Changes' assessment in the interrelation of productive traits of holsteinized black pied cattle

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Abstract. Holstein black pied cattle with a high genetic potential of productivity are bred in the Sverdlovsk region. The study of the interrelation between the productive traits of modern domestic dairy black pied cattle of the Middle Urals zone with high thorough-bredness for the Holstein breed is relevant. The purpose of the work was to study the conjugation dynamics of productive traits by lactation depending on the line. According to the average milk yield indicators. There were no differences in MFF and MFP in milk from cows of different lines, yet the fluctuations in milk yield within the lines were significant. The highest indicators of the correlation coefficient are established between the qualitative indicators of milk, which means that an increase in one of the indicators invariably leads to an increase another. A positive low conjugacy was established between milk yield and MFP in milk, as well as milk yield and cows' live weight for the first and second lactation in cows of both lines. In cows of the Vis Back Ideal 1013415 line, the conjugacy of productive traits for the third lactation turned into negative, except for milk yield and live weight. Thus, the linear affiliation of cows and their age (lactation) influence the interrelation of productive traits, which can be considered when further planning breeding work with the herd.

1 Introduction

Ensuring the food security of any country in the world is ensured by the development of agricultural production, including the livestock industry. Particular attention is paid to the development of dairy cattle breeding as an industry responsible for the sustainable supply of the population with high-grade and high-quality food products, such as milk and beef [1-2]. Milk is a valuable food product and raw material for the dairy industry, which can be consumed by people of any age, health condition, and income. This is explained by its composition and properties, the content of all essential nutrients for normal life in an optimal ratio, which in turn ensures the health of the nation and food security of any country [3]. Cattle produce over 97% of the total milk production. Raw milk has strict requirements for its quality; therefore, tasks are being set to improve the quality indicators of milk along with increasing productivity [4]. Dairy and combined breeds of cattle of both domestic and foreign

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breeding are used for its production in the Russian Federation. The main livestock of dairy cattle is represented by domestic black pied and Holstein breeds, which are related in origin. Since the mid-80s of the past century, Holstein stud bulls have been widely used to improve the productive and technological qualities of domestic cattle, which made it possible to create new breed types in different regions of the country. In the Sverdlovsk region, the Ural type of Holstein black pied cattle has been created and officially registered, the breeding of which is done mainly along Holstein lines. The thorough-bredness share of the breeding stock in individual farms of the country has increased to 91% or more for the Holstein breed [5-10]. The study of interrelation between the productive traits of modern domestic dairy cattle of the black pied breed remains relevant and has practical significance.

2 Materials and methods

The research was carried out in the conditions of one of the breeding plants for Holstein black pied cattle breeding (with thorough-bredness of more than 94.0%) of the Sverdlovsk region. The interrelation of productive traits depending on lactation and linear affiliation of cows was studied. Milk yield was considered for 305 days of lactation. MFF and MFP in milk, their interrelation to each other by calculating correlation coefficients. Milk yield per lactation was evaluated daily from each cow using the "Selex-Dairy Cattle" program "Plinor"; milk quality indicators were evaluated 1 time per month in an average milk sample from each cow. Data from the zootechnical and breeding records of the Selex database were used for the analysis.

3 Results

The farm is engaged in breeding highly productive Holstein cattle of the black pied breed with high thorough-bredness share in the Holstein breed (more than 94.0%). As of 01.01.2021, the livestock of the milking herd was 1400 heads, milk yield per cow was 10646 kg, productive longevity - 2.2 lactation. The breeding stock is represented by animals of the Vis Back Ideal 1013415 lines; Reflection Sovereign 198998.

Table 1 presents data on the indicators of cows' dairy productivity by lactation depending on the linear affiliation.

Table 1. Dairy productivity of cows by lactation.

