Variability of indicators of milk productivity in cows of different genotypes and with different index of lactation constancy

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Abstract. at present, the livestock industry in Russia is aimed at obtaining highly productive cows, taking into account their individual characteristics. It is known that animals with high genetic potential react to certain environmental changes especially. Hence, phenotypic evaluation will not help select the best cows with high genetic potential. Therefore, the assessment of individual qualities requires a new approach, which can be safely attributed to various kinds of indices, among which the index of lactation constancy occupies a special place. Such an index score fully characterizes the genotype. Any herd is characterized by a large genetic diversity of individuals. The variability of milk productivity traits determines this diversity, therefore, among highly productive cows there are those that are able to maintain the amount of milk yield and other valuable traits and be able to pass them on to their descendants. The main goal of breeding is aimed at identifying cows with such a valuable genotype and further their widespread use within the farm. Cows, daughters of different breeding bulls with a high index of lactation constancy, can serve as a starting point in the selection of producers with further recommendation for their use in different populations with different levels of productivity.

1 Introduction

The need to select highly productive cows requires new breeding approaches and activities aimed at finding special methods for assessing the individual qualities of cows.

The development of such methods, along with traditional zootechnical methods, makes it possible to identify breeding animals that differ in their biological qualities from the population as a whole. For the genetic improvement of the herd of dairy cattle, such animals are important. Having high productivity in its genotype and the ability to maintain this productivity for a number of years is unique. High productivity and intensive use wear out the body of cows faster, so the question arises of repairing the herd. Assessment of the genetic potential of cows using indicators of variability takes breeding to a new level of genotype assessment. There are not so many cows capable of high productivity in the herd. This ability is considered as maintaining high productivity over a number of lactations in combination

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with such traits as milk yield, mass fraction of fat and protein. The study of the relationship between these indicators, the degree of variability of traits with high indices of lactation constancy will provide additional objective materials for the selection and evaluation of cows.

The purpose of the research was to study the possibility of selecting cows based on genotypic characteristics and indices of lactation constancy.

2 Materials and methods

Scientific and economic experience was carried out in 4 best farms in different regions of Russia, specifically in the Moscow and Belgorod regions. Cows of black-and-white breeds of different origins belonged to APK Vokhrinka LLC, Matveevskoe CJSC, Avido Agricultural Holding and Povadino Breeding Plant OJSC.

In cows, the main indicators of milk production were taken into account for a number of lactations. In each of the farms, 2 groups of cows of different origin were formed. The first group was represented by cows with an index of lactation constancy of less than 100%, the second, those that had an index of more than 100%. When calculating the index, the traditional formula was used, as the ratio of milk yield for the fourth, fifth and sixth month of a particular lactation to milk yield for the first, second, and third months of the same lactation × 100. The results of the data obtained were processed using the excel computer program. The mean value, standard deviation, variability and their errors were calculated. When comparing the mean values, the significance of the difference was determined using Student's t-test.

The following groups were formed to determine the effect of linear affiliation on ILC: the first group of animals included cows with ILC less than 100%, the second group of animals with ILC more than 100%. Then, within the first and second groups, groups of animals were formed, taking into account the linear affiliation, in each group, productivity and its variability were studied.

3 Results and discussion

According to the results of the study, it was determined that after the first lactation, the productivity of animals naturally increases. At the same time, some animals change their belonging to the group, taking into account the level of the lactation constancy index. Such a pattern of change in belonging to the ILC level group after the second lactation was not revealed. For the third lactation, the productivity indicators of animals increase in comparison with the first and second lactations. At the same time, the increase in animal productivity indicators is different and is closely related to the index of lactation constancy. Full-aged third lactation was characterized by a higher milk yield, we did not reveal a change in the percentage of fat mass fraction in milk.

The results showed (Fig. 1) that the milk productivity of cows for the 3rd lactation of JSC Breeding Plant Povadino has changed, so that the change in belonging to the group also affects the degree of its variability of the trait.

