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The Efficiency of Dairy Herds Created Based on First-Calf Heifers of "Karatomar" Black-And-White Interbreed Cattle on Northern Kazakhstan.

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ABSTRACT

Currently the agriculture of the Republic of Kazakhstan faces the challenge to meet the needs of population in food products at the reasonable balance between costs and results. Specialized dairy cattle being a part of the contemporary industrial technology, plays a leading role in scientific-technical progress in dairy cattle breeding. A decisive factor in increasing the efficiency of this industry is improvement of existing domestic breeds, as well as the creation on their basis of new highly productive breeds, lines and types on the basis of crossbreeding with bulls of Holstein breed. In anticipation of joining the world Trade Organization, market conditions and fierce competition require obtaining the best products at rational production that is possible in dairy farming only using high productive animals. And therefore we can confidently assert that new types of animals will be highly sought in farms of all forms of ownership.

Keywords: black-and-white breed, inbreeding type, first-calf heifers, efficiency, milk productivity, exterior.

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INTRODUCTION

Domestic zootechnical science constantly uses global gene pool to improve the local dairy and combined breeds. In the 30's of the last century European black-and-white cattle (especially the Dutch cattle) was used intensively to obtain milk-type animals with a larger body [1]. Since 1985 and to date, the Holstein breed, which allows not only significantly increasing milk production but also improving the fitness of animals to industrial milk production technology, is widely used in agriculture that should be considered the most important at the present stage of dairy farming development [2].

In Kazakhstan, dairy cattle breeding is one of the leading livestock industry. Its successful development is determined by many factors, of which the most important are the value of reared breeds, animals' welfare, their health, quality of products, etc.

The main task of the pastoralists of Kazakhstan is increasing the productivity of dairy cows and obtaining a large number of healthy calves per every 100 dams. To do this, along with breeding and preparing cows for calving, the work is focused on rearing herd replacements of dairy cattle. Various breeds differ from each other in terms of productivity and adaptation ability to various climatic conditions. Technical progress in dairy cattle breeding is based on a combination of technical performance and biological characteristics of animals. This brings to the fore the suitability of cows for machine milking.

At the initial stage, the main method to improve the herd consists in selection of animals with regard to the phenotype, i.e. by actually manifested productivity and related exterior and body tympanum characteristics. The method is based on the insights of an outstanding breeder M.F. Ivanov, who noted that "the best genotypes are among the best genotypes".

A positive trend in the development of dairy cattle breeding was noted since 1999. Data of the Statistics Agency of the Republic of Kazakhstan indicate that the number of cattle in the country for 9 years have grown by 2124 thousand heads, i.e. by 54% (6060 thousand heads at the end of 2008 against 3936 thousand heads in 1999). Total milk production during the same period increased from 3498 to 5300 thousand tons, or by 51.5%. The average annual milk yield of cows increased from 1913 kg in 1999 to 3300 kg in 2015, or by 72.5% (+1387 kg) [3, 4].

These indicators in dairy cattle were achieved through research-based selection targeted on the breeding of four new intensive types of cattle – black-and-white type – in black-and-white Aulieatin cattle breed, red type – in red steppe breed, red-and-white type – in Simmental breed, and brown type – in Alatau breed, using the best world gene pool of dairy breeds, among which a black-and-white and red-and-white Holstein cows and the American selection Schwyz cows occupy the leading positions.

The improvement of domestic breeds of agricultural animals as well as enhancement of their breeding and productive qualities at the present stage of livestock development contribute not only to the preservation of the gene pool, but are associated also with targeted research on creation of new types and breeds in source populations according to the planned scientific research. Naturally, the creation of new types and breeds of farm animals is a long selection process, and the actual achievement of set goals is possible only at the precise definition of breeding objectives, as well as anticipation of exterior peculiarities of generated types and breeds, which would differ from the original specimens by a significant increase in the productivity with simultaneous manifestation of adaptive qualities to harsh environmental and poor forage conditions at their breeding, as well as by ability to preserve the amazing specific features of reproductive functions, typical for domestic breeds of farm animals [5, 6, 7].

