

Influence of the age of the first insemination on the milk production of cows

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Abstract. The article presents the results of milk productivity and quality indicators of milk, depending on the age of the first insemination. The results obtained showed that under the conditions of the Izhagroplem Research and Production Complex of the Izhevsk State Agricultural Academy, it is necessary to inseminate replacement heifers at the age of 14-15 months upon reaching a live weight of 545 kg, which will allow you to get the first calving at the age of 23-24 months. **Key words.** Dairy cattle breeding, cows, milk productivity, calving.

1 Introduction

Ensuring people's nutrition is a major problem for society nowadays. A comprehensive approach to this problem is required. One of the main sectors of animal husbandry is cattle breeding, which enables the production of high-value foodstuffs. Thanks to dairy cattle breeding, the population is provided with foodstuffs such as milk, beef and veal, and products of their processing, as well as raw materials for the tanning industry by one third [1, 2].

The milk productivity of cattle is the amount of milk produced by a cow over a given period of time: a day, a week, a month, and a lactation. It is one of the main indicators of economic efficiency of a farm in animal husbandry. It is evaluated for each cow and for the entire herd. The milk production rate of cows depends on many factors and can vary upwards or downwards.

Intensive work on the level of dairy productivity in enterprises is carried out by providing animals with optimal conditions. On the basis of scientific data, differences in milk productivity are revealed to be caused by conditions of feeding and keeping animals under different technological methods and the level of selection and breeding work with cattle breeds [3-6].

In the practise of pedigree work, a comprehensive assessment of animals is applied according to many indicators: origin, exterior and body type, productivity and quality of offspring. However, animals can only be evaluated on the basis of direct performance parameters once they have reached adulthood and require optimal environmental conditions. Practically, the question of animal assignment is decided at an early age, and therefore the development of methods for predicting the productive and breeding qualities of animals is of great importance.

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The dairy performance of the cattle is directly influenced by the age of the cows, which is of no small importance and affects the economic performance of the farm. The age of the cows is influenced by most of the breeding factors [7, 8].

The longevity of cows has an impact on the level of dairy productivity on farms. Farms that breed dairy cows often use only three or four lactations and drop out of the herd before reaching their highest productivity. Therefore, lengthening the period of their productive use is one of the current problems of dairy cattle breeding. It should be noted that positive results were obtained with a longer use of highly productive cows; this allows for extended herd reproduction and a significant increase in farm productivity [9-10].

The age of first insemination and the age of first calving, from which the period of intensive use of cows begins, affect their productive longevity. Therefore, it is necessary to identify the optimal date for the first insemination of cattle, which allows the production to be carried out over a long period of time.

The main challenge today is to increase milk production and improve the efficiency of dairy farming. This is influenced by the acceleration of the rate of improvement of animal breeds. Dairy cattle breeding facilities use aspects such as improving the reproductive capacity of animals, housing, and feeding methods. Many scientists have found that animal breeding increases the milk productivity of cows.

One of the most important conditions for the development of dairy cattle breeding is rationally organised herd reproduction. The reduction in the nonproductive period due to early insemination of cows is relevant only when combined with good indicators of increased dairy productivity [11-12].

The age of cow use is of great importance for the practice of dairy cattle breeding, as early culling of cows leads to under-milking, and late culling leads to a decrease in the genetic development of the herd.

Some researchers point out that dairy cattle breeding depends on herd reproduction and therefore depends on breeding and genetic work with animals. The age of first insemination is an important factor influencing future cow productivity. Researchers believe that young cows give 70-80% of the milk yield of full-grown cows. At the same time, if heifers are covered very early, their development is delayed and subsequent milk production is reduced. Late heifer cover is not desirable for economic reasons.

The main prerequisite for increasing the economic efficiency of dairy farming is to maximise cow productivity and milk quality while reducing the cost of milk production.

