Correlation of performance traits of black-and-white first-calves

A S Gorelik\textsuperscript{1}, O V Gorelik\textsuperscript{2}, A V Miftakhutdinov\textsuperscript{3}, N P Smolyakova\textsuperscript{3} and S G Zernina\textsuperscript{4}

\textsuperscript{1}Ural Institute of the state fire service of the EMERCOM of Russia, Yekaterinburg, 620075, Russia
\textsuperscript{2}Ural State Agrarian University, Yekaterinburg, 620075, Russia
\textsuperscript{3}South-Ural State Agrarian University, Troitsk, 457100, Russia
\textsuperscript{4}Saint-Petersburg State Agrarian University, St. Petersburg, 196601, Russia

E-mail: temae077ex@mail.ru

Abstract. The long-term use of Holstein breeding bulls of foreign selection has led to the creation of a large quantity of Holsteinized cattle in various climatic and ecological forage zones of the country, which also differs in their economically useful traits and biological features inherited from the breed resources of cattle in the breeding zone and the country of origin of the breeding bulls involved in crossing. In Sverdlovsk region the Holsteinized black-and-white cattle of the Ural type are being bred, which are represented by large highly productive animals with a high genetic potential for milk productivity. The aim of the work is to study the correlation of productive qualities parameters among first-calves of black-and-white cattle. There is no difference between the breed lines in their productivity or they are so insignificant that they prove the uniformity of the bred livestock. This uniformity is achieved by strict selection and constant observance of the same type of selection applied for breeding bulls to serve in the herd. An insignificant difference in milk productivity parameters of cows of different Holstein lines is caused to the high level of inbreeding in the herd. The inbred animals account for up to 65 percent or more, depending on the age. A low positive correlation between the live weight of cows and their productive qualities is established, which practically has no dependence on the linear origin of cows.

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 parameters [15-18].

For milk production dairy cattle of both domestic and foreign selection are used. The main livestock is represented by the domestic black-and-white breed. For its improvement in recent few decades the
The herd, and the proportion of IOP Conf. Series: Earth and Environmental Science 848 (2021) 012072 doi:10.1088/1755-1315/848/1/012072
the herd. uniformity is achieved by strict selection and the uniform
so insignificant that they prove uniformity of the bred livestock in their productivity parameters. This
of cows, depending on the linear parameters
9 average milk yield for 305 days of lactation in cows of both lines was almost the
Ural type with a high proportion of blood
The farm is engaged in breeding
3. Results
parameters
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parameters
in the brood stock increased to 91% or more among the Holstein breed [25-27].
Taking into account the correlation of productive qualities in further selection and breeding this
The aim of the research is to study the correlation of productive qualities parameters in first-calves
of black-and-white cattle.
2. Materials and method
The research was run in one of the breeding farms engaged in breeding of Holsteinized black-and-white
cattle of Ural type. The research included cows that completed their lactation period on 01. Oct.2020.
There were 2 groups of first-calves, depending on the linear pertaining. The 1\textsuperscript{st}group consisted of cows
of the Reflection Sovering line, and the 2\textsuperscript{nd}group consisted of cows of the Vis Back Ideal line. For
analysis data from the zootechnical and breeding records of the Selex database were used. Milk
productivity was analyzed. For that milk was sent to lab for analysis once a month. The following milk
quality parameters were measured: mass fraction of fat (MFF) and mass fraction of protein (MFP) in
milk for its maximum during lactation.
Those parameters were checked monthly per each cow in the dairy laboratory of JSC
“Uralpmcenter” of Sverdlovsk region. The coefficients of correlation between the productive
parameters within the groups were calculated.
3. Results and Discussion
The farm is engaged in breeding of highly productive Holsteinized cattle of black-and-white breed of the
Ural type with a high proportion of blood relationship to the Holstein breed (more than 91%). The
average milk yield for 305 days of lactation in cows of both lines was almost the equal; it accounted for
9.471-9.501 kg per cow, and the difference between them was insignificant, as well as the quality
parameters of milk also differed insignificantly: MJ – 3.94 – 3.95%; MDB – 3.23 – 3.23%.
Table 1 below presents data on milk yield and milk quality parameters for 305 days of the 1\textsuperscript{st} lactation
of cows, depending on the linear breed affiliation.

