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A Study on the Dynamics of the Development of Red Steppe Cows and Their Ayrshire and Holstein Crossbreeds

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Abstract

When purchasing animals from abroad, agricultural enterprises often underestimate their demand for feed quality and feeding standards for ensuring genetically determined milk productivity. Therefore, increasing attention should be paid to raising local breeds. During the creation of new production relations, it is very important to preserve achievements of scientists and breeders. The widespread use of red steppe cows is due to good feed payment, unpretentiousness, and their adaptability to the steppe zone with its arid climate. There was a real threat of extinction of purebred red steppe cattle: with the intensification of dairy cattle breeding, as well as low milk productivity, these animals are inferior to the best dairy breeds by productivity, but they are better by endurance, resistance to diseases, and adaptability to extreme environmental conditions. Therefore, scientific research is needed on improving the productive and technological qualities of this breed using the best global gene pool of dairy cattle. This article presents the results of a study on the development of heifers of purebred red steppe cows and their Ayrshire and red-motley Holstein crossbreeds. Differences in the live weight indicators of the purebred and crossbred heifers were due to the effect of crossbreeding and intensive growing technology, which made it possible to maximize the genetic potential of the crossbred animals.

Keywords: breed, steppe red, Holstein, Ayrshire, live weight, feed costs, diet.

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1. Introduction

At present, one of the urgent problems of the agrarian complex defined in the State Program for the Development of Agriculture of the Russian Federation (2013-2020) is the search for an intensive way of livestock farming aimed at increasing the efficiency of breeding of domestic cattle [1]. Therefore, in order to ensure import substitution, reduce risks of epizootic diseases, and possible restrictions on the supply of genetic materials from abroad, it is necessary to improve technological methods for raising domestic

breeding animals that are characterized by high productivity, good adaptability to local climatic conditions, and high profitability [1]. There was a real threat of extinction of purebred red steppe cattle, which is characterized by worse productivity, but better endurance, resistance to diseases, and adaptability to extreme environmental conditions [2, 3]. Therefore, it is necessary to form a competitive domestic breeding base that will satisfy needs of agricultural producers in high-quality breeding products and provide commodity enterprises with highly productive young animals [4, 5]. The first important step towards the successful implementation of any breeding program is to analyze characteristics of production systems and identify the best animals [6].

Therefore, the aim of the article is to study the growth and development of red steppe heifers and Ayrshire and red-motley Holstein hybrids raised by Dzerzhinsky JSC (Azov district, Rostov region). The research period is 2010-2014.

2. Material and Methods

The object of the study was purebred red steppe heifers (group I) and red-steppe Ayrshire (group II) and red-steppe x red-motley Holstein (group III) crossbreeds obtained by crossing red steppe cows with dairy bulls. The groups were formed from the March calving of cows selected on the basis of analogues. Each group consisted of 15 heifers. The intensive breeding technology used by the farm provides for the presence of a maternity ward which is adjacent to the calf-dispensary. Newborns calves are fed according to the technology adopted for manual milking - with maternal colostrum from an individual nipple drinker (MPK-2.5) up to 7 days; at the end of the colostrum period, the calves are fed with milk from healthy cows 3 times a day. Since 30 days' age to 6 months' age, skim milk and concentrated feeds are included in the diet of heifers. At the end of the prophylactic period, calves are transferred to boxes. There are feeders containing lick salt. Juicy feed is given using the universal feed dispenser KTU-10, concentrates, hay and root crops are given manually. Between the adjacent boxes, there are automatic drinkers.

According to the experimental procedure, animals were weighed monthly: in the morning, before feeding using a medium-precision scale with a weighing limit of up to 500 kg according to GOST 23676-79 with an allowable error of not more than 0.1%. Based on the weighing results, the intergroup differences were studied: the average live weight, the absolute and average daily gains were calculated according to the generally accepted methodology [7].

Feed consumption was taken into account on the basis of control feedings according to the number of feeds and uneaten residues for two days.

The obtained experimental data were processed by the method of N.A. Plokhinsky (1969) in Microsoft Excel program. Basic statistical parameters were calculated [8].

3. Results and Discussion

During the six-month dairy period, the feed consumption structure (Fig. 1) per one animal was as follows: whole milk - 450 kg, skim milk - 500 kg, alfalfa hay - 250 kg, corn silage - 400 kg, concentrates - 200 kg, root crops - 160 kg, table salt -235 g and chalk - 310 g.

The nutritional value of the consumed feed per one animal was 634 kg of feed unit, 238.80 kg, protein, and metabolic energy - 456.28 MJ. One feed unit contained 133.0 g protein and 10.3 MJ of exchange energy.

In the 6-9 month period, heifers received alfalfa hay - 270 kg, leguminous hay - 270 kg, corn silage - 540 kg, beet feed - 450 kg, concentrates - 117 kg. The nutritional value of feed per one animal was 556.2 kg of feed unit, 59.94 kg of protein, 6202.8 MJ of exchange energy. One feed unit contained 107.8 g of protein and 11.2 MJ of metabolic energy.

The amount of feed consumed during the period from 9 to 14 months was as follows: alfalfa hay -450 kg, leguminous hay - 600 kg, corn silage - 1275 kg, beet feed - 750 kg, concentrates - 180 kg. The nutritional value of feed was as follows: 1054.5 feed units, 10479.5 MJ of metabolic energy, 141.52 protein. One feed unit contained 10.9 g protein and 9.9 MJ of exchange energy.

Table 1 shows that in the structure of feed consumed, the share of coarse feed was 21.0%, of juicy feed (silage, hay, fodder beets) - 42.2%, of whole milk and skim milk - 9.8%, of concentrated forage - 27, 0%.

