

Productivity of Holsteinized black-and-white cattle depending on age

*O.P. Neverova**, *S.Yu. Harlap*, *Ya.S. Pavlova*, *E.P. Neverova*, and *E.V. Alexandrina*

Ural State Agrarian University, Karl Liebknecht 42, Yekaterinburg, 620075 Russian Federation

Abstract. The Ural type of the domestic black-and-white breed is characterized by high productivity and good suitability for use in the conditions of industrial milk technology. During its breeding, the use of purebred bulls-producers of the Holstein breed of both domestic and foreign breeding continues. As a result of the conducted research, it was found that the productivity of cows changes significantly with age. Milk yield for 305 days of lactation increases from 1 lactation to 3 lactation, and then decreases by 369 kg or 3.8% in the fourth, relative to the third, and by 2090 kg or 22.2% in the fifth, relative to the fourth. The productivity of full-aged cows is higher than that of young cows and can remain at a high level for a long period. The quality indicators of milk changed upward from the first to the fifth lactation. High correlation coefficients were established by the conjugation of milk quality indicators with each other, regardless of lactation. They ranged from 0.364 (2 lactation) to 0.533 (1 lactation). That is, a decrease or increase in MJ in milk will lead to the same change in MDB.

1 Introduction

Ensuring the food security of any country in the world with an ever-increasing population poses great challenges to farmers to increase production and improve the quality of agricultural products, including of animal origin [1-3]. Great importance is attached to the development of dairy cattle breeding as a branch of animal husbandry, from which such a valuable food product and raw material for the food industry – milk, is received [4-6]. For its production, highly productive dairy cattle is used, the main livestock of which belongs to related breeds of Dutch origin – Holstein, black-and-white, etc. [7-9].

The Holstein breed is considered the best dairy breed in the world and therefore it is widely used to improve dairy cattle around the world. The widespread and long-term use of crossing the breeding stock of the domestic black-and-white breed in Russia with purebred stud bulls of the Holstein breed led to the creation of a large array of Holsteinized black-and-white cattle [10-13]. This made it possible to officially register new breed types of black-and-white dairy cattle in different regions, including the Sverdlovsk Region [14-16].

The Ural type of the domestic black-and-white breed was distinguished by high productivity indicators, good suitability for use in the conditions of industrial milk technology. High productivity is accompanied by a decrease in productive longevity, which

* Corresponding author: olgao205en@yandex.ru

raises new questions for livestock workers. The study of the dairy productivity of modern Holsteinized black-and-white cattle, depending on the use duration and the relationship of productive traits by lactation, is relevant and has practical significance.

2 Materials and Methods

The objects of research were cows of Holsteinized black-and-white cattle. The research was carried out on the basis of one of the breeding plants for the breeding of Holsteinized black-and-white cattle of the Ural type in the Sverdlovsk region. We used the data of zootechnical and veterinary records of the IAS "SELEX-Dairy cattle" database. The sample included all cows that completed 5th lactation. Milk yield for 305 days of lactation, FDM, and PDM in milk were considered. Correlation coefficients between indicators of milk productivity depending on lactation were calculated. Milk yield per lactation was evaluated by conducting control milking once a month, milk quality indicators were determined in an average milk sample from each cow once a month in the Uralplemcenter dairy laboratory.

3 Results and Discussion

Highly productive Holsteinized black-and-white cattle of the Ural type are bred in the breeding reproducer. The average productivity indicators for breeding stock in 2020 amounted to 8,300 kg, FDM – 3.93%, PDM – 3.24%. Cows that lactated on the farm for 5 lactations had a yield higher than the average for the herd. The productive qualities of cows vary by lactation (Table 1).

Table 1. Dynamics of dairy productivity of cows

Lactation	Milk yield for 305 days of lactation, kg	FDM, %	PDM, %
1	9069±55.04	3.88±0.004	3.15±0.003
2	9162±91.09	3.88±0.005	3.16±0.004
3	9780±147.09	3.90±0.006	3.21±0.005
4	9411±311.70	3.93±0.008	3.24±0.005
5	7321±507.92	3.94±0.029	3.23±0.008
Onaverage	8949±122.47	3.91±0.007	3.20±0.005

As a result of the analysis, it turned out that the productivity of cows changes significantly with age. Milk yield for 305 days of lactation increases from 1st lactation to 3th lactation, and then decreases by 369 kg or 3.8% in the fourth one, relative to the third one, and by 2090 kg or 22.2% in the fifth one, relative to the fourth one. It is confirmed that the productivity of full-aged cows is higher than that of young ones, and it can remain at a high level for a long period when optimal feeding and maintenance conditions are created. The quality indicators of milk changed upward from the first to the fifth lactation.

Within each individual group of cows studied, a large variability of the trait was observed. The difference in milk yields in the group of cows, depending on lactation, ranged from 1869 kg (5th lactation) to 13957 kg (2nd lactation). This is due to the wide variety of cows on this basis and makes it possible to carry out effective selection when planning breeding work with the herd (Table 2).

