Influence of the breed line origin of cows on correlation of productive qualities depending on lactation

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Abstract. In Sverdlovsk region new Ural type of black-and-white breed with a high proportion of Holstein breed relationship has been created. Animals of this type feature high productivity rates. The research of the productive qualities of modern black-and-white cattle, depending on its origin and lactation, is relevant and of practical importance. Milk yield increases from the first lactation to the third. The most significant increase was recorded between the first and second lactations, when the increase in milk yield during the second lactation was 934 and 1.165 kg respectively, or 9.86 and 12.26% (P≤0.05 in favor of the second lactation). For the third lactation, the increase was insignificant and unreliable. There were no significant differences between the lines of cows’ origin. In our opinion, it is explained by thorough and uniform selection of the servicing bulls, a high level of inbred animals in the herd (more than 65%) and cross-breeding. The increase of MFF and MFP in the milk of cows during the second lactation and a slight decrease in these parameters in full-age cows after the third lactation was observed. Correlation of quality indicators and milk yield per lactation varied depending on the ordinal number of lactation, but the quality indicators were almost equally independent from the linear origin of cows. So, the correlation between milk yield and MFF in milk per each lactation increased in negative direction, and content of milk protein ranged from low negative (1st lactation) to low positive (3rd lactation).

1. Introduction

The global world-wide problem is the task of providing a country’s population with high quality food. Those food products include in general food products obtained from farm animals, and for sure this range includes milk. Providing the population with milk and dairy products is the main concern to ensure the health of the nation and food security of any country [1-6].

Milk provides a person with complete essential nutrients and is well digested by body. Most of the milk comes from dairy cattle. An increase in milk productivity of cows is inseparably associated with an improvement of milk quality, which greatly influences on the quality of finished dairy products [7-11].

For milk production in the country recently dairy cattle of domestic and foreign selection have been used. Its main livestock is represented by the black-and-white and Holstein breed. In the past few decades, the domestic black-and-white cattle have been systematically improved everywhere by their
crossing with bulls of the Holstein breed. As a result of such selection and breeding work in individual regions of the country, a large livestock of dairy cattle with high blood relationship to the Holstein breed was created, which differ from each other in biological and economically useful traits, depending on breeding zone and original breeding resources used for crossing [12-16].

In Sverdlovsk region, a new Ural type of black-and-white breed with a high blood relationship to the Holstein breed has been created. Animals of this type feature high performance [17-19].

The study of the productive qualities of modern black-and-white cattle, depending on their origin and ordeal number of lactation, is relevant and of practical importance.

The aim of the research is to study the productive features of modern black-and-white cattle, depending on their origin and ordeal number of lactation.

2. Materials and method
The research was carried out in one of the breeding farms engaged in breeding black-and-white cattle of the Ural type. For the analysis, the data of zootechnical and pedigree registration of the Selex base were used. Animals that had finished their lactation at the time of bonitation were divided into groups depending on their origin. Group 1 consisted of Reflection Sovering line, Group 2 consisted of Vis Back Ideal line. Milk productivity was measured by control milking once a month, milk quality indicators: MFF and MFP in milk were checked monthly from each cow in the dairy laboratory of JSC “Uralplemcenter” of Sverdlovsk region. The milk production coefficient was calculated; correlation coefficients were calculated for milk yield for 305 days for lactations, for milk yield and milk quality indicators, for MFF-MFP in milk and milk yield for 305 days of lactation and live weight of cows by lactation and lines.

3. Results
During selection and breeding work with a herd, in order to increase the efficiency of selection they used lines breeding method. This farm uses cows from two Holstein lines - Reflection Sovering Line and Vis Back Ideal line. Their milk yield was measured. In 2019 in average 10.032 kg of milk was obtained from 1.400 cows, MFF was equal to 3.97% and MFP was 3.27%, productive longevity was equal to 2.2 lactation.

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

![Figure 1. Milk yield for 305 days of lactation of cows of different lines by lactation, kg.](image-url)
In result of the analysis of the obtained values, it was found that milk yield increases steadily from the first lactation to the third. It is explained by the regularity of changes in productivity when cow reaches physiological maturity. The most significant increase was noted between the first and second lactations. The increase in milk yield during the second lactation was 934 and 1.165 kg or 9.86 and 12.26% (P≤0.05 in favor of the second lactation) respectively. During the third lactation the increase was insignificant and unreliable. It is necessary to note that there were no significant differences between the lines of cows origin, which, in our opinion, is explained by the careful homogeneous selection of servicing bulls, by high level of inbred animals in the herd (more than 65%) and cross-breeding.