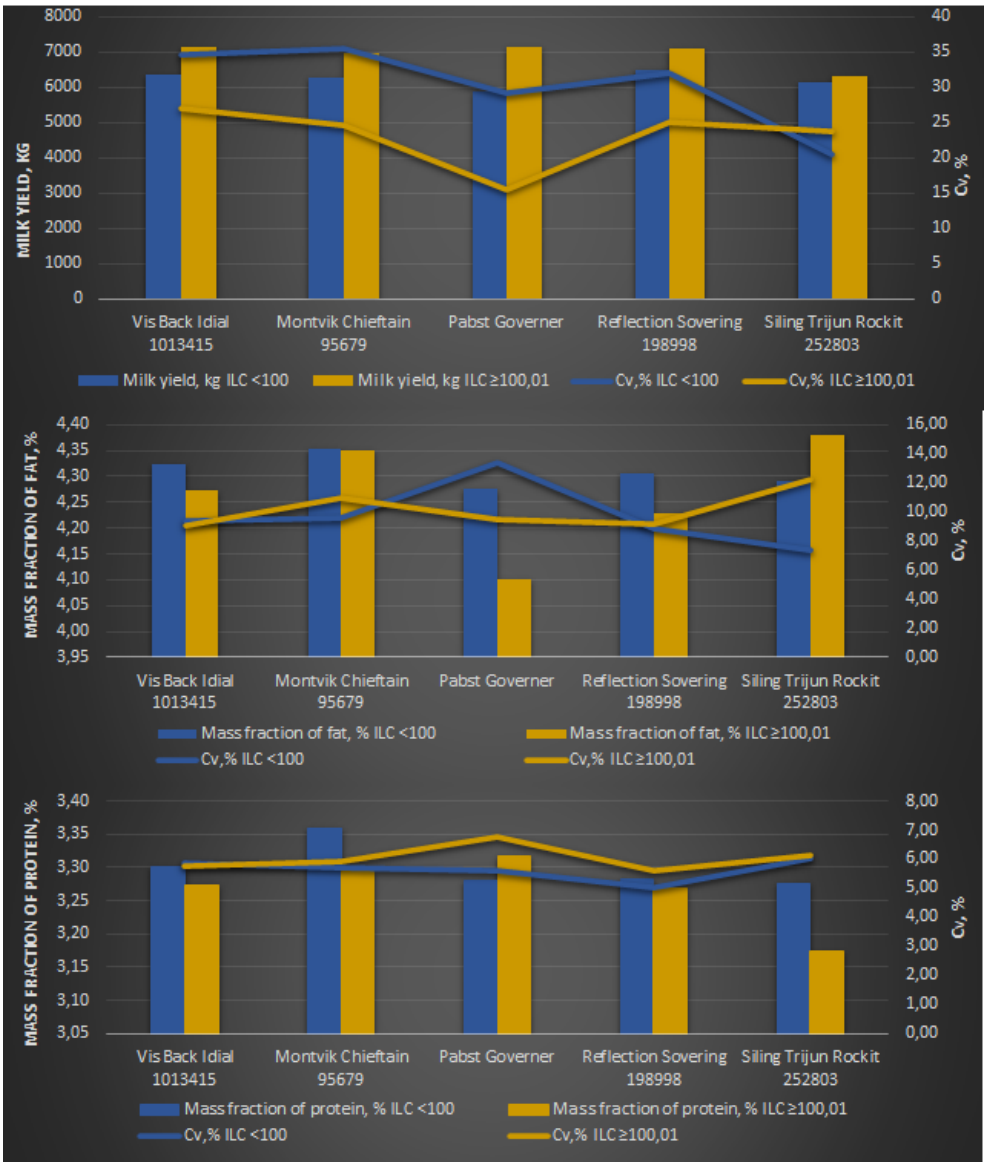

Fig. 1. Indicators of milk productivity in cows of JSC Breeding Plant Povadino of different linear affiliation with different levels of the lactation constancy index (3rd lactation).