Table 2. Fluctuations in milk yield in a group of cows, kg

Lactation	Milk yield for 305 days of lactation, kg	Fluctuation of milk yield, kg		
		Maximum	Minimum	Difference
1	9069±55.04	2794	13444	10650

2	9162±91.09	2734	16691	13957
3	9780±147.09	5932	16525	10593
4	9411±311.70	5489	16713	11224
5	7321±507.92	6413	8282	1869
Onaver age	8949±122.47	4672	14331	9659

According to the first and second lactations, there are a small number of low-yielding cows in the herd, which are culled from the herd by the third lactation. From the third lactation, animals that have a yield higher than the requirements of the breed standard remain and are used in the herd.

The possibility of selection in the herd by milk yield for 305 days of lactation is evidenced by a fairly high variability coefficient of milk yields by lactation from 13.8 to 23.2% (Fig. 1).

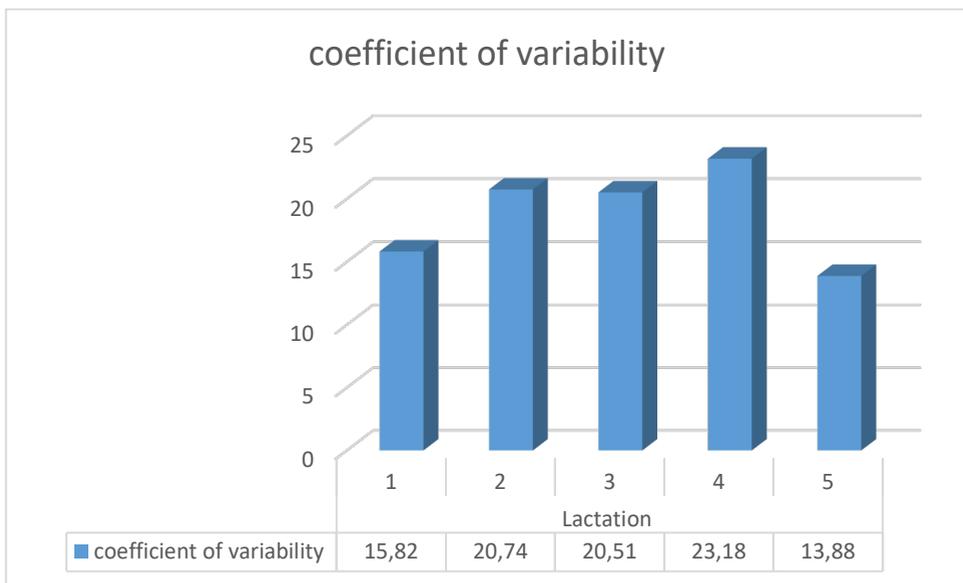


Fig. 1. Variability coefficient of milk yield in cows by lactation, %.

The lowest coefficient of variability was found for the fifth lactation, and the highest for the fourth one. It should be noted that the correlation coefficient increases from the first to the fourth lactation, and then decreases, which can be explained by a decrease in the number of livestock for the fifth lactation due to the culling of cows for various reasons.

Correlation coefficients between productive indicators – milk yield and milk quality (FDM and PDM in milk) also differed by lactation (Fig. 2).

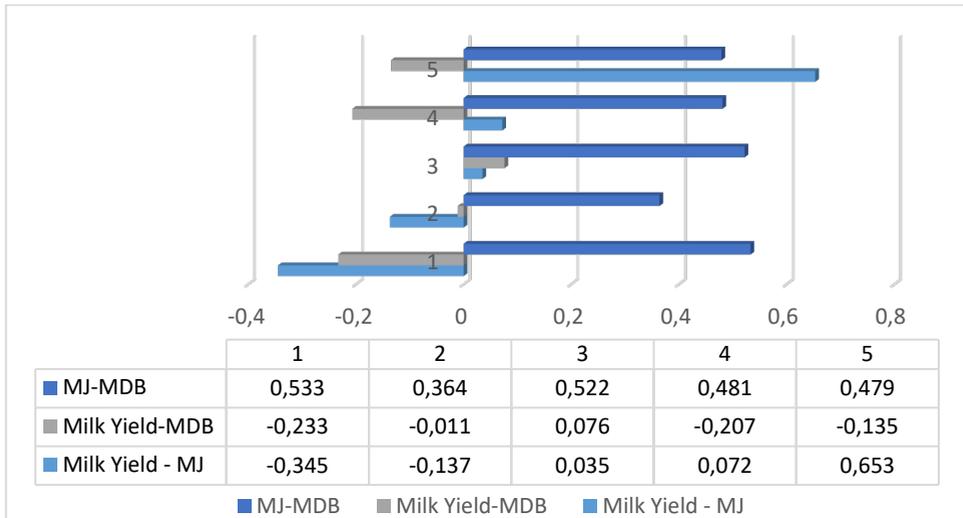


Fig. 2. Contingency of productive traits in cows by lactation.

