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СОЗДАНИЕ СЕЛЕКЦИОННОЙ ГРУППЫ ГЕРЕФОРДСКИХ КОРОВ, УЛУЧШЕННЫХ БЫКАМИ КАНАДСКОЙ РЕПРОДУКЦИИ

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Представлены результаты исследований по созданию селекционной группы герефордских коров в племенном репродукторе Новосибирской области. Установлено, что по живой массе наименьший коэффициент изменчивости имеют коровы с 3-го по 7-й отел (от 1,9 до 2,7%), по молочности – от 1,9 до 5,6%. По высоте в крестце (характеризующая выраженность типа) вариация составила 1,3–1,6%. Исходя из этих показателей отобрана и оценена селекционная группа коров в количестве 82 гол. В среднем живая масса животных составила 570,5 кг с превосходством показателя стандарта породы на 50,5 кг, или 9,7%, и соответствовала классу элита-рекорд. Селекционный дифференциал по живой массе коров всего стада и селекционной группы составил 11 кг. С учетом коэффициента наследуемости и эффекта селекции на первое поколение для достижения показателей желательного типа на основе коров селекционной группы понадобится 3,5 поколения (10,5 лет), соответственно по молочности – 3,9 поколения (4,5 года). Более эффективного селекционного достижения можно добиться по высоте в крестце (1,1 поколения и 3,3 года). Десять быков-производителей, отобранных для заказного спаривания, однородны и оценены классом элита-рекорд. По живой массе превосходили стандарт породы в 3 года на 151,5 кг (8,1%), в 5 лет и старше – на 115,3 кг (14,1%). Они характеризуются хорошо выраженным желательным типом телосложения. Быки-производители, полученные от кросса канадской и сибирской селекций с комплексным индексом «Б», по качеству потомства 104–105 признаны улучшателями.

Ключевые слова: порода, селекционная группа, живая масса, молочность, изменчивость, поколение

CREATION OF A BREEDING GROUP OF HEREFORD COWS IMPROVED BY BULLS OF CANADIAN REPRODUCTION

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The results of research on the creation of a breeding group of Hereford cows at the Novosibirsk Region breeding reproducer are presented. It was found that cows from the 3rd to 7th calves have the lowest coefficient of variability for live weight (from 1.9 to 2.7%), for milk yield - from 1.9 to 5.6%. The variation in height at hips (characterizing the manifestation of the type) was from 1.3-1.6%. Based on these indicators, a breeding group of 82 cows was selected and evaluated. The average live weight of the animals was 570.5 kg, which exceeds the standard of the breed by 50.5 kg or 9.7%, and corresponded to the elite-record class. The selection differential by live weight of cows of the whole herd and breeding group was 11 kg. Taking into account the coefficient of inheritance and the effect of selection on the first generation to achieve the indicators of the desirable type based on the

cows of the breeding group will take 3.5 generations (10.5 years), respectively, for milk yield - 3.9 generations (4.5 years). More effective breeding achievement can be achieved in height at hips (1.1 generations and 3.3 years). Ten stud bulls selected for custom mating are homogeneous and rated elite-record class. They exceeded the breed standard by 151.5 kg (8.1%) in live weight at 3 years of age and by 115.3 kg (14.1%) at 5 years and older. They are characterized by a well-defined desirable type of constitution. Stud bulls obtained from the cross of the Canadian and Siberian selections with the complex index "B", according to the quality of progeny 104-105 recognized as improveers.

Keywords: breed, breeding group, live weight, milk content, variability, generation

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INTRODUCTION

The development of specialized beef cattle breeding in the Russian Federation is a priority for agriculture. From 2010 to 2019 production of cattle for slaughter in live weight decreased from 3030.0 to 2827.1 thousand tons or by 202.9 thousand tons (-6.7%). This is a consequence of the reduction in the number of dairy cows and over-replacement young cattle in the share of fattening stock[1] [1, 2]. They can be replaced only by animals of beef breeds, so the creation of new genotypes of cattle with high meat productivity is the main goal of breeding and pedigree work in specialized beef herds. According to forecasts, by 2025 the number of beef cattle of specialized beef breeds should reach 10 million heads [3]. Currently, the development of beef cattle breeding is carried out both with the use of domestic cattle breeds and with the involvement of foreign cattle breeds[2,3]. The Hereford cattle breed in the breeding farms of the Russian Federation is the third and most common among the imported specialized beef cattle breeds in Siberia.