During assessing milk productivity, the attention is paid not only to amount of obtained milk, but also to its quality indicators, namely MFF and MFP (tables 1 and 2).

### Table 1. MFF in milk of cows of different lines by lactation, %.

| Line                | 1 lactation | 2 lactation | 3 lactation |
|---------------------|-------------|-------------|-------------|
| Reflection of Sovering | 3.94        | 3.99        | 3.97        |
| Vis Back Idial      | 3.95        | 3.99        | 3.96        |

### Table 2. MFP in milk of cows of different lines by lactation, %.

| Line                | 1 lactation | 2 lactation | 3 lactation |
|---------------------|-------------|-------------|-------------|
| Reflection of Sovering | 3.23        | 3.25        | 3.22        |
| Vis Back Idial      | 3.23        | 3.25        | 3.22        |

The increase in MFF and MFP in milk of cows during the second lactation and a slight decrease in these indicators in mature cows after the third lactation are obviously seen. Most likely, it is regularity, quite common for dairy cattle – i.e. decrease of fat and protein in milk along with increase of milk yield, which is clearly seen in tables 3 and 4. The increase in quality indicators in milk of cows during their second lactation is determined by the continuing growth and development of animals. Those processes are accompanied by increased digestion of nutrients consumed by cow with the feed.

### Table 3. The correlation of milk yield for lactation and MFF in the milk of cows of different lines by lactation (Milk yield for 305 days of lactation, kg – MJ, %).

| Line                | 1 lactation | 2 lactation | 3 lactation |
|---------------------|-------------|-------------|-------------|
| Reflection of Sovering | -0.03       | -0.12       | -0.18       |
| Vis Back Idial      | -0.002      | -0.11       | -0.21       |

### Table 4. The correlation of milk yield for lactation and MFP in the milk of cows of different lines by lactation (Milk yield for 305 days of lactation, kg – MDB, %).

| Line                | 1 lactation | 2 lactation | 3 lactation |
|---------------------|-------------|-------------|-------------|
| Reflection of Sovering | 0.12        | -0.06       | -0.14       |
| Vis Back Idial      | 0.10        | 0.04        | -0.21       |

Correlation of quality indicators with milk yield per lactation varied depending on ordeal number of lactation, but it varied almost equally independently of the line origin of cows. So the correlation between milk yield and MFF in milk per each lactation increased in negative direction, and for protein ranged from low negative (the 1st lactation) to low positive (the 3rd lactation).

In comparison with themselves the quality indicators of milk for the first and second lactation had high positive correlation coefficients. Differences in conjugation of quality indicators between themselves, depending on line origin of cows, were established only for the third lactation (table 5).
The figure shows that in the third lactation of Reflection Sovering cows the correlation coefficient between MFF and MFP in milk becomes low negative, which indicates that during selection and breeding work with these cows, both these traits must be taken into account, while breeding the Vis Back Ideal cows it is enough to take into account only one indicator, and the second will also increase, in case of increase of the first one.

Table 5. Correlation coefficients between milk quality indicators in cows of different lines by lactation.

| Line                  | MJ-MDB, % |
|-----------------------|-----------|
|                       | 1 lactation | 2 lactation | 3 lactation |
| Reflection of Sovering | 0.69        | 0.66         | -0.05       |
| Vis Back Idial        | 0.64        | 0.78         | 0.25        |

4. Discussion

The farm uses highly productive black-and-white cattle with a high Holstein blood relationship. The conjugation of productive traits with each other is important for breeding work on the farm in order to increase the breeding value of the cows. It has been established that in this farm it is possible to select and breed the cows by their milk yield and milk quality indicators. When working with Reflection Sovering cows, it is necessary to take into consideration each indicator.

Similar researches were conducted by N Bogolyubova, V Korotky, A Zenkin, V Ryzhov, N Buryakov, V Mymrin, O Lorettis, O Gorelik, O Lihodeevskaya, N Zezin, M Sevostyanov and O Leshonok.

5. Conclusion

The milk yield of cows in a herd increases from the first lactation to the third, which is explained by regularity of changes in productivity when cow reaches its physiological maturity. The most significant increase of milk yield was recorded between the first and second lactations. The increase in milk yield during the second lactation was 934 and 1.165 kg or 9.86 and 12.26% (P≤0.05 in favor of the second lactation) respectively. For the third lactation the increase in milk yield was insignificant and unreliable. It was established that milk yield per lactation and MFF in milk have a stable negative correlation, which decreases per lactations. During selection and breeding work in this farm it is necessary to select and breed cows by milk yield and milk quality indicators separately for each parameter, especially when breeding the cows of Reflection Sovering line.

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