The interrelation of holstein black pied cattle's productive qualities by lactation

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Abstract. Holsteinized Russian black pied cattle of the Ural type are bred in the Sverdlovsk region, which is represented by large highly productive animals with a high genetic potential of productivity. The purpose of the work was to study the productive qualities of Holsteinized black pied cattle with a high proportion of thorough-bredness in the Holstein breed and their interrelation. Milk yield per lactation increases reaching the maximum for the third lactation. The increase amounted to *o* 1409 kg or 14.9% relative to the first one. The study has found changes in milk quality indicators; the indicators fluctuated depending on lactation, yet a tendency to increase MFF in milk from the first to the third lactation was revealed. The highest indicators were shown in the second lactation. During this lactation, the highest milk protein content was observed – 3.26%. Due to the increase in milk yield and milk quality indicators, an increase in the amount of milk fat and milk protein per lactation is observed from 679 kg (1 lactation) to 782 kg (2 lactation). The correlation between milk yield and milk quality indicators being MFF and MFP varies depending on lactation. Mainly, with the exception of the first lactation and the interrelation of milk yield per lactation - MFP in milk was negative and amounted to 0.11. That is, with an increase in milk yield, there is a decrease in MFF and MFP in milk.

1 Introduction

The development of dairy cattle breeding is given great importance in the light of the country's Food Security Doctrine adopted in 2016 as an industry responsible for the sustainable supply of high-grade and high-quality food to the population [1-3]. Milk and dairy products are valuable food products that can be consumed by people of any age, health condition, and income. This ensures the health of the nation and the food security of any country [4-7]. Cattle produce the main part - over 97% of the total production - of milk, which is a valuable food product and raw materials for the dairy industry. Raw milk has strict requirements for its quality; therefore, tasks are being set to improve the quality indicators of milk along with increasing cattle productivity [8-18]. Dairy cattle of both domestic and foreign breeding are used for milk production; its main livestock is

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represented by the domestic black pied breed. In the last few decades, the gene pool of the world's best dairy breed - Holstein - has been widely and universally used for its improvement; it continues to be used. The long-term use of Holstein stud bulls of foreign breeding has led to the creation of a large array of Holstein cattle in various climatic and ecological-feeding zones of the country, which also differs in economically useful and biological traits due to the breed resources of cattle breeding zone and the origin country of stud bulls involved in crossbreeding [19-21]. In the Sverdlovsk region, the breeding stock of the black pied breed of the Ural offspring was inseminated with the seed of stud bulls of Canadian, Danish, and German breeding. As a result, large highly productive animals with high genetic potential of productivity were obtained; they were also well adapted to industrial milk production. In 2002, the Ural type of black pied cattle with a 75% thorough-bredness share in the Holstein breed was officially registered. The use of pure-bred Holstein bulls continued in subsequent years; the thorough-bredness share of the breeding stock increased to 91% or more for the Holstein breed [22-27]. There is insufficient data on the productive qualities of modern animals; therefore, the study of their milk productivity is relevant and has practical significance.

The purpose of the work was to study the productive qualities of Holsteinized black pied cattle with a high proportion of thorough-bredness in the Holstein breed and their interrelation.

2 Materials and methods

The research was carried out in the conditions of one of the breeding plants for the breeding of Holsteinized black pied cattle of the Ural type. The study involved cows that completed lactation by 01.10.2020. 2 groups of animals were selected depending on the linear affiliation. Group 1 - cows of the Reflection Sovereign line, group 2 - cows of the Vis Back Ideal line. Data from the zootechnical and breeding records of the Selex database were used for the analysis. Milk productivity was taken into account by conducting control milking once a month; milk quality indicators: MFF and MFP in milk, which were checked monthly from each cow in the conditions of the Uralplemcenter dairy laboratory in the Sverdlovsk region. The milkiness coefficient and the lactation stability coefficient, the amount of milk fat and milk protein were calculated. The indicators of the interrelation between productive traits were studied.