Scientists have been working and dedicating decades of research to studying the factors affecting dairy cow productivity. The technological and organisational-economic model of milk production includes the following main blocks: technology of animal housing, feeding of dairy cattle, reproduction, primary processing, and sale of milk.

Studies of specialists show that numerous factors, such as feeding, housing, technological methods of animal breeding, age of first insemination, age of first calving, duration of dry period of cows and others, influence milk productivity [13-14].

The aim of the investigation was to investigate the effect of the age of first insemination on cows' dairy performance.

The following objectives were set to fulfil the objective:

1. To trace the age dynamics of changes in milk production;

To study the influence of the age of first insemination on milk productivity and cow milk quality.

2 Materials and methods

The researches were carried out in the scientific research center "Izhagrolep" of the Izhevsk State Agricultural Academy, the object of the research were black-motley cows.

The investigation was carried out using the data of the primary zootechnical record, the program "SeleX: Dairy Cattle", the annual reports on economic activity and the results of own researches.

3 Results and discussion

Dairy productivity is influenced by many factors, most of which act cumulatively, so it is difficult to establish the measure of influence of each of the factors separately. However, special studies have been able to identify the importance of some factors, which is very important for breeding to improve the milk productivity of cattle. The age of cows has a definite influence on the level of milk productivity.

The age dynamics of changes in milk productivity by boning is presented in Table 1.

Table 1. Characteristics of cows by milk production and live weight in 305 days of last completed lactation.

Groups of animals	Milk yield, kg	Milk fat		Milk protein		Live weight, kg
		%	kg	%	kg	
The entire livestock	8291	3.89	322.7	2.97	246.3	579
1 lactation	7593	3.96	299.3	2.98	226.0	550
2 lactation	8716	3.94	337.2	2.95	257.4	582
3 lactation and older	8862	3.81	345.5	2.97	263.5	610

Analysis of the cow population in dynamics showed that the milk yield of cows in the third lactation and older was 8,862 kg of milk, which was 146 kg higher than in cows in the second lactation and 571 kg in first-calf cows. The mass contents of fat and protein in the milk of fresh cows are higher than in other groups and amount to 3.96 kg and 2.98 kg, respectively. The amount of fat in milk and protein content are higher in the third lactation and older lactations and are 345.5 kg and 263.5 kg, respectively.

Figure 1 shows the distribution of cows in the herd according to fat content in milk.

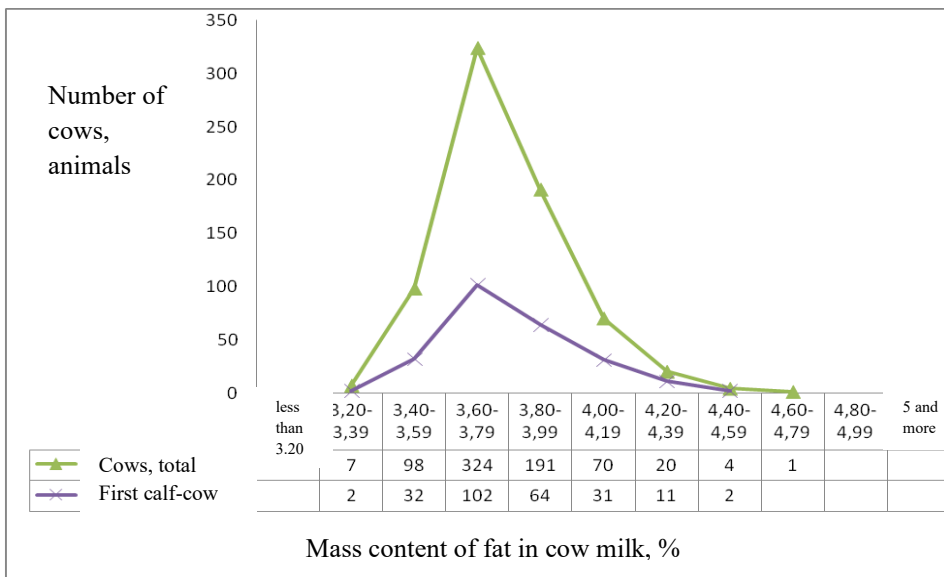


Fig. 1. Distribution of cows in the herd according to milk fat content.

Analysis of the cow distribution in the herd by fat content in milk showed that this index among all cows varies in the range of 3.22 % - 4.70 %. In the last completed

lactation, 85.3 % of the cows had a fat mass content in milk that corresponded to the breed standard or higher, and in 14.7 % of the cows the fat content in milk was below the breed standard. Among first-calf cows, the mass content of fat in milk was observed below the standard in 34 cows, that is 13.9 %.

Figure 2 shows the distribution of cows in the herd in terms of protein content in milk.

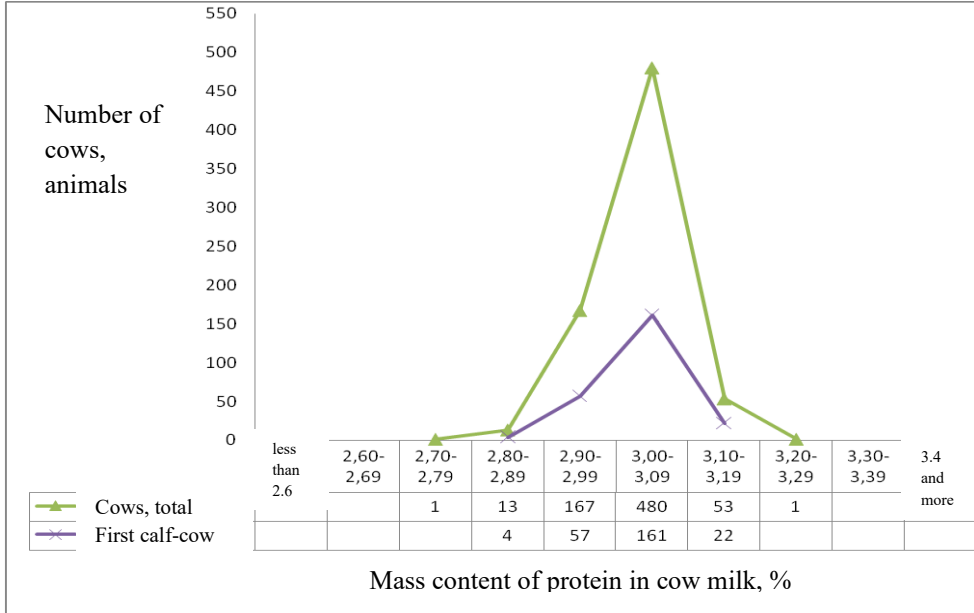


Fig. 2. Distribution of cows according to protein content in milk.

The mass content of protein in milk varies in the range of 2.7-3.22% between all cows in Figure 2, with 25.3% of the cows having a protein content below the breed standard. The mass content of protein in milk varies in the range of 2.8-3.19% among first cows, in 75.0% of first cows the index is within the standard of the breed and above.

Thus, we can say that there is a gradual increase in the level of productivity of cows with age in lactations, so there is an increase in productivity from the second lactation compared to the first heifers. In general, the level of milk productivity of the herd under study is considered rather high.

In cattle breeding, one of the main economic and breeding traits is the milk productivity of cows. It depends on a large number of factors such as genetic and paratypical aspects, one of the main ones being the age of the heifers at first insemination.

Milk production is characterised by the quantity and quality of milk produced by the cows. The main indicators characterising the quality of milk are the fat and protein content and quantity, and the milk production ratio. The authors state that the age of the first insemination of animals has an impact on the quality indicators of milk, namely, fat and protein content in milk.

The cows were selected for the study after first calving. All animals were kept in optimal conditions of confinement and feeding as required.

The animals were selected into experimental groups and the age at first insemination was taken into account.

Table 2 presents data on milk production and milk quality according to the age of first insemination.

Table 2. Dairy productivity and milk quality indicators according to age of first insemination.

Characteristics	Gradation of age at first insemination, months			
	14-15	16-17	18-19	20+
305 days of first lactation, kg	8739±107	8653 ±106	8530 ± 101	8365.5
Fat mass content, %	3.89 ± 0.01	3.87 ± 0.02	3.88 ± 0.01	3.79
Protein mass content, %	2.99 ± 0.01	2.98 ± 0.01	2.98 ± 0.02	2.97
Quantity of milk fat, kg	339.65 ± 45.69	335.45 ± 52.12	331.23 ± 49.52	317.10
Quantity of milk protein, kg	261.32 ± 32.56	257.85 ± 41.56	254.19 ± 23.25	248.45
Live weight, kg	545 ± 12.65	548 ± 11.36	550 ± 10.25	553
Dairy ratio	1603.57 ± 125.21	1597.11 ± 113.51	1550.91 ± 123.54	1512.75

Analyzing the data in Table 2, we see that the optimal age for the first insemination of heifers is 14-15 months, so the milk productivity of cows inseminated at this age is higher compared to the milk productivity of cows of other ages. The yield of cows inseminated at the age of 14-15 months is 8739.48 kg, which is 86 kg higher than the yield of cows inseminated at the age of 16-17 months and 18-19 months. - at 18-19 months of age were 209 kg. The mass content and fat content are also higher in cows inseminated at 14-15 months of age by 0.02 % and 0.01 % respectively than in cows inseminated at 16-17 months and 18-19 months of age. The milk yield of cows inseminated at 14-15 months of age is 1603.57, which is higher than that of cows inseminated at 16-17 months and 18-19 months of age by 6.46 and 52.66, respectively.

4 Conclusions

Therefore, the research conducted allowed us to conclude that replacement heifers are necessary at 14-15 months of age when the live weight reaches 545 kg, which will enable to have the first calving at the age of 23-24 months under the conditions of the Izhagroplem Scientific and Production Association of the Izhevsk State Agricultural Academy.

References

1. P.D. Gumennikova, *Influence of age of first insemination on dairy productivity and reproductive qualities of cows* (Izhevsk State Agricultural Academy, Izhevsk, 2022)
2. N.I. Romanenko, *Actual issues of biotechnology and veterinary sciences: theory and practice: Proceedings of the national scientific conference of the Institute of Veterinary Medicine* (South Ural State Agrarian University, Troitsk, 2019)
3. G.V. Azimova, Y.V. Isupova, Influence of feeding technology on dairy productivity of black-motley breed cows **11**, 25-29 (2021) DOI 10.30906/1999-5636-2021-11-25-29
4. V.P. Anisimov, E.A. Pshenichnaya, *BIO* **6(249)**, 23-26 (2021)
5. E.M. Kislyakova, *Intensification of milk production on the basis of progressive methods of feeding cows in the conditions of the Udmurt Republic* (Izhevsk State Agricultural Academy, Izhevsk, 2020)
6. E.M. Kislyakova, A.A. Lomaeva, E.V. Achkasova, *Productivity indices of black-motley breed cows when using organic chromium in rations* (Izhevsk State Agricultural Academy, Izhevsk, 2021)

7. A.I. Shendakov, T.A. Shendakova, T.I. Khanina, S.P. Klimova, Improvement of the system of genetic and environmental factors assessment in making parental pairs in dairy cattle **1**, 2-13 (2013)
8. T.A. Russkikh, V.A. Bychkova, *Agrarian science to agricultural production: proceedings of International scientific and practical conference: in 3 volumes* (Izhevsk State Agricultural Academy, Izhevsk, 2019)
9. M.D. Dedov, N.V. Sivkii, *Zootehnