The level of productive qualities of cows of black-motley breed contained in standard conditions of Russian farms

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Abstract. Researchers pay much attention to productivity aspects of cows of various breeds and are looking for approaches to its growth. The milk productivity of lactating cows of black-motley breed is a very important economic indicator, which they are constantly trying to increase by selecting young animals for the breeding process and economic use. When evaluating the economically useful qualities of black-motley cows contained in standard conditions of Russian households, they have excellent reproductive qualities. They turned out to be characterized by high levels of milk yield, mass fraction of fat in milk and the amount of milk fat received. The examined cows showed correlation between the volume of milk yield for the first, second, third and highest lactation with the level of milk yield in the second, third and highest lactation, as well as with the mass fraction of fat and live weight of the animal. Considering the obtained data, it can be considered that selection of cows of black-motley breed should be carried out taking into account the volume of milk yield during the first lactation, which positively correlates with the size of milk yield for subsequent lactation, with the level of live weight and with the level of butterfat for the period of the second and third lactation.

1. Introduction

Modern animal husbandry is an intensively developing branch of agriculture that provides a large number of the world’s inhabitants with dairy products and beef [1]. For this reason, modern researchers pay especially much attention to the productivity aspects of cows of various breeds and consider in detail approaches to the possibility of its growth [2]. In this regard, in recent years, a lot of scientific work has been carried out on cattle, which is devoted to hematological parameters [3,4], which are very significant for anabolism in muscle tissue [5,6] and for the active functioning of the mammary gland [7]. It becomes clear that a detailed study of the manifestations of cow productivity and elucidation of environmental conditions conducive to its growth can lead to the creation of approaches of low cost systematic increase in the productivity of dairy herds of cows, that is, to ensure intensification of livestock production with insignificant material investments [8].

Black-motley breed is now very common in many countries of the world. In Russia, this breed is known for a long time and represented by a large population in many climatic regions in view of its high efficiency and relative simplicity [9]. The number of cattle black-motley breed in Russia and in the world at present is gradually increasing. At the moment of black-motley breed bred in the Russian
Federation in economies of all forms of ownership and many of them have the status of breeding farms [10]. Such a prevalence of this breed is largely due to its high productivity [11], second only to the Holstein breed, which are more demanding in terms of content and more expensive. However, black-and-white breed has a high level of butterfat and alcoholocaust, has a fast maturation and highly adapted to the process of machine milking [12]. Milk yield of lactating cows of black-motley breed is a very important economic indicator, which is continuously trying to improve through the selection of young animals for breeding and commercial use. Given that milk yield and reproductive ability are strongly associated with conditions of detention seemed important to assess their severity at standard conditions of Russian households. In this regard seemed important to put in the work to assess the level of milk productivity and reproductive qualities of cows of black-motley breed contained in the standard conditions of farms of Central Russia.

2. Materials and Methods
The research was conducted in standard livestock farms in the central zone of Russia. To conduct the study, 117 purebred cows from this breed were selected from a number of cows of black-motley breed by random sampling, which were tracked during the first, second and third lactation.

In the study, milk productivity was assessed by the level of milk yield in the first, second, third and highest lactation. The following indicators of milk productivity were recorded: milk yield per 305 days of lactation (kg), mass fraction of fat (%), amount of milk fat (kg), milk ratio.

To determine the state of reproductive parameters in the cows taken into the study, the age of the first calving (in days), the value of live weight at the time of calving (in kg), the duration of the service period (in days), and the length of the dry period (in days) were taken into account.

The resulting digital material was processed using Microsoft Office Excel using the standard statistical software package.

3. Results
It was found that in terms of milk yield, fat volume, live weight of animals, the observed group of cows showed some excess of the known standard of black-motley breed. This circumstance should be associated with their excellent conditions of detention. In addition, the observed cows regularly rang out, which led to their gradual increase in the volume of milk production from the first lactation to the highest lactation. It is very important that the level of mass fraction of fat in the observed cows was only slightly lower than the standard for lactation for black-motley breed.