3 Results and Discussion

The farm is engaged in breeding highly productive Holsteinized cattle of the black pied breed of the Ural type with a high thorough-bredness share in the Holstein breed (over 91%). In 2019, 9677 kg of milk was received from 1400 cows, MFF and MFP in milk – 3.96 and 3.23%, respectively. The live weight of full-aged cows was 634 kg.

Table 1 presents data on dairy productivity indicators of cows of different lines.

Table 1. Indicators of milk productivity of cows of different lines

Indicator	Lactation		
	1	2	3
Milk yield for 305 days of lactation, kg	9471±56,53	10554±82,64	10880±274,73
MFF, %	3,94±0,002	3,99±0,004	3,97±0,009
MFP, %	3,23±0,001	3,26±0,002	3,22±0,003
Amount of milk fat, kg	373±1,1	421±3,3	432±2,47

Amount of milk protein, kg	306±0,5	344±1,6	350±0,55
The coefficient of milkiness	1619±36,00	1659±37,56	1621±56,41
Lactation stability coefficient	99,0±0,62	85,9±0,52	85,0±1,17

The data in the table shows that the milk yield per lactation increases reaching the maximum in the third lactation. The increase amounted to *o* 1409 kg or 14.9% relative to the first one. This is explained by a natural increase due to cows reaching physiological maturity. Changes in milk quality indicators were found as a result of the conducted studies; those indicators fluctuated depending on lactation, yet a tendency to increase MFF in milk from the first to the third lactation was revealed. The highest indicators were shown in the second lactation. During this lactation, the highest milk protein content was observed – 3.26%. Due to the increase in milk yield and milk quality indicators, an increase in the amount of milk fat and milk protein per lactation is observed from 679 kg (1 lactation) to 782 kg (2 lactation). However, more importance is given to milk yield in this case since it is the main source of increasing the yield of nutrients. High indicators of the milkiness coefficient indicate the constitutional orientation of animals towards dairy productivity. Lactation activity of animals indicates a stable lactation curve, which confirms the high coefficient of lactation stability (Figure 1).

Fig. 1. Evaluation coefficients of cows' dairy productivity.

The milkiness coefficient changes due to changes in cows' milk yield by lactation and their live weight, and the coefficient of stability decreases with age.

The study of productive traits' conjugacy allows to choose the right selection traits when improving the herd. Data on the interrelation between milk yield and quality indicators for groups of cows depending on the linear affiliation are presented in figure 2.
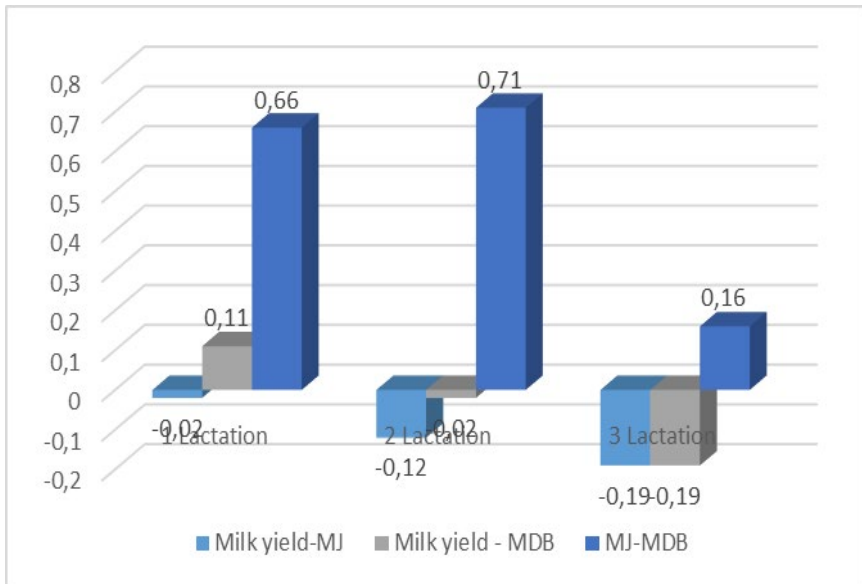
Fig. 2. Conjugacy of productivity traits in cows of different lines.