Indicator	Line	
	Vis Back Ideal 1013415	Reflection Sovereign 198998
1 lactation		
Milk yield. kg	9501±82.06	9471±78.59
MFF, %	3.95±0.004	3.94±0.003
MFP, %	3.23±0.002	3.23±0.002
Amount of milk fat. kg	375±2.95	373±2.57
Amount of milk protein. kg	307±0.88	306±1.33
2 lactation		
Milk yield. kg	10666±107.71	10405±128.05
MFF, %	3.99±0.005	3.99±0.006
MFP, %	3.25±0.003	3.25±0.004
Amount of milk fat. kg	426±3.34	415±2.95
Amount of milk protein. kg	347±2.45	338±2.25
3 lactation		
Milk yield. kg	10866±441.04	10890±359.38

MFF, %	3.96±0.010	3.97±0.014
MFP, %	3.22±0.004	3.22±0.004
Amount of milk fat. kg	430±5.94	432±3.33
Amount of milk protein. kg	350±3.85	351±2.58

It follows from the table data that cows used in the farm had almost the same productivity indicators regardless of linear affiliation. The difference in milk yield is insignificant and unreliable, the quality indicators of milk are the same. Thus, there is a herd selected in accordance with productive qualities that are higher than the standard requirements for both black pied and Holstein breeds. Despite that there were no differences between the lines in terms of average indicators, large fluctuations in milk yield were found in groups of animals of different lines (Figure 1).
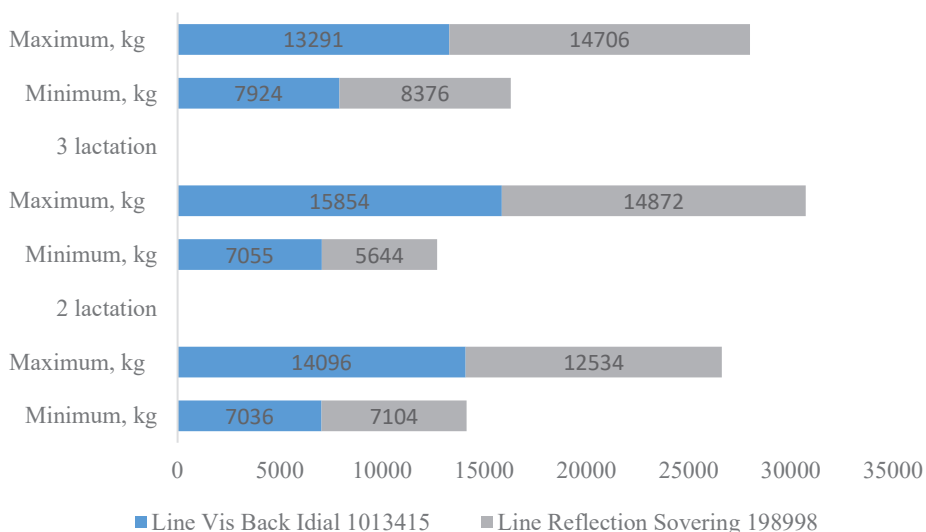

Fig. 1. Minimum and maximum milk yield of cows along the lines. kg.

The figure clearly shows that the milk yields of cows within groups vary significantly along the lines, which allows for targeted selection and breeding work on selection and choosing to further increase the productive potential of the herd. The difference ranges from 168% (3 lactation, Vis Back Ideal line 1013415) to 264% (2 lactation, Reflection Sovereign line 198998).

