 to 930 min/day; the animals tried to stay near the wind break fencing.

The genetic potential of productivity, as well as the conditions of keeping, affected the growth of animals (Table 1). The bull calves of the Simmental breed were characterized by the largest live weight. At the age of 17 months, they exceeded the herdmates of the Kazakh white-headed and black-and-white breed by this indicator, on average, by 18.7 (4.0%) and 40.0 kg (8.9%), respectively, including while growing indoors by 20.5 (4.3%) and 36.0 kg (7.9%) and in the feedlot by 16.9 (3.6%) and 44.0 kg (10.0%). The absolute gain of the live weight of the bull calves of the Kazakh white-headed breed kept indoors was higher than while keeping in the feedlot by 5.2 kg, black-and-white by 13.9 ($P < 0.01$), and Simmental by 8.0 kg ($P < 0.05$). Within the period of experiment, the average daily gain of live weight of the bull calves of group I was within 863–1016 g, group II was within 836–980, group III was within 810–953, group IV was within 740–886, group V was within 906–1076, and group VI group was within 853–1030 g.

It was defined that the animals of the Kazakh white-headed breed that reduced the growth intensity to a lesser degree were the most stress resistant and more easily endured the unfavorable environment factors. In particular in the young stock of this breed while growing in the feedlot as compared to the animals kept indoors, the average daily gain of live weight for the first month after formation of production groups (stress factor) was lower by 3.1%; while that in the herdmates of the black-and-white breed was by 8.7% ($P < 0.01$); Simmental was by 5.9% ($P < 0.05$); at the age of 13–14 months was, respectively, by 3.0, 6.4 ($P < 0.01$), 4.3% ($P < 0.05$); 16–17 months was by 1.9, 9.0 ($P < 0.01$), 1.5%; and on the whole for the experiment was by 2.7, 7.5 ($P < 0.01$), 4.0% ($P < 0.05$).

The total losses of the live weight during transportation or preslaughter treatment in the animals of the Kazakh white-headed breed made, on average, 5.50% of the weight after fattening, black-and-white made 6.91%, and Simmental made 6.52% (Table 2). The total losses of the live weight in all breeds in the young stock grown indoors made 6.53% of the initial level and that in the feedlot made 6.09%.

The analysis of the data of control slaughtering at the age of 17 months showed that the bull calves kept in the standard room and having a larger live weight in the end of the experiment had high slaughtering qualities (Table 3). Thus, the difference by the weight of carcass of the bull calves of the Kazakh white-headed breed made 2.7 kg (1.09%), black-and-white made 8.0 kg (3.5%; $P < 0.05$), and Simmental made 4.4 kg (1.7%). Furthermore, the largest values of this indicator was marked in the young stock of the Simmental breed. However, by the carcass yield they were behind the animals of the Kazakh white-headed breed. The largest amount of visceral fat was synthesized in the bull calves of the Kazakh white-headed breed: on average, 13.5 kg upon the yield of 3.05%, which is higher than in the animals of the black-and-white breed by 1.9 kg and 0.27%, respectively, and Simmental by 0.9 kg and 0.29%. Keeping of the animals indoors contributed to an increase of the visceral fat weight by 0.3–0.6 kg. According to the slaughtering, the bull calves of the Kazakh white-headed breed also had an advantage. On average, it made 59.41% and was higher than in the herdmates of the black-and-white and Simmental breeds by 1.15 and 0.82%, respectively.

The calculations of economic efficiency prove a significant influence of the technology of the young stock breeding on the cost value and profitability of

Table 2. Live weight losses during transportation and preslaughter treatment

Indicator	Group					
	I	II	III	IV	V	VI
Live weight after fattening, kg	471.0	466.7	455.3	439.3	492.0	483.3
Live weight after transportation, kg	452.7	449.7	434	420.7	470.3	463.3
Losses during transportation:						
kg	18.3	17.0	21.3	18.6	21.7	20.0
%	3.88	3.64	4.68	4.23	4.41	4.14
Live weight after fasting, kg	444.3	441.7	422.7	410.0	458.7	453.0
Losses during the fasting period:						
kg	8.4	8.0	11.3	10.7	11.6	10.3
%	1.78	1.71	2.48	2.43	2.36	2.13
Total losses:						
kg	26.7	25.0	32.6	29.3	33.3	30.3
%	5.66	5.35	7.16	6.67	6.77	6.27

Table 3. Results of control slaughtering of animals

Indicator	Group					
	I	II	III	IV	V	VI
Preslaughter live weight, kg	444.3 ± 3.29	441.7 ± 2.71	422.7 ± 3.68	410.0 ± 2.90	458.7 ± 3.87	453.0 ± 5.23
Hot carcass weight, kg	251.0 ± 2.32	248.3 ± 2.13	235.0 ± 2.30	227.0 ± 1.74	256.7 ± 2.13	252.3 ± 2.52
Carcass yield, %	56.49	56.21	55.59	55.36	55.96	55.69
Visceral fat weight, kg	13.7 ± 0.16	13.4 ± 0.13	11.9 ± 0.19	11.3 ± 0.12	12.8 ± 0.12	12.4 ± 0.12
Visceral fat yield, %	3.08	3.03	2.81	2.75	2.79	2.74
Slaughter weight, kg	264.7 ± 2.41	261.7 ± 2.08	246.9 ± 2.23	238.3 ± 1.86	269.5 ± 2.25	264.7 ± 2.63
Slaughtering yield, %	59.57	59.25	58.41	58.12	58.75	58.43

Table 4. Economic efficiency of animal breeding

Indicator	Group					
	I	II	III	IV	V	VI
Absolute gain, kg	198.0	192.7	186.3	172.4	206.6	198.6
Costs for 1 dt of the gain of:						
fodder units	935.30	972.34	976.33	1072.50	906.43	954.98
metabolic energy, MJ	9500.70	9896.90	9917.50	10909.20	9224.80	9731.10
digestible protein, g	99.39	103.27	103.81	113.98	96.22	101.31
Production costs, rub/head	25696.37	25273.41	25318.50	24759.10	26501.11	26025.53
including within the experimental period	9334.37	8833.41	9184.48	8721.10	9425.11	8919.53
Cost value of 1 dt of the gain, rubles	4713.33	4584.02	4929.94	5058.64	4562.01	4491.20
Sales value, rubles	35302.50	35010.00	34140.00	32977.50	36840.00	36277.50
Profit, rub./head	9606.13	9736.59	8821.50	8218.40	10338.89	10251.97
Profitability level, %	37.38	38.52	34.84	33.19	39.01	39.39

beef production (Table 4). While keeping the young stock in the feedlot as compared to keeping indoors, the consumption of fodder for the unit of live weight gain of bull calves of the Kazakh white-headed breed where higher by 3.9%, black-and-white by 9.8%, and Simmental by 5.3%. However, with the same technology of young stock breeding, the operational costs reduced on average by 5.5% per 1 head and the load of

animals per one worker increased nearly 1.5 times. Furthermore, the cost value of 1 dt of the live weight gain of bull calves of the Kazakh white-headed and Simmental breed was lower by 2.8 and 1.6%, and profitability of beef production is higher by 1.14 and 0.38%. The low economic indicators were obtained during growing of the young stock of the black-and-white breed in the feedlot. Due to a lower live weight, the profit was lower by 6.84% and the level of profitability was lower by 1.65%.

Thus, in Southern Urals and regions similar to it by the natural-climatic conditions it is reasonable to complete growing and fatten the young stock of the Kazakh white-headed and Simmental breeds in the feedlots and the black-and-white breed indoors.

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