Productive qualities of holsteinized black-and-white cattle

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Abstract. In Sverdlovsk region Holsteinized black-and-white cattle of Ural type are bred. This livestock is represented by highly productive animals with a high genetic potential for productivity. The aim of the research is to study the productive qualities of the Holsteinized black-and-white cattle with a high proportion of blood relationship to Holstein breed. Milk yield increases with age of cows. The difference between the first and second lactation amounts to 1.084 kg or 11.4%, and between the second and third lactation it is 326 kg (3.0%). In general, the milk yield of mature (full-aged) cows was higher by 1.410 kg or 14.9% than the milk yield of first-calves. It is known that mature full-aged cows have a productivity 30% higher than the first-calves. I.e. the genetic potential of the farm broodstock of full-aged cows is within 12.595 kg, and this potential is not fully used. The farm uses cows that are quite different in terms of milk yield. The fluctuations in milk yield from lactation to lactation are 7.060 kg (1st lactation), 10.210 kg (2nd lactation) and 6.785 kg (3rd lactation). In terms of the milk quality indicators – MFF (mass fraction of fat) and MFP (mass fraction of protein) no significant differences in lactation were established, although a certain positive tendency was observed for increase of MFF with age gaining in reference to the first-calves.

1. Introduction
In the Doctrine of the country’s food security, adopted in 2016, special attention is paid to the development of animal breeding, because the food industry is responsible for sustainable supply of high-quality food to the population [1-7].

Milk and dairy products are valuable kinds of food that can be consumed by people of any age, any health status and any income. That ensures the health of the nation and food security of any country [8-13].

In this regard special attention is paid to development of dairy cattle breeding, since the main share (more than 97% of the total production of milk) is obtained from cattle, while milk is a valuable food product and raw material for the dairy industry. For raw milk strict quality requirements are presented; therefore, along with increasing the productivity of cattle, the other tasks are set, in particular – to improve milk quality indicators [14-18].

For milk production dairy cattle of both domestic and foreign selection is used. The main livestock is represented by domestic black-and-white breed. For its improvement in recent few decades the genetics of the world’s best dairy breed, the Holstein breed, has been widely used, and is still being
used. Long-term use of breeding Holstein bulls of foreign selection has led to creation of a wide amount of Holsteinized cattle in various climatic and ecological & forage zones of the country. The herd also differs in economically useful traits and biological features, caused by the breed resources of cattle in the breeding zone and the country of origin of the bulls involved in crossing [19-21].

In Sverdlovsk region the breeding stock of the black-and-white breed of the Ural offspring was inseminated with the seed of servicing bulls of Canadian, Danish and German breeding. As a result, large bodied, highly productive animals with a high genetic potential for productivity and well adapted to industrial milk production were obtained. In 2002 the Ural type of black-and-white cattle was officially registered with percentage of Holstein blood relationship equal to 75%. In subsequent years the pure-bred Holstein servicing bulls has continued to serve in a livestock, and the proportion of Holstein blood relationship in the brood stock increased to 91% or more in reference to the Holstein breed [22-27].

There is not enough data on the productive qualities of modern animals, therefore the study of their milk productivity is relevant and of practical importance.

The aim of the research is to study the productive qualities of Holsteinized black-and-white cattle with a high proportion of blood relationship to the Holstein breed.

2. Materials and method

The research was run in one of the breeding farms engaged in breeding the Holsteinized black-and-white cattle of the Ural type. The research included cows that completed their lactation as of 01.10.2020. The animals were separated into groups, depending on the date of the last completed lactation – first, second and third lactation. Data and records of zootechnical and breeding information from Selex database were used for analysis. Milk yield was taken into account by control milking once a month, as well as by measuring of milk quality parameters: mass fraction of fat (MFF) and mass fraction of protein (MFP) in milk.

These parameters were checked monthly per every cow in a dairy laboratory of OJSC “Uralplemcenter” of Sverdlovsk region. The coefficient of milk yield capacity was calculated.

3. Results and discussion

The farm is engaged in breeding of highly productive Holsteinized black-and-white cattle of the Ural type with a high proportion of blood relationship to the Holstein breed (more than 91%). In 2019, 9.677 kg of milk was obtained from 1.400 cows; MFF and MFP in milk are 3.96 and 3.23%, respectively. The live weight of full-aged cow is 634 kg.

Figure 1 below shows milk yield for 305 days of lactation of cows, by lactations.

![Figure 1. Milk yield for 305 days of lactation, kg.](image-url)
The figure above clearly shows that milk yield increases with the age of the cows. The difference between the first and second lactation is 1.084 kg or 11.4%, and between the second and third lactation is 326 kg (3.0%). In general the milk yield of full-aged cows was higher than that of first-calves by 1.410 kg or 14.9%. It is known that full-aged cows feature milk productivity 30% higher than milk productivity of the first-calves. It means that the genetic potential of the broodstock on the farm in full-age cows is within 12.595 kg, and it is not fully used. However the study of fluctuations in milk productivity of cows from lactation to lactation showed that the herd contains animals with various levels of milk productivity. So, as it is unequal, there is a potential of selection in reference of milk yield per lactation (figure 2).

![Figure 2. Fluctuations in milk yield of cows by lactation, kg.](image)

As a result of research, it was established that fluctuations in milk yield per lactation account for 7.060 kg (1st lactation), 10.210 kg (2nd lactation) and 6.785 kg (3rd lactation). This fact proves that the farm uses cows that are quite different in milk yield. This fact provides potential for further selection within targeted breeding in order to improve subsequently the Ural type of Holsteinized black-and-white cattle. Along with the milk yield, great attention is paid to milk quality indicators, such as MFF and MFP (figure 3).

![Figure 3. MFF and MFP in cow milk, %](image)
In terms of milk quality indicators – MFF and MFP – no significant differences in lactation were recorded, although a certain positive tendency was observed in increase of MFF together with age relative to first-calf cows. Higher rates of MFF and MFP in milk were established for the second lactation. In our case, there is no natural decrease in milk quality indicators along with increase in milk yield per lactation. As well as milk yield in terms of milk quality indicators, there are significant fluctuations in groups of cows (figure 4).

![Figure 4. Fluctuations of MFF and MFP in cow milk, %](image)

Within each group of cows the significant fluctuations in MFF and MFP were observed as well as milk yield. They are most significant in the group of first-calves. MFF in milk amounted to 0.41%, MFP was equal to 0.23%. Less profound fluctuations were recorded during the third lactation –0.21% and 0.08%, respectively. It is explained by the smaller number of cows samplings for the third lactation. It was caused by culling of cows after the first and second lactations.

Our data on high productivity of the Ural type cows of Holsteinized black-and-white cattle are confirmed by researches of many authors: N Bogolyubova, V Korotky, A Zenkin, V Ryzhov, N Buryakov, V Mymrin, O Lorets, O Gorelik, O Lihodeevskaya, N Zezin, M Sevostyanov and O Leshonok.

4. Conclusion
Based on the foregoing it is possible to conclude that the farm uses highly productive Holsteinized black-and-white cattle of the Ural type. The productivity is increased during full-age lactation, and cow milk quality indicators tend to increase along with maturing of a cow.

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