It is known that the value of milk yield in first-calf heifers is approximately equal to 85% of the productivity of full-aged cows [11]. In this case, the highest volume of milk yield is usually achieved during the third, fourth and fifth lactation. In this work, an increase in milk production of the observed cows from the first lactation to the second lactation by 12.5% (P≥0.999), from the second lactation to the third lactation by 12.2% (P≥0.95), from the first lactation to the third was noted 26.2% of lactation (P≥0.999).

By the level of milk fat in the examined cows, only a weak tendency to its decrease from the first to the third lactation was found, which amounted to only 1.9%. The maximum fat content of milk occurred during the first lactation, amounting to 4.15 ± 0.03%.

As a result of the increase in the volume of milk being fed, the observed cows also increased the amount of milk fat received in the third lactation compared to the first lactation by 17.6% (P≥0.999). The live weight of a cow is one of the very important economically useful traits that are of great importance in the process of breeding cattle in view of the fact that as it increases, there is a clear increase in the volume of milk production. With increasing age and with the transition from the first to the third lactation, the live weight of the observed cows increased by 13.7%.

According to existing standards, the milk yield of a cow should be approximately 8–10 times greater than its live weight [13]. Judging by the milk yield coefficient, cows of black-motley breed should be considered abundant in milk productivity. During the observation, animals reached 1012.4±16.9% in the first lactation, 1045.1±16.2% in the second, and 1036.1±19.2% in the third.
In cattle breeding, the correlation of traits in cows kept on farms is of great importance [14]. This helps to choose their main characteristics, taking into account which subsequently selection will be actively conducted [15]. As a rule, in practice, cows are selected for several reasons. Of the accepted methods of selection, taking into account a set of features, selection according to a single evaluating parameter, in which the share of each individual feature taken into account, is strictly proportional to the level of its significance, is considered very effective [16]. However, this method is ideal only from a theoretical point of view, but in practice it is considered not very perfect. This is caused by the fact that, basically, such a trait with all other breeding important traits correlates very ambiguously. It is clear that the practice of conducting selection is successful in the case when it will be conducted on those grounds that are able to influence positively on each other. The more pronounced the positive correlation of the considered attributes, the more successful the selection will be on them.

In the course of the study, an assessment was made of the relationship between the breeding of especially important traits: milk for the first lactation, milk for the second lactation, milk for the third lactation and milk for the highest lactation, mass fraction of fat and live weight of the cow.

Table 1 contains the values of the relationship between the considered characteristics in the cows of the black-motley breed taken in the study.

Between the milk yield for the first and second lactation, during the second and third lactation, an average positive correlation was found, which was indicated by the values of the correlation coefficients reaching +0.392 (P≥0.999) and + 0.486 (P≥0.999), respectively. For this reason, an increase in the level of milk production with an increase in the number of lactation should be considered very significant.

The cows examined showed a negative relationship between the amount of milk yield and the amount of fat in the milk obtained. As age increased, it did not change much (–0.259 during the first lactation (P≥0.99) and –0.249 during the third lactation (P≥0.99)). In the second lactation, no relationship was found in cows. In the highest lactation, she also showed herself to be slightly negative. This suggests that black-motley cows have an increase in milk yield while lowering the level of milk fat received. The data obtained allow us to consider the breeding and breeding work carried out on the farm as very well organized and suggest that the observed cows have high productivity growth in butterfat dairy production.

It becomes clear that there is a weak but positive correlation between the value of live weight and the milk yield of cows of black-motley breed (during the period of the first and highest lactation). For the second lactation, the presence of such a correlation was not noted. Apparently, for large volumes of milk yield, cows of black-motley breed should not in all cases have a greater live weight.