The whole history of improving existing and creating new domestic breeds and types of farm animals suggests that along with a pure-breeding, this process is associated also with interbreeding using selected highly productive "affined" spices of the best world gene pool. Selection of these methods depends on the breeding goals and objectives and to a large extent - on the depth of knowledge and intuition of the breeders.

Black-and-white cattle previously bred in the North of Kazakhstan, although having a good adaptability to a wide range of environmental conditions of the region, was not notable for high milk yield. Besides, the animals had a narrow body, low udder index and milk excretion intensity during machine milking,

equal to 1.2-1.4 kg/min. The udder of dairy herd cows had a number of disadvantages: the bottom was characterized by a two-step configuration and the udder parts were often different even in terms of their volume, the location of the nipples was asymmetrical, and their length, thickness, and configuration varied within the wide range.

Productivity of cows in the herds remained low 2200–2400 kg. Even in breed herds the yield of milk did not exceed 3500 kg with a fat content of 3.71%.

The black-and-white cattle brought to Kostanay region differed by weaken body tympanum, weakness of the limbs and ligaments of the udder.

To create a new dairy type of black-and-white cattle, domestic black-and-white breed was used as a maternal breed in interbreed crossing with the Holstein cattle of black-and-white breed. In 2013, a new interbreed type of black-and-white cattle named "Karatomar" was approved [8, 9 10].

MATERIAL AND RESEARCH METHOD

To determine the efficiency of dairy herds creation by first-calf heifers of "Karatomar" black-and-white interbreed cattle, a science-based economic experiment was carried out on the animals of the first lactation in the Karl Marx Farming Enterprise in Kostanay region of the Republic of Kazakhstan. For carrying out science-based economic experiment, two groups of first-calf heifers were created, each containing 20 heads. The purebred heifers of black-and-white breed were selected into the 1st group (control), while the 2nd group consisted of "Karatomar" black-and-white interbreed cattle (test). All the animals were managed under the same welfare and feeding conditions. Records on milk production were conducted daily in the morning and evening, i.e. every 12 hours. The animals' productivity for 305 days of lactation was assessed based on the results obtained. Mass fraction of fat was measured using the Klever-2M apparatus. The amount of milk fat was determined by multiplying the milk yield for 305 days of lactation on the fat mass fraction and divided by 100. Exterior indicators of the animals were measured on the second month of lactation. These included the animal height at the withers, back, and sacrum, body length, chest depth and width, width of hips, hip joints, and loin, the girths of chest and metacarpus. Economic efficiency of milk production from first-calf heifers in tested and control groups was calculated based on the results of productive performance and the level of fodder consumption per production of 1 kg of milk, defining also the profitability level.

DISCUSSION AND RESEARCH RESULTS

The "Karatomar" black-and-white interbreed cattle was bred in the Karl Marx Farming Enterprise, which has also a small number of purebred black-and-white animals. The effectiveness of animal breeding, both interbreded "Karatomar" type and purebred black-and-white type was studied through comparative characteristics of both groups. Created interbreded type met the requirements of the milk type cows, and was characterized by a strong body tympanum. In terms of body heights measurements, the animals in the experimental group exceeded those in the control group. They were well built, had a long and wide body, and were distinguished by a strong skeletal frame, as shown in Table 1.

Table 1. Exterior indicators of the heifers in experimental group

Measurements, cm	Black-and-white breed	Interbreed type "Karatomar"
Height at the withers	130.4	133.4
Height of the back	132.1	134.2
Height in the sacrum	134.6	136.8
Body length	156.1	160.4
Chest depth	67.5	70.8
Chest width	37.8	40.0
Hips width	48.4	51.9
The width of the hip joint	44.8	46.7
Loin width	31.0	33.4
Girth of chest	188.4	192.9
Girth of metacarpus	18.0	18.9

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To confirm the evidence of the milk type breed, the assessment of milk productivity over a complete lactation period, was carried out that is shown in Figure 1.