High variability was found in cows of the Vis Back Idial 1013415 line and the Montvik Chieftain 95679 line, which amounted to 35% in terms of milk yield. While cows of the line Montvik Chieftain 95679 showed a decrease in milk yield to 6278 kg., Against 6581 kg. after the first lactation. In all animals, with age, as well as with a change in the index of lactation constancy, the variability of signs increases.

In the works of researchers [4-8], it was noted that the course of lactation, its course in this case, the uniformity of lactation of cows, is explained by the selection of pairs and serves as a fixation in the offspring without peak lactations with uniform daily milk yields, and this is important, because milk yields are high. This selection allows you to select highly productive cows after the first and second calving. As a result of our study, it was determined

that heifers with uneven lactation and, as a result, ILC less than 100 are not able to equalize milk yield in the next lactation.

It is possible to select highly productive animals only under the condition of an uneven distribution of traits in the herd. It is important to determine the variability of signs. Based on the findings of [9-10], it would be logical to assume that the greater the variability of the trait, the more effective the selection will be. At the same time, the practical application of selection indicates that the value of a trait only partially depends on the hereditary characteristics of the animal. At the same time, no one canceled the influence of paratypical factors, for example, environmental conditions on milk productivity indicators [11]. The task of the research was to study the influence of the genotype (origin) on the amount of milk yield and the index of lactation constancy under different conditions.

The indicators of milk productivity of cows for the third lactation in LLC APK Vokhrinka, presented in Figure 2, indicate that the productivity of animals of different genotypes increases with age. It should be noted the highest milk yield, mass fraction of fat and protein in the offspring of the Governor of Kornation 629472 line with a lactation constancy index of more than 100% - 8655 kg., 4.61%, 3.23%, respectively, as well as the fact that not a single offspring of this line was not assigned to the group with ILC less than 100%. In second place in terms of milk yield among cows were the descendants of the line Montvik Chieftain 95679 - 8558 kg. in the group with ILC less than 100% and 8538 kg. in the group with ILC more than 100%