A serious factor in increasing reproduction rates in dairy cattle breeding is the timely and competent preparation of heifers for insemination [9,17]. Black-motley breed has signs of precocity. You can seed heifers of this breed at the age of 17–19 months when they reach a level of live weight of 360–380 kg. The first calving in cows of black-motley breed is possible at the age of 26–30 months. The live weight

| Sign | Milk during the second lactation | Milk during the third lactation | Milk during the highest lactation | Mass fraction of fat, % | Live weight of a cow, kg |
|------|---------------------------------|---------------------------------|---------------------------------|-------------------------|------------------------|
| Milk during the first lactation | + 0.392<sup>c</sup> | + 0.250<sup>b</sup> | + 0.165 | − 0.259<sup>b</sup> | + 0.035 |
| Milk during the second lactation | - | + 0.486<sup>c</sup> | + 0.342<sup>c</sup> | − 0.097 | − 0.008 |
| Milk during the third lactation | - | - | + 0.461<sup>c</sup> | − 0.249<sup>b</sup> | − 0.162 |
| Milk during the highest lactation | - | - | - | − 0.190<sup>a</sup> | + 0.179<sup>a</sup> |

<sup>a</sup> P≥0.95,  <sup>b</sup> P≥0.99,  <sup>c</sup> ≥ P>0.999.
of cows by the time of the first calving is often about 430 kg, by the time of the second calving is about 450 kg, and in full-age cows, the body weight is about 500 kg [14, 18].

The mean age of the examined black-motley cows at the time of the first calving was 842.2 ± 1.8 days. At the same time, their live weight at the first hotel reached 428.7 ± 2.6 kg, which slightly exceeded the standard adopted for the black-and-white breed. This indicates the optimal organization in the farms of the process of growing repair heifers (table 2). In the second and third lactations, the considered indicators for the live weight of the cows examined were higher, which should be considered quite natural.

| Observed observation periods | The value of live weight at the hotel, kg | The duration of the dry period, days | Duration of the service period, days |
|-----------------------------|------------------------------------------|--------------------------------------|--------------------------------------|
|                             | X±Sx | Cv, % | X±Sx | Cv, % | X±Sx | Cv, % |
| I lactation                 | 428.7±2.6 | 7.2 | -     | -     | 86.9±4.2 | 58.0 |
| II lactation                | 456.5±2.3 | 5.3 | 63.2±0.8 | 16.6 | 97.5±5.0 | 59.2 |
| III lactation               | 486.3±2.1 | 4.5 | 63.8±0.7 | 13.5 | 99.0±5.7 | 66.7 |
| Highest lactation           | 498.2±2.7 | 6.4 | 62.7±0.8 | 15.5 | 132.4±7.5 | 62.3 |

It is recognized that the duration of service period significantly affects the level of productivity of cows in the future. It is clear that the optimum duration of service period is 60-90 days (it may increase to 120 days). The cows have observed the value of service period was slightly above normal. Average dry period of black-motley breed of cows in the study was 63 days, which corresponds to the generally accepted technology norm.

The highest service period was observed in cows during the lactation and the volume amounted to 132.4±7.5 days. This is probably associated with a high level of milk productivity of the surveyed cows (6210.4±71.2 kg). However, there was very great coefficient of variation (62.3 per cent).

The examined cows of black-motley breed in the level of milk yield, quantity of obtained milk fat, the value of live weight was in excess of known standards of the breed. The work confirmed the pattern of increasing the productivity of dairy cows between first and third lactation. A high level of reproductive performance in the observed cows of black-motley breed speaks of them breeding. Some excess in the examined cows value of service period on the values of the optimum, apparently, due to the high milk productivity of the surveyed animals. It is clear that the cows of black-motley breed selection should be based on the amount of milk yield during the first lactation. It is positively correlated with the magnitude of the milk yield for the subsequent lactation, with levels of live weight and level of butterfat during the second and third lactation.