Currently, with the advent of market relations under the influence of economic factors, the beef cattle breeding industry in Russia and the CIS has the opportunity to expand the marketing niche in the market of agricultural products. As a consequence, the role of breeding farms in increasing the number of beef cattle population is growing.

Work with cattle breeds, in particular with Siberian-bred Herefords, should be aimed at improving the efficiency of forage and technological resources through the creation of new breeding groups. It is known that all breeds of animals bred in the world by artificial human selection need continuous improvement of breeding and productive qualities for the future. Otherwise, under the influence of both natural selection factors and environmental pressure, any breed will degenerate. In this regard, Herefords of domestic reproduction are improved by adding blood of Canadian selection animals to improve both breeding and meat qualities [4-

[1]Dunin I.M., Butusov D.V., Shichkin G.I. et al. The condition of beef cattle breeding in the Russian Federation // Yearbook on the breeding work in beef cattle breeding on the farms of the Russian Federation (2019). M., 2020. 442 p.

[2]Gizatullin R.S., Sedykh T.A. The condition and prospects of increasing beef production in the Republic of Bashkortostan // Achievements of science and innovation - agricultural production: materials of the national scientific conference. Ufa, 2017. Pp. 208-215.

[3]Khamiruyev T.N., Tyukavkin A.A. Canadian selection Herefords in the Trans-Baikal region // Meat cattle breeding in the arid territories of southern Middle Siberia: current status and prospects for development: proceedings of interregional scientific and practical conference with international participation. Khakassia, 2017. Pp. 76-80.

10][4]. Similar work has been started in the Siberian breeding farms.

MATERIAL AND METHODS

Animals of specialized meat Hereford breed became the object of long-term studies. The variability of the main traits of purebred Hereford cattle of "Voznesenskoye" breeding reproducer of Novosibirsk region was determined by conventional methods.

The indices of breeding differential by productivity indices were calculated and the evaluation of stud bulls by the quality of progeny with the definition of the breeding index "B" was carried out. For this purpose, 30 of their sons, 10 from each, were selected for control breeding. Bulls were tested for their own productivity from 8 to 15 months of age by four traits: live weight at 15 months of age, average daily gain at 8 to 15 months of age, lifetime assessment of meat qualities, and expression of the body type[5].

RESULTS AND DISCUSSION

According to the norms of evaluation of the breeding qualities of beef cattle, approved by the Ministry of Agriculture of the Russian Federation, the animals are divided into the following groups:

– the nucleus is the best part of the herd, comprising 50-60% of the total number of cows in the herd;

– breeding group (bull breeding group) included in the nucleus - 18-20% of the total number of cows in the herd;

– production group - cows not included in the breeding nucleus that are in the herd.

For further improvement of the herd, the most valuable is the breeding group, so its consolidation of the main traits is of great importance for its formation.

During the experiment, biometric processing was carried out on three traits: live weight, milk yield and height at hips of cows (see Table 1).

Табл. 1. Основные показатели продуктивности и экстерьера коров герефордской породы по отелам, кг/см

Table. 1. The main indicators of productivity and exterior of Hereford cows by calving, kg/cm

Calving	*n*	Indicator					
		Live weight		Milking capacity		Height at hips	
		M ± *m*	*Cv*	*M* ± *m*	*Cv*	*M* ± *m*	*Cv*
1-st	21	477,8 ± 7,2	6,9	185,6 ± 2,4	6,0	123,7 ± 0,5	2,1
2-nd	24	522,7 ± 6,5	6,1	186,9 ± 3,3	8,6	122,8 ± 0,4	1,8
3-rd	22	553,6 ± 3,1	2,6	202,1 ± 2,0	4,8	123,5 ± 0,4	1,3
4-th	18	544,4 ± 2,6	2,0	214,9 ± 2,5	4,8	124,3 ± 0,4	1,5
5-th	19	551,3 ± 3,4	2,7	216,9 ± 2,8	5,6	124,0 ± 0,4	1,3
6-th	22	553,5 ± 2,3	1,9	226,6 ± 0,9	1,9	124,9 ± 0,3	1,4
7-th	17	551,8 ± 2,8	2,1	226,5 ± 1,9	3,5	124,6 ± 0,5	1,6
8-th	19	553,6 ± 5,3	4,2	211,4 ± 4,1	8,4	122,3 ± 0,5	1,6
9-th	16	569,3 ± 7,8	5,5	217,9 ± 3,7	6,8	121,7 ± 0,7	2,3
10-th	14	570,2 ± 14,9	9,8	215,5 ± 4,2	7,3	121,9 ± 0,9	2,7

[4]Kuzmina T.N. Results of research to improve the genetic potential of the Hereford cattle breed of domestic selection // Scientific and information support of innovative development of the agro-industrial complex: materials of the XI International Scientific and Practical Internet Conference. 2019. Pp. 25-29.