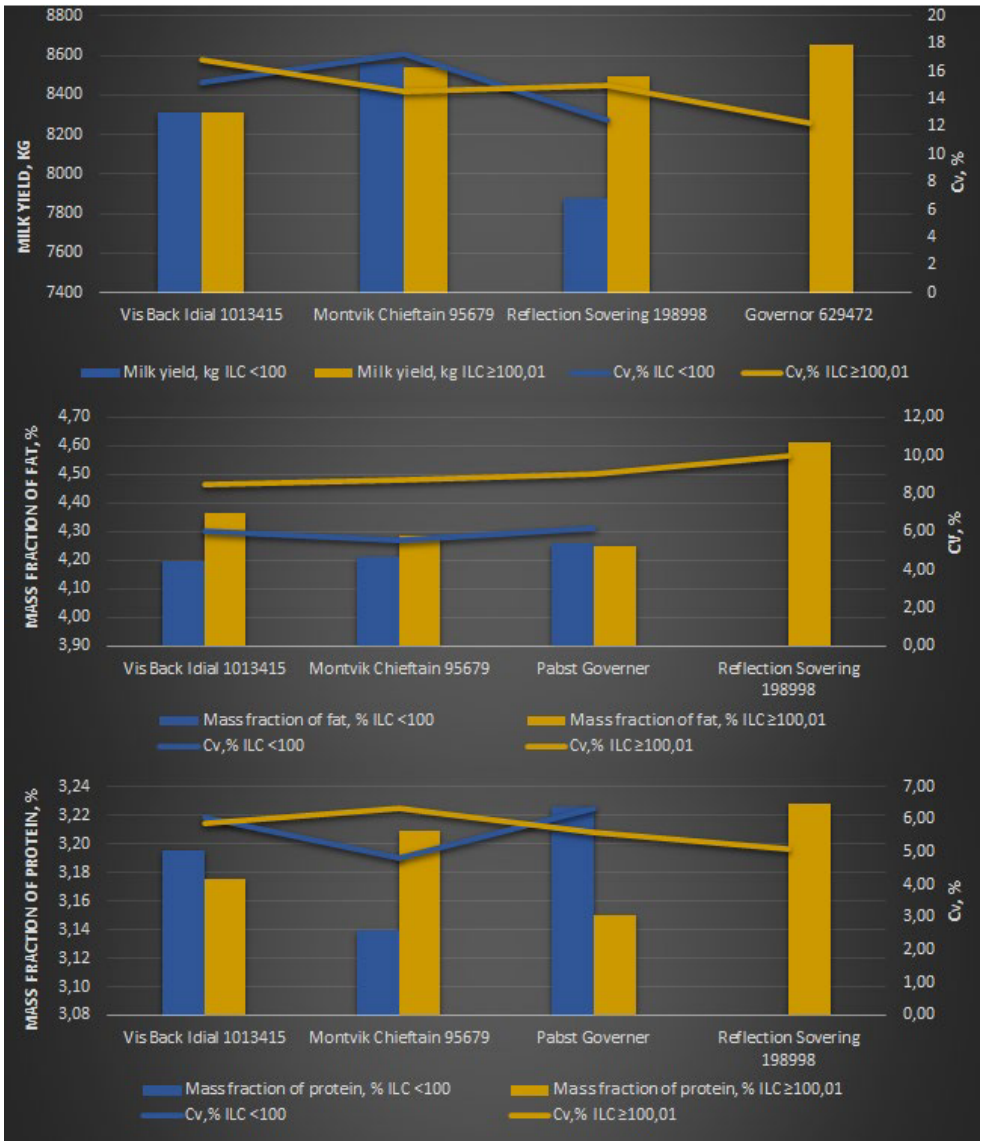

Fig. 2. Indicators of milk productivity in cows of LLC APK Vokhrinka of different linear affiliation with different levels of the lactation constancy index (3rd lactation).

In CJSC Matveevskoye (Figure 3) it was found that groups of animals of different genotypes with different index of lactation constancy also differ in similar coefficients of variability in milk yield.

According to the mass fraction of fat and protein, the descendants of the Montvik Chieftain 95679 line turned out to be the best - 4.04% (P>0.95), 3.25% (P>0.95), respectively.