The interrelation of productive traits between each other is also of interest to determine the traits of dairy productivity, according to which selection and choosing are carried out during breeding work with the herd. The conjugacy of traits for the first lactation depending on the linear affiliation is presented in Figure 2.
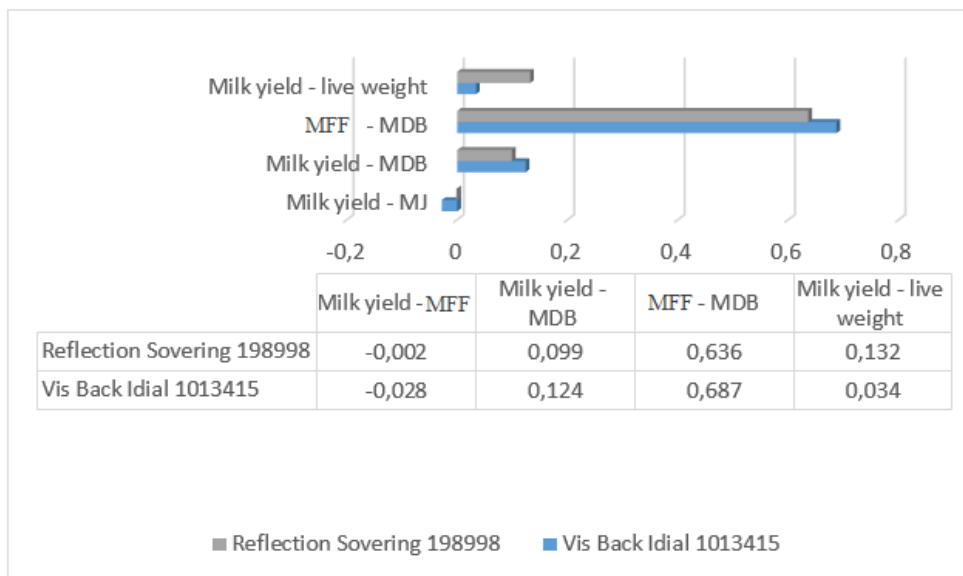
	Milk yield - MFF	Milk yield - MDB	MFF - MDB	Milk yield - live weight
Reflection Sovering 198998	-0,002	0,099	0,636	0,132
Vis Back Idial 1013415	-0,028	0,124	0,687	0,034

Fig. 2. Interrelation of productive traits (1 lactation).

The figure shows that the highest indicators of the correlation coefficient were established between the qualitative indicators of milk. They show that an increase in one of the indicators invariably leads to an increase in another, since the coefficients in both groups are positive and high. A positive low conjugacy was established between milk yield and MFP in milk, as well as milk yield and live weight of cows. These indicators show that selection based on these traits is possible, yet it will not give a quick effect. Milk yield is negatively correlated with MFF in milk. There are differences in conjugacy of the trait along the lines but they are not significant.

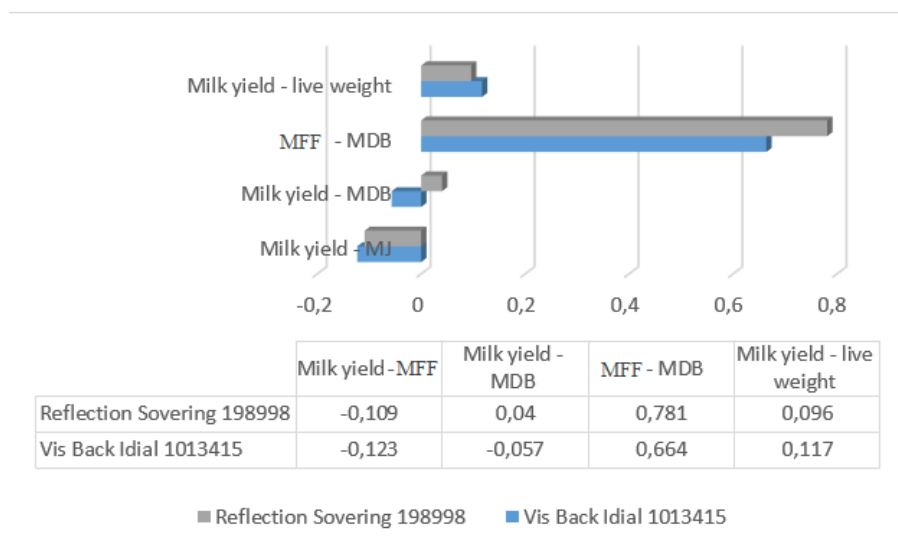Figure 3 shows the correlation coefficients between the productive traits for 2 lactation.

	Milk yield - MFF	Milk yield - MDB	MFF - MDB	Milk yield - live weight
Reflection Sovering 198998	-0,109	0,04	0,781	0,096
Vis Back Idial 1013415	-0,123	-0,057	0,664	0,117

Fig. 3. Interrelation of productive traits (2 lactation).