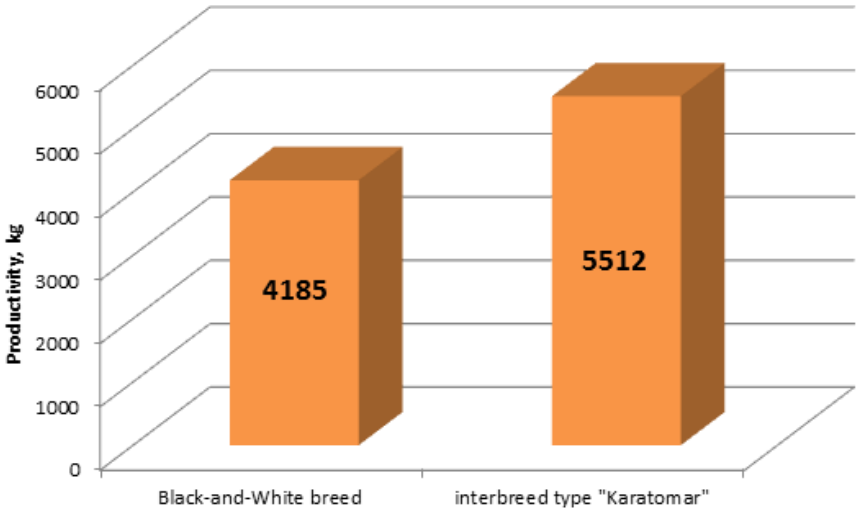

Figure 1. The productivity per lactation.

The average duration of lactation in animals of black-and-white breed was 303 days. During this period they produced 4185 kg of milk. The lactation period in interbreed animals was 6 days longer and reached 309 days; the amount of produced milk was 5512 kg. The difference in milk productivity amounted to 1327 kg in favor of the animals of "Karatomar" interbreed type. According to analysis, fat mass fraction in milk of black-and-white breed amounted to 3.92%, whereas in animals of "Karatomar" interbreed type – 3.87%.

Weighing of animals at 3rd month of lactation showed the superiority of the interbred black-and-white cattle type (491 kg), whose weight was by 29 kg or 6.3% greater than that for animals of black-and-white breed (462 kg). A more objective assessment was given to first-calf heifers after the analysis of their lactations by months that were considered during the control milking. Daily milk yield indicators, especially higher daily milk yields allowed making a first assessment of the specific productivity of the first-calf heifers and characterized their potential capabilities of increasing milk yield. Daily milk yield is closely associated with milk yield during full lactation that allowed using this indicator as a criterion to assess milk productivity (Fig. 2).