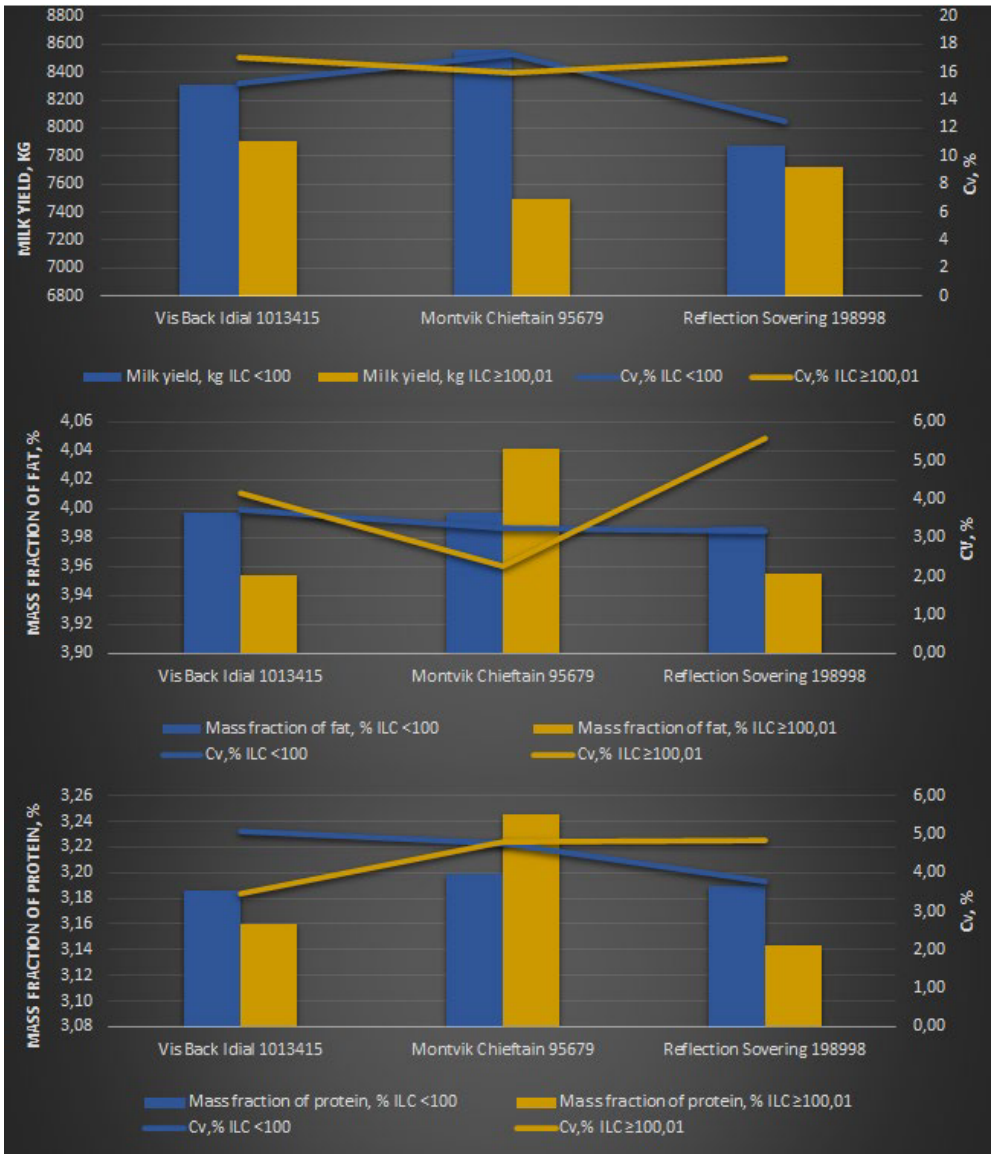

Fig. 3. Indicators of milk productivity in cows of CJSC Matveevskoe of different linear affiliation with different levels of the lactation constancy index (3rd lactation).

In some cases [12-13], selection was more effective in herds with a lower coefficient of variability.

It is worth noting the high coefficient of variability in the descendants of the line Vis Back Idial 1013415 in terms of the mass fraction of fat 3.73% in the ILC group less than 100% and 4.15% in the ILC group more than 100%. As for the mass fraction of the protein, similar levels of the coefficient of variability were found in the descendants of the line Montvik Chieftain 95679 in both groups of the ILC level, but the average values were different in the ILC group less than 100% - 3.20%, and in the ILC group more than 100% - 3.25%. The descendants of the lines Vis Back Idial 1013415 and Reflection Sovering 198998 differ in average values both in the percentage of the mass fraction of the protein and in the coefficients of variability between the ILC groups within each line.