[5]Amerkhanov Kh.A., Dunin I.M., Sharkaev A.A. Norms of evaluation of the breeding qualities of beef cattle // Ministry of Agriculture of the Russian Federation. M., 2010. Pp. 5-10.

Cows from the 3rd to 7th calving had the lowest coefficient of variability for live weight - from 1.9 to 2.7%, for milk yield - from 1.9 to 5.6%. The variation in the height at hips (characterizing the expression of the type) was from 1.3 to 1.6%. In this connection, 82 cows of these lactations were selected in the breeding group as the most homogeneous, which would increase the efficiency of the breeding work. It included representatives of both Siberian reproduction and those improved by Canadian producers. The average live weight of the cows was 570.5 kg with an excess of 50.5 kg, or 9.7%, over the breed standard and corresponded to the elite-record class (see Table 2).

The highest indicator was 670 kg. In terms of milk yield, height at hips, and live weight, the bulls at 12 and 15 months of age were rated elite class.

Cows are characterized by a pronounced breed type, harmonious build and correspond to the desirable exterior-constitutional type (see Fig. 1).

Admixture of new blood of Hereford bulls

Табл. 2. Показатели продуктивности и высоты в крестце селекционной группы коров племенного репродуктора «Вознесенское»

Table. 2. Indicators of productivity and height in the sacrum of the breeding group of cows of the «Voznesenskoye» pedigree breeding unit

Indicator	Value			Breed class
	M ± *m*	Б	*Cv*	
Live weight of cows, kg	570,5 ± 3,11	28,2	4,9	Elite-record
Milkiness of cows by live weight of calves at 205 days	210,3 ± 0,93	8,4	3,9	Elite
Height at hips of cows, cm	130,1 ± 0,34	3,1	2,4	»
Live weight of steers at 12 months, kg	338,2 ± 1,06	9,6	2,8	»
Live weight of steers at 15 months, kg	414,4 ± 1,2	11,2	2,7	»

Рис. 1. Лучшие представительницы селекционной группы

Fig. 1. The best representatives of the breeding group

of Canadian reproduction had a statistically significant effect (p > 0.95-0.99) - from 23.5 to 60.5%, except for the live weight of steers at 12 months of age (see Table 3). We believe that this was a consequence of stress in steers after weaning from their mothers. The breeding differential in the live weight of cows of the whole herd and breeding group was 11 kg (see Table 4).

Taking into account the heritability estimate and the genetic progress through selection effect on the first generation, it will take 3.5 generations (10.5 years) to achieve the indicators of the desirable type on the basis of cows of the breeding group, respectively, for milk yield - 3.9 generations and 4.5 years. More effective breeding achievement can be achieved in the height at hips (1.1 generations and 3.3 years).

Ten high-yield stud bulls were selected for custom mating with cows (see Table 5).

The animals are homogeneous, rated elite-record class and exceed the breed standard at 3

Табл. 3. Влияние быков-производителей канадской селекции на продуктивность и промер животных

Table. 3. The influence of Canadian breeding stud bulls on the productivity and size of animals

Indicator	Breeding		Difference	Effect size (h_x^2), %	*p*
	Siberian	Canadian			
Live weight of cows, kg	530,6 ± 8,21	564,1 ± 5,49	+33,5	38,3	> 0,99
Milkiness of cows by live weight of calves at 205 days, kg	205,2 ± 2,21	217,6 ± 0,79	+12,4	60,5	> 0,99
Height at hips of cows, cm	128,4 ± 0,21	130,3 ± 0,33	+1,9	23,5	> 0,95
Live weight of steers at 12 months, kg	338,3±1,88	341,5 ± 1,89	+3,2	2,7	< 0,90
Live weight of steers at 15 months, kg	415,5 ± 2,47	424,9 ± 1,94	+9,4	30,8	> 0,99