| index        | Line                  |
|--------------|-----------------------|
|              | Reflection Soveringa  |
| Milk yield, kg | 9471±49.27           |
| MJ, %        | 3.94±0.003            |
| MDB, %       | 3.23±0.002            |
|              | Vis Back Ideal       |
| Milk yield, kg | 9501±67.12           |
| MJ, %        | 3.95±0.004            |
| MDB, %       | 3.23±0.002            |

The table above clearly shows that there is no difference between the lines or these differences are
so insignificant that they prove uniformity of the bred livestock in their productivity parameters. This
uniformity is achieved by strict selection and the uniform type of selection of breeding bulls to serve in
the herd.
The slight difference in parameters of milk productivity among the cows of different Holstein lines is explained by the high level of inbreeding in the herd. Inbred animals account for up to 65 percent or more, depending on the age. In our case the number of such animals among the first-calves amounted to 65.8%. In addition, in recent years, despite taking into account the linear pertaining of animals, breeding is most often aimed to the parameters of servicing bull and selection of animals for their mating is run irrelevant to the line of brood stock. In this regard it is possible to record the fact of crossing between breed lines.

Great importance in breeding work is conferred to study of correlation between productive parameters (table 2).

**Table 2. Correlation of productive parameter sin first-calves.**

| index                | On average | Line Reflection Soveringa | Vis Back Idiala |
|----------------------|------------|----------------------------|------------------|
| Milk yield-MJ        | -0.02      | 0.002                      | -0.03            |
| Milk yield-MDB       | 0.11       | 0.09                       | 0.12             |
| MJ-MDB               | 0.66       | 0.64                       | 0.69             |

It was established that in a herd there was no correlation between milk yield and MFF in milk, but a positive low and positive high correlation was recorded between milk yield and MFP in milk and between the parameters of milk quality. Thus, the selection of cows per their productivity – in particular – milk yield per lactation, will lead to slight increase in protein fraction in milk. That will be accompanied by improvement of milk quality parameters as a whole.

Most often an increase of animals breeding value and their productive qualities leads to improvement in their phenotypic traits, such as body weight parameter. The low positive correlation between body weight and productivity parameters (table 3).

**Table 3. Correlation coefficients between live weight and productivity parameters.**

| index                         | On average | Line Reflection Soveringa | Vis Back Idiala |
|-------------------------------|------------|----------------------------|------------------|
| Milk yield-live weight        | 0.09       | 0.13                       | 0.03             |
| MJ-live weight                | 0.09       | 0.06                       | 0.10             |
| MDB-live weight               | 0.06       | 0.06                       | 0.06             |
| Lactation stability coefficient-live weight | 0.02 | 0.05 | 0.10 |

As can be seen from the above, the increase in milk yield and milk quality parameters is accompanied by increase of cow’s body weight, which confirms the claim about the effect of body weight on the cow’s productivity.

The data on correlation between productivity parameters and lactation activity of cows (which is estimated by coefficient of lactation constancy) are presented below in table 4.

**Table 4. Yield of nutrients with milk, kg.**

| index                        | On average | Line Reflection Soveringa | Vis Back Idiala |
|------------------------------|------------|----------------------------|------------------|
| Lactation stability coefficient-milk yield | 0.07 | 0.02 | 0.16 |
| Lactation stability coefficient-MJ | -0.17 | 0.11 | -0.24 |
| Lactation stability coefficient-MDB | 0.04 | 0.03 | 0.05 |
The coefficient of lactation constancy (stability) accounted for 100 and 98% per the lines, which values prove a uniform lactation activity. There is no highly expressed correlation of this coefficient with productivity qualities. The correlation was low positive for milk yield and MFP in milk, and it ranged from low negative to low positive in regards to fat fraction. Thus, the lactation activity of first-calves does not depend on productivity of cows, but it is determined by breed features and characteristics.

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

4. Conclusion
Based on the foregoing it can be concluded that the farm uses highly productive Holsteinized black-and-white cattle of Ural type. No significant differences were found in the productivity qualities of cows from different lines of Holsteinized black-and-white cattle. Low positive correlation was found between the body weight of cows and their productivity qualities, which practically does not depend on the linear pertaining of the cows.

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