There are changes in the contingency of the studied indicators for lactation from negative between milk yield and FDM in milk in the first, second lactation to high positive in the fifth lactation. Between milk yield and PDM in milk, the correlation coefficient changed along the sinusoid from an average negative in the first lactation to a small positive in the third lactation and again to an average negative in the fourth one with an increase to a small negative in the fifth lactation. That is, the contingency of lactation traits in cows of Holsteinized black-and-white cattle of the Ural type varies and cannot serve as an indicator during breeding work (Figure 2).

High correlation coefficients were established by the contingency of milk quality indicators with each other, regardless of lactation. They ranged from 0.364 (2nd lactation) to 0.533 (1st lactation). That is, it is very likely to state the fact that a decrease or increase in FDM in milk will lead to the same change in PDM.

Correlation coefficients for the contingency of milk yield between lactations were calculated (Table 3).

Table 3. Correlation coefficients for milk yield depending on lactation.

Milk yield for 305 days of lactation, kg	Milk yield for 305 days of lactation, kg				
	1 Lactation	2 Lactation	3 Lactation	4 Lactation	5 Lactation
1 Lactation	1	-	-	-	-
2 Lactation	0,361	1	-	-	-
3 Lactation	0,260	0,527	1	-	-
4 Lactation	0,129	0,440	0,667	1	-
5 Lactation	-0,117	0,557	0,951	-0,781	1

In all cases, except for the correlation of milk yield for 305 days of lactation for the first-fifth lactation and the fourth-fifth lactation, positive correlation coefficients are observed, which allows to conclude that the first lactation can be selected by milk yield. The relationship of milk yield for the first lactation weakens with the age of the animals and becomes negative for the fifth lactation. The highest indicators of milk yield conjugacy for lactation are observed from the second and third to the fifth ones.

4 Conclusion

Thus, based on the above, the following conclusions can be drawn:

- the farm uses highly productive Holsteinized black-and-white cattle of the Ural type, which has significant variability in milk yield per lactation;
- the correlation coefficients between milk yield and milk quality indicators vary by lactation and cannot be used when carrying out breeding work with the herd;
- milk yield for 305 days of the first lactation can serve as a sign of selection during breeding work with the herd.

References

1. A. Gorelik, et al. *Advances in Agricultural and Biological Sciences* **2(1)**, 5-12 (2016)
2. O.V. Gorelik, et al. *Advances in Agricultural and Biological Sciences* **2(1)**, 27-33 (2016)
3. V. Mymrin, O. Loretts, Contemporary trends in the formation of economically-beneficial qualities in productive animals. Digital agriculture - development strategy *Proceedings of the International Scientific and Practical Conference (ISPC 2019) Advances in Intelligent Systems Research* 511-514 (2019)
4. S. Gridina, V. Gridin, O. Leshonok, *Advances in Engineering Research*, 253-256 (2018)
5. N. Bogolyubova, V. Korotky, A. Zenkin, V. Ryzhov, N. Buryakov, *OnLine Journal of Biological Sciences*, **17(2)**, 121-27 (2017)
6. N. Bogolyubova, V. Romanov, V. Korotky, V. Ryzhov, A. Zenkin, *Asian Journal of Pharmaceutical and Clinical Research*, **10(10)**, 117-20 (2017)
7. O.V. Gorelik, et al., *IOP Conf. Ser.: Earth Environ. Sci.* **548**, 082009 (2020) doi:10.1088/1755-1315/548/8/082009
8. O.V. Gorelik, et al., *IOP Conf. Ser.: Earth Environ. Sci.* /10.1088/1755-1315, /548/8/082013 (2020)
9. V.F. Gridin, S.L. Gridina, K.V. Novitskaya, *Agrarian Bulletin of the Urals*, **8(187)**, 34-38 (2019)
10. S.L. Gridina, V.F. Gridin, D.V. Sidorova, K.V. Novitskaya, *Achievements of science and technology of the agro-industrial complex*, **32(8)**, 60-61 (2018)
11. S.L. Gridina, V.F. Gridin, O.I. Leshonok, L.V. Guseva, *Agrarian Bulletin of the Urals*, **8(175)**, 30-34 (2018)
12. V.F. Gridin, S.L. Gridina, O.I. Leshonok, K.V. Novitskaya, *Issues of regulatory regulation in veterinary medicine*, **4**, 222-225 (2018)
13. I.M. Donnik, I.A. Shkuratova, L.V. Burlakova, V.S. Mymrin, V.S. Portnov, A.G. Isaeva, O.G. Lorets, M.I. Barashkin, S.N. Koshelev, G.U. Abileva, *Agrarian Bulletin of the Urals*, **1(93)**, 24-26 (2012)
14. O.G. Loretz, *Agrarian Bulletin of the Urals*, **9(127)**, 34-37 (2014)
15. O.G. Loretz, O.E. Likhodeevskaya, *Agrarian Bulletin of the Urals*, **1(119)**, 44-46 (2014)
16. O.G. Loretz, M.I. Barashkin, *Veterinary pathology*, **40(2)**, 113-115 (2012)