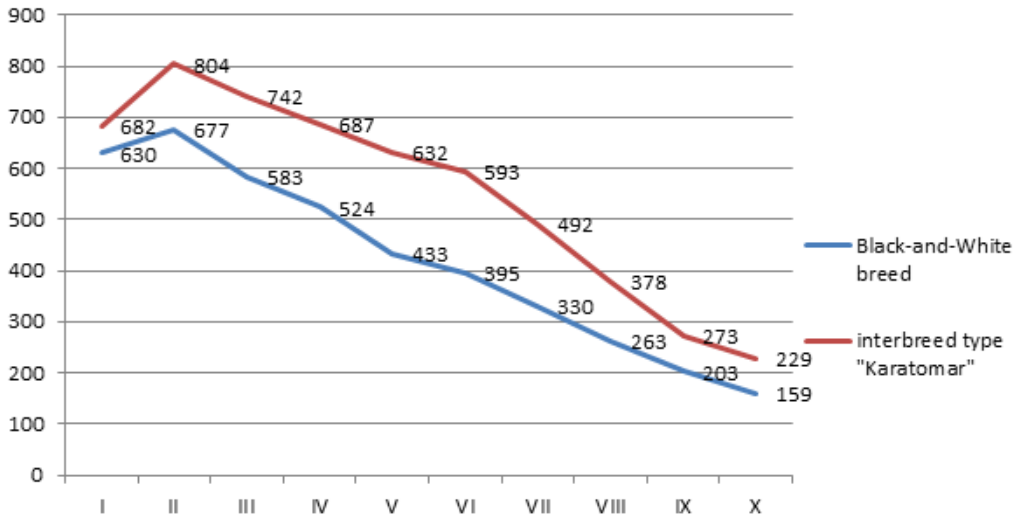

Figure 2. Milk yield of first-calf heifers by month.

Figure 2 characterizes the lactation dynamics of the first-calf heifers by months. Lactation curves correspond to the general pattern, i.e. from the first to the second month of lactation milk yield increased.

The peak of lactation accounted for the 2nd month and further the productivity of the animals gradually decreased. The lactation curve of "Karatomar" black-and-white interbreed cattle is more stable. A smooth decline in milk yield in this group was observed starting from the 6th month of lactation. This indicates the ability of cows to increase the milk yield and maintain a high level of milk yield during lactation that resulted in higher milk productivity of these cows in comparison to control animals.

Thus, the first-calf heifers of "Karatomar" black-and-white interbreed cattle were superior to purebred black-and-white animals in terms of monthly milk yield. The difference in milk yield ranged within 52-199 kg depending on lactation month. As shown by studies, first-calf heifers of purebred black-and-white breed were essentially inferior by all counts to the animals of interbreed type of "Karatomar" black-and-white cattle. Consequently, the economic efficiency of the management of these animals is different. Table 2 shows the main indicators for determining the efficiency of animal breeding.

Table 2. Economic efficiency of milk production.

Parameter	Black-and-white breed	Interbreed type "Karatomar"
Yield per lactation, kg	4185	5512
Milk fat content,%	3.92	3.87
Yield of basic fat milk, kg	4837	6245
Total feed consumption, energy feed unit	57.96	67.37
Feed consumption per 1 kg of milk, energy feed unit	1.18	1.08
The cost of milk sold, tenge	75457	97422
The total cost of milk produced, tenge	62318	75024
The cost of 1 quintal of milk, tenge	1288	1201
Profit per management of one animal, tenge	13139	22398
Yield of milk production,%	21.08	29.8

Studies have shown that the first-calf heifers of interbreed type were significantly superior in terms of the production of basic fat milk as compared to control cows taking into account the offspring of purebred black-and-white animals. In addition, they consumed less amount of feed to produce 1 hundredweight of milk. The total cost of feeding, management and care of first-calf heifers of interbreed type is higher than that for the purebred black-and-white cows, though these costs were paid off due to higher milk productivity. The profit from each interbreed first-calf heifer is by 9259 tenge greater than that for purebred black-and-white breed, while the milk production profitability is higher by 8.72%. Though, purebred black-and-white first-calf heifers also gave a good profit for the farming enterprise, ensuring the profitability of milk production at the level of 21.08%.

According to the results of science-based economic experiment, we came to the conclusion that in Kostanay region it is advisable to create dairy herds based on the "Karatomar" black-and-white interbreed cattle that far exceed the local black-and-white cattle in terms of productivity and the body tympanum.

CONCLUSION

The exterior and body tympanum indicators as well as economic traits were studied, and research was conducted to study the lactation characteristics of the first-calf heifers of purebred black-and-white cows and "Karatomar" black-and-white interbreed cattle at Karl Marx Farming Enterprise. Besides, the calculation of economic efficiency of animals in both groups was assessed. It was revealed that first-calf heifers of "Karatomar" black-and-white interbreed cattle significantly outperform animals of black-and-white breed in terms of all economic traits and gave a greater profitability from milk production.

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