An important indicator of the efficiency of the livestock industry is reduction of feed costs for raising animals [9, 10]. The consumption of feed units per 1 kg of live weight gain was different and amounted to 5.64 units in the control group, 5.59 units in the second group, and 5.40 units in the third group. The difference between the control and experimental groups was 0.99 and 4.25%. The costs of feed per unit of live weight gain for growing periods are presented in Table 2.

In the milky period, crossbred heifers III consumed less feed (3.7 feed units) compared to groups I and II by 2.7 and 5.4%, respectively. In the post-dairy period the feed consumption per 1 kg of live weight gain was in the range of 6.9-8.2 feed units. Over

Figure 1: Raising young animals up to 6 months. Age

the 14-month period, heifers of group III consumed 5.4 feed units per one kilo of live weight gain which is less than in groups I and II by 3.7 and 1.8%, respectively.

TABLE 1: Feed consumption and nutritional value per animal

Feed	Periods			Content				
	0-6	6-9	10-14	Total feed consump-tion kg	Total, f.u.	EKE, MJ	Protein, kg	Nutrition structure, %
Milk	450	-	-	450	135	1026	14,85	6,6
Skim milk	500	-	-	500	65	655	17,50	3,2
Alfalfa hay	250	270	450	970	426,8	651,9	97,97	21,0
Cereal hay	-	270	600	870	278,4	3862,8	26,97	13,6
Corn silage	400	540	1275	2215	443	5094,5	31,01	21,6
Roots	-	450	750	120	144	1982,7	1,08	7,04
Concentrates	200	117	180	497	551,7	606,3	44,73	27,0
Total	-	-	-	-	2043,9	13880,2	234,11	100

An important indicator characterizing the growth and development of animals is live weight. Control over the dynamics of live weight growth allows us to judge the effectiveness of crossbreeding [11]. The growth dynamics is shown in Table 3.

At birth, the highest live weight was in animals of group III (32.0), which is higher than in group I by 9.6%, and in group II - by 4.5%.

By the age of 6 months, the largest live weight gain was observed in group III (193.3 kg), the advantage over animals of the first and second groups was 3.8 and 3.7%. When

TABLE 2: The cost of feed for increasing live weight during the growing period

Group	Indicator	Age periods, months.			
		0-6	6-9	9-14	0-14
I	Gain per one animal., Kg	157,0	77,4	127,6	326,0
	Feed consumption for the period, f. u.	610,0	556,2	1054,5	2043
	Feed per one kilo of live weight gain, f.u..	3,8	7,2	8,2	5,6
II	Live wight gain per one animal, kg	156,0	77,6	131,7	365,3
	Feed consumption per one kilo of live weight gain, f.u	610,0	556,2	1054,5	204
	Feed consumption per one kilo of live weight gain, f.u..	3,9	7,1	8,0	5,5
III	Live wight gain per one animal, kg	193,3	80,5	136,4	378,2
	Feed consumption for the period, f. u..	610,0	556,2	1054,5	2043
	Feed consumption per one kilo of live weight gain, f.u..	3,7	6,9	7,7	5,4

inseminated, red-spotted Holstein heifers of group III had a live weight of 410.2 kg. This index was higher than in group I by 19.0 kg, and in group II by 14.4 kg or 4.8 and 1.2%. Thus, differences in the live weight indicators of crossbred heifers make it possible to maximize the genetic potential [12]. The data on the absolute and average daily gain in live weight of heifers are presented in Table 4. Regardless of the origin of heifers of all the groups, the growth rate was highest in the milky period. At 0-6 months, the average daily growth ranged from 867.6 to 894.0 g, in the period of 6-9 months, it was 861.0-900.0 g, in the period of 9-14 months, it was 850.2-907.1 g. The most intensive growth was observed in group III produced from red-motley Holstein bulls.

TABLE 3: Dynamics of live weight of experimental heifers, kg ($M\pm m$)

Age, month	Group		
	I	II	III
Birth	29,2±1,7	30,5±0,8	32,0±0,8
1	53,2±1,8	55,0±1,7	58,5±1,7
3	105,3±1,9	106,9±2,3	112,0±2,7
6	186,2±3,0	186,5±2,6	193,3±4,0*
9	263,8±2,7	264,1±3,3	273,8±3,5
12	344,4±3,0	346,7±4,3	353,9±5,1
13-14 (insemination period)	391,2±3,6	395,8±3,5**	410,2±2,1

Note:*P>0,95;***P>0,99

It should be noted that the current level of feeding increased live weight values. Under the identical conditions of feeding and keeping, the animals of group II and III had a large live weight during insemination (395.8 kg and 410.2 kg); these animals had a higher adaptive ability than purebred red steppe peers. Cross-breeding Ayrshire and red-motley Holstein cows were able to maximize their genetic potential in specific environmental conditions [13, 14].

TABLE 4: Weight gain by growing periods (n=15)

Group	Age periods, months	Absolute gain, kg	Average daily gain, g
I	0-6	157,0±3,6	871,7±20,0
	6-9	77,4±4,9	861, ±53,50
	9-14	127,6±4,4	850,2±28,9
	0-14	362,0±4,1	861,9±9,9
II	0-6	156,0±2,9	867,6±15,9
	6-9	77,8±4,8	863,7±53,7
	9-14	131,7±4,4	877,3±29,6
	0-14	365,3±3,7	859,9±8,7
III	0-6	161,3±4,3	894,0±23,1
	6-9	80,5±5,5	900,0±58,3
	9-14	136,4±4,4	907,1±29,1
	0-14	378,2±1,8	889,4±3,9

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