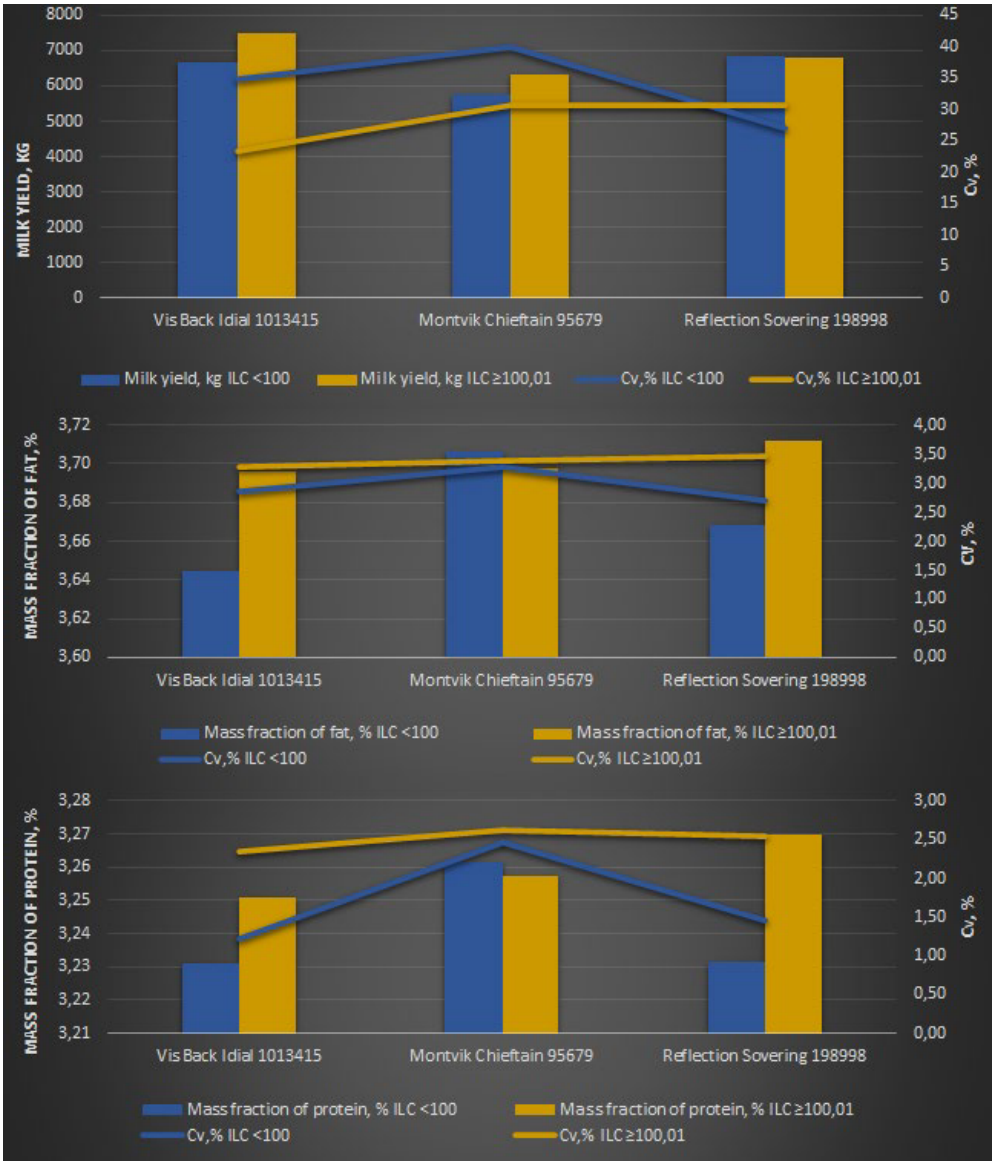

Fig. 4. Indicators of milk productivity in cows of Agroholding Avido of different linear affiliation with different levels of the lactation constancy index (3rd lactation).

According to the third lactation in animals in Avido Agroholding (Figure 4), the best among all in terms of milk yield were the descendants of the Vis Back Idial line 1013415 - 7477 kg. High variability in milk yield in the descendants of the Montwick Chieftain 95679 line in the ILC group is less than 100%, it is 40%, and in the ILC group more than 100% - 31%. The descendants of this line also have a high variability in the mass fraction of protein in both groups of ILC less than 100% - 2.46%, and in the ILC group more than 100% - 2.62%.

The same high variability in milk yield in the descendants of the Vis Back Idial 1013415 line in the ILC group is less than 100% - 35%, and in the ILC group more than 100% - 23%.