4. Conclusion
Black-motley breed is currently very widespread in many countries of the world. In Russia, this breed is represented by a large constantly increasing livestock in many climatic zones. The cows of the black-motley breed examined in terms of milk yield, the amount of milk fat received, and the amount of live weight slightly exceeded the known standards of this breed. The study confirmed a gradual increase in the milk production of cows between the first and third lactation. The excess in the observed cows of the value of the service period over standard indicators is apparently due to the high milk productivity of the examined animals. We can assume that cows of black-motley breed should be selected taking into account the volume of milk yield during the first lactation, which positively correlates with the size of milk yield for subsequent lactation, with the level of live weight and with the level of milk fat for the period of the second and third lactation.
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References
[1] Glagoleva T I and Zavalishina S Yu 2017 Physiological Peculiarities of Vessels’ Disaggregating Control over New-Born Calves’ Erythrocytes ARRB 19(1) 1-9 DOI: 10.9734/ARRB/2017/37232
[2] Vorobyeva N V and Medvedev I N 2020 Platelet function activity in black-motley calves during the dairy phase BIO Web Conf. International Scientific-Practical Conference “Agriculture and Food Security: Technology, Innovation, Markets, Human Resources” (FIES 2019) 17 00167 Published online: 28 February 2020 DOI: https://doi.org/10.1051/bioconf/20201700167
[3] Zavalishina S Yu 2018 Functional Activity Of Vascular Hemostasis In Newborn Calves With Iron Deficiency RJPBCS 9(6) 1490-6
[4] Zavalishina S Y 2017 Restoration of Physiological Activity of Platelets in New-Born Calves With Iron Deficiency Biomed Pharmacol J 10(2) 711-6 DOI: http://dx.doi.org/10.13005/bpj/1160
[5] Vorobyeva N V and Medvedev I N 2019 Functional activity of platelets in new-born calves of black-marked breed Bulgarian Journal of Agricultural Science 25(3) 570-4
[6] Oshurkova Ju L and Medvedev I N 2018 Physiological Indicators Of Platelets In Newborns Calves During The Dairy Feeding Phase RJPBCS 9(6) 171-6
[7] Zavalishina S Yu 2018 Functional Activity Of Primary Hemostasis In Calves During The First Year Of Life RJPBCS 9(6) 1575-81
[8] Vorobyeva N V and Medvedev I N 2020 Functional platelet activity in Dutch newborn calves IOP Conference Series: Earth and Environmental Science 421 022042 doi:10.1088/1755-1315/421/2/022042
[9] Degtyarev V P, Masalov V N and Mikheeva E A 2009 The dependence of the reproductive abilities of heifers and cows on the timing of insemination Bulletin of the Oryol State Agrarian University 2 14-5
[10] Zavalishina S Yu 2018 Physiological Features Of Primary Hemostasis In Newborns Calves With Functional Digestive Disorders RJPBCS 9(6) 1514-20
[11] Shevkuzhev A F, Ulimbashesv M B and Serkova Z Kh 2016 Meat and dairy qualities of black-and-white cattle with different ways of keeping News of St. Petersburg State Agrarian University 44 63-7
[12] Kostomakhin N M 2011 Breeds of cattle (Moscow: KoloS) p 199
[13] Oshurkova Ju L and Medvedev I N 2018 Functional Features Of Platelets In Newborns Calves Ayrshire Breed RJPBCS 9(6) 313-8
[14] Gorkovenko L G, Leshchuk A G and Shcherbatov V I 2016 Reproductive ability of cows of black and motley breed of various origin Proceedings of the Kuban State Agrarian University 58 189-93
[15] Zavalishina S Yu 2018 Functional Features Of Hemostasis In Calves Of Dairy And Vegetable Nutrition RJPBCS 9(6) 1544-50
[16] Glagoleva T I and Medvedev I N 2020 Physiological features of aggregation of the main formed elements of blood in calves at the beginning of early ontogenesis BIO Web Conf. International Scientific-Practical Conference “Agriculture and Food Security: Technology, Innovation, Markets, Human Resources” (FIES 2019) 17 00161 Published online: 28 February 2020 DOI: https://doi.org/10.1051/bioconf/20201700161
[17] Vorobyeva N V and Medvedev I N 2020 Functional Platelet Activity in Dutch Newborn Calves Bioscience Biotechnology Research Communications 13(1) 201-5
DOI: http://dx.doi.org/10.21786/bbrc/13.1/35

[18] Medvedev I N 2017 The Impact of Durable and Regular Training in Hand-to-hand Fighting Section on Aggregative Platelet Activity of Persons at the First Mature Age *ARRB* 15(2) 1-6
DOI: 10.9734/ARRB/2017/35048