The conjugacy of the traits repeats the same patterns as for the first lactation with the exception of the correlation between milk yield and MFP in the milk of the Vis Back Ideal 1013415 line cows, which was low negative for the 2nd lactation. The correlation coefficients between milk yield and MFF in milk decreased. The greatest changes in the conjugacy of the studied indicators depending on age were established by the third lactation in cows of both lines (figure 4).
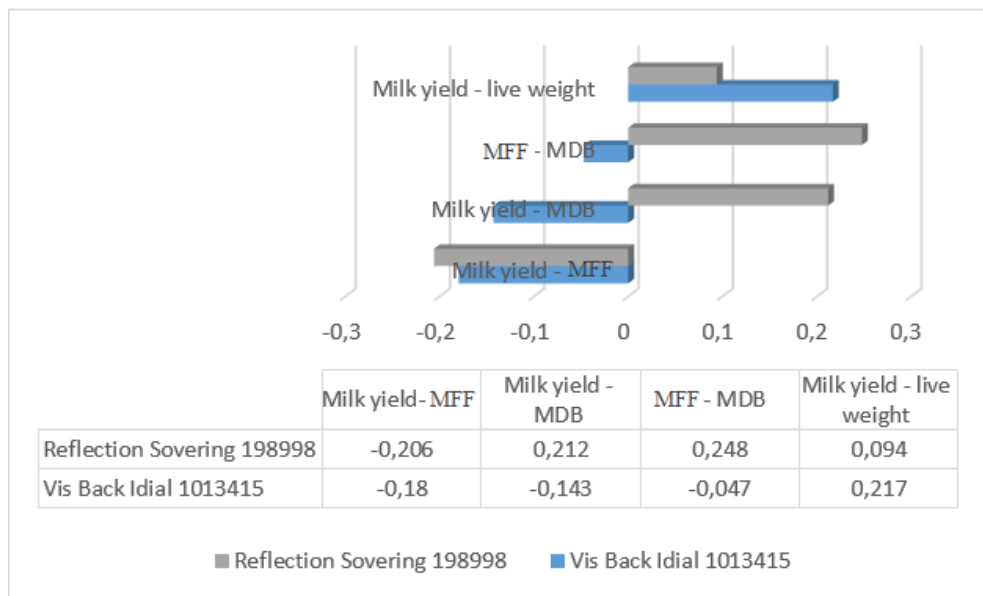

	Milk yield-MFF	Milk yield – MDB	MFF - MDB	Milk yield - live weight
Reflection Sovering 198998	-0,206	0,212	0,248	0,094
Vis Back Idial 1013415	-0,18	-0,143	-0,047	0,217

■ Reflection Sovering 198998   ■ Vis Back Idial 1013415

Fig. 4. Interrelation of productive traits (2 lactation).

The figure clearly shows that only cows of the Reflection Sovereign 198998 line have the same conjugation pattern of productive traits with each other, despite an increase or decrease in their indicators in absolute values. In cows of the Vis Back Ideal 1013415 line, the conjugacy of productive traits turned into negative, except for milk yield and live weight. This suggests that they all need to be taken into account when conducting selection and choosing, whereas it is possible to forecast certain changes in one of them in the Reflection Sovereign 198998 line.

4 Discussion

The authors' data on the high breeding quality of Holstein stud bulls are confirmed by the studies of many authors S.Y. Harlap, M.A. Bitkeeva, N.A. Demina, A.S. Gorelik, G.M. Mullagulova [6], *S.Yu.Harlap, N.I. Sorokina, L.A. Moskvina, N.I. Kulmakova, T.I. Bezhinar* [7].

5 Conclusion

Based on the above, it can be concluded that the linear affiliation of cows and their age (lactation) affect the interrelation of productive traits, which can be taken into account when further planning breeding work with the herd. The farm breeds highly productive Holstein black pie cattle with great variability in milk yield within each line.

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