The figure clearly shows that the conjugation between milk yield and milk quality indicators – MFF and MFP - varies depending on lactation; mainly, except for the first lactation and the interrelation of milk yield per lactation, it is MFP in milk is negative and amounts to 0.11. That is, with an increase in milk yield, there is a decrease in MFF and MFP in milk; therefore, when planning breeding work with breeding stock on the farm, it is necessary to select improving stud bulls either on three traits at once, or neutral in MFF or MFP in milk from the maternal ancestors of the stud bull. There is a high correlation between the conjugacy of qualitative indicators in milk, especially in the first and second lactation, then its decrease is observed, yet the correlation coefficient remains positive.

It is known that an increase in milk yields can be observed with an increase in the cows' live weight, which is primarily associated with cows reaching physiological maturity. However, the interrelation of productive indicators with cows' live weight in this herd is of interest (Figure 3).
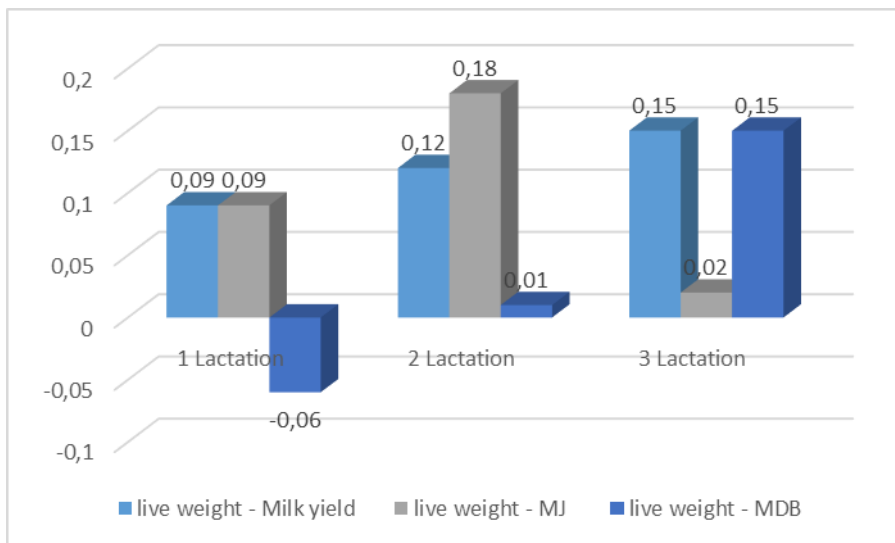
Fig. 3. The conjugacy of live weight and productive traits.

Changes in live weight have a positive interrelation with milk yield, MFF and MFP in milk (the exception is the first lactation; correlation live weight-MFP). In all cases, it turned out to be low and had no natural change except for the conjugation of live weight-milk yield. The authors' data on high productivity of Ural type cows of Holstein black pied cattle and the conjugation of traits between each other are confirmed by the studies of many authors N.V. Bogolyubova, V.P. Korotky, A.S. Zenkin, V.A. Ryzhov, N.P. Buryakov [23,24], Mymrin V and Loretts O [21], O V Gorelik, O E Lihodeevskaya, N N Zezin, M Ya Sevostyanov and O I Leshonok [25-27].

4 Conclusion

Based on the above, it can be concluded that the farm uses highly productive Holsteinized black pied cattle of the Ural type. There are no significant differences in the productive qualities of different cow lines of Holsteinized black pied cattle. A positive correlation has been established between milk yield, MFF in milk on the one hand and the live weight of cows.

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