Табл. 4. Прогноз эффективности селекции по лучшим генотипам коров

Table. 4. Prediction of breeding efficiency by the best genotype of cows

Indicator	Economic trait		
	live weight, kg	milking capacity, kg	height at hips, cm
By herd	559	204	130
Of desirable type	570	210	131
Selection differential	11	6	1
Heritability estimate	0,28	0,66	0,89
The effect of selection on the first generation	3,1	3,9	0,9
The need for generational change	3,5	1,5	1,1
Time to achieve the indicator, years	10,5	4,5	3,3

Табл. 5. Живая масса быков-производителей, кг

Table. 5. Live weight of stud bulls, kg

Age	Indicator			± to the breed standard, kg/%
	M ± *m*	Б	*Cv*	
3 years	821,5 ± 1,19	2,4	0,29	151,5/22,6
5 years and older	935,3 ± 5,33	13,1	1,39	115,3/14,1

years by 151.5 kg (8.1%), at 5 years and older by 115.3 kg (14.1%). They are characterized by a well-defined desirable type of build (see Fig. 2).

The growth energy of young cattle in beef cattle breeding has remained at the same level for many years. The reason for the slow improvement of beef cattle lies not in the conservatism of heredity, but in the method of its improvement. For a long time, selection of beef cattle was carried out on a set of traits. This method has failed to justify itself not only in our country but also abroad, because the judgment of breeding merits of bulls only by their origin, phenotypic features is insufficient and does not give reliable results. Assessment of bulls by their own productivity and of adult stud bulls by quality of progeny is required.

In 2020, three stud bulls (Ideal 4127, Diego 4235 and Bars 53510) were evaluated for progeny quality at OJSC “Voznesenskoe” (see Table 6).

According to the test results, stud bulls Ideal 4127 and Diego 4235, obtained from the cross of Canadian and Siberian selection, were evaluated as elite class. With the complex index "B" for the quality of progeny 104-105 they are recognized as improveers.

Bulls with a complex index of own productivity "A" 112.0-113.0 are recommended for

Рис. 2. Бык-производитель Аракс 40295
(6 лет – 932-137-86, элита-рекорд)
Fig. 2. Stud bull Araks 40295
(6 years old-932-137-86, elite-record)

Табл. 6. Результаты оценки быков-производителей по качеству потомства
Table. 6. The results of the evaluation of stud bulls by the quality of the offspring

Stud bull	Live weight at the age of 15 months, kg	Average daily weight gain from 8 to 15 months, g	Lifetime meat quality score, point	Body type expression, point	Breed class	Composite index by quality of progeny (B)
Ideal 4127	429,0	1001,9	51,6	4	Elite	104
Diego 4235	427,9	986,7	54,3	4	»	105
Bars 53510	408,9	924,8	54,5	3,8	1	101

the replacement of stud bulls. Their average daily gain of live weight was 1038.1-1104.8 g.

CONCLUSION

Over the long term, breeding work with the most common animals of the Hereford breed in Siberia should be carried out by creating new breeding groups in herds. They should be homogeneous and consolidated, which is expressed in the coefficient of variability for the main traits. The lowest coefficient of variability has been established in cows from the 3rd to the 7th calving - from 1.3 to 5.6%. The breeding group of cows in the pedigree reproducer "Voznesenskoe" in the number of 82 heads was selected and evaluated on the basis of these indicators. On average the live weight of the cows was 570.5 kg with an excess of 50.5 kg or 9.7% of the breed standard and corresponded to the elite-record class. The blood of the Hereford bulls of the Canadian reproduction had a significant statistically reliable effect ($p > 0.95$-0.99) - from 23.5 to 60.5.

The breeding differential by live weight of cows of the whole herd and the breeding group was 11 kg. Taking into account the heritability estimate and the selection effect for the first generation, it would take 3.5 generations or 10.5 years to achieve the indicators of the desirable type based on the cows of the breeding group, for milk yield - 3.9 generations and 4.5 years. A more effective breeding achievement can be achieved in the height at hips (1.1 generation and 3.3 years).

Ten highly productive stud bulls, including those obtained from crossbreeding with Canadian Herefords, were selected for custom mating with them. The animals are homogeneous, estimated as elite-record class and exceed the breed standard at the age of 3 years by 151.5 kg (8.1%), at 5 years and older by 115.3 kg (14.1%), are characterized by a well-defined desirable type of build.

According to test results, stud bulls Ideal 4127 and Diego 4235, obtained from the cross of Canadian and Siberian selection, were evaluated as elite class. With the complex index "B" on the quality of progeny 104-105 they are considered to be improveers.

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