4 Conclusions

Under the conditions of APK Vohrinka LLC, it was found that the highest milk yield, mass fraction of fat and protein in the descendants of the Governor Of Kornation 629472 line with a lactation constancy index of more than 100% - 8655 kg., 4.61%, 3.23% respectively, as well as the fact that no descendant of this line was assigned to the group with an ILC of less than 100%.

Animals of OJSC BREEDING PLANT Povadino, belonging to the line Vis Back Idial 1013415 and the line Montvik Chieftain 95679, have a variability in milk yield of up to 35%. In all animals, with age, as well as with a change in the index of lactation constancy, the variability of signs increases.

In CJSC Matveevskoe groups of animals of different genotypes with different index of lactation constancy also differ in similar coefficients of variability in milk yield. According to the mass fraction of fat and protein, the descendants of the Montvik Chieftain 95679 line turned out to be the best - 4.04% (P>0.95), 3.25% (P>0.95), respectively.

According to the third lactation of animals in the Avido Agroholding, the best among all in terms of milk yield were the descendants of the Vis Back Idial line 1013415 - 7477 kg. High variability in milk yield in the descendants of the Montwick Chieftain 95679 line in the ILC group is less than 100%, it is 40%, and in the ILC group more than 100% - 31%. The descendants of this line also have a high variability in the mass fraction of protein in both groups of ILC less than 100% - 2.46%, and in the ILC group more than 100% - 2.62%.

Data on the productivity of daughters with different indices of lactation constancy and the dynamics of the level of variability can serve as an additional method for selecting animals, as well as a sufficient basis for determining the breeding value of a sire.

References

1. N.A. Plokhinsky, Biometrics algorithms, M. (1980)
2. G.F. Lakin, Biometrics, (M.: Higher school; 3rd edition, revised. and additional, 1980)
3. A.V. Bakai, I.I. Kochish, G.G. Skripnichenko, Genetics, 448 (M.: KolosS, 2006)
4. A.M. Ulimbashev, *Evaluation of cows and sires according to a set of characteristics, taking into account the nature of the lactation curve of daughters*: dis. cand. s.-x. Sciences: 06.02.01, GNU All-Russian Research Institute of Genetics and Breeding of Farm Animals (GNU VNIIGRZH) of the Russian Academy of Agricultural Sciences, St. Petersburg, 74 (2009)
5. A. S. Mityukov, E. V. Firsova, A. P. Kartashova, Proceedings of the St. Petersburg State Agrarian University, **43**, 107-113 (2016)
6. N.I. Lykasova, Agrarian Bulletin of the Urals., **1 (31)**, 50-52 (2006)
7. N. Fedoseeva, A. Golikova, Yu. Zabudsky et al., Dairy and beef cattle breeding, **4**, 13-14 (2013)
8. N. Yu. Safina, Sh. K. Shakirov, FF Zinnatova [et al.], Research Journal of Pharmaceutical, Biological and Chemical Sciences, **9 (6)**, 2028-2031 (2018)
9. Z. A. Kadzaeva, Proceedings of the Gorsky State Agrarian University, **58-2**, 87-90 (2021)
10. K.K. Esmagambetov, K. K. Esmagambetov, I. M. Donnik, O. G. Loretts, P. V. Leonov, Agrarian Bulletin of the Urals **11 (141),** 27-29 (2015)
11. E. Van Laer, B. Sonck, F. A. M. Tuyttens, C. P. H. Moons, Livestock Science, **159(1),** 87-101 (2014) DOI 10.1016/j.livsci.2013.11.003.

12. A.K. Gordeeva, O.A. Potapova, S.L. Belozertseva, L.L. Petrukhina, Achievements of science and technology of the agro-industrial complex **12**, 51-53 (2011)
13. V.B. Dmitriev, Yu.V. Boikov, T.V. Reshetova, *Selection strategy in dairy cattle breeding*, Modern methods of increasing the productivity of farm animals. Collection of scientific papers, 83-89 (VNIIGRZH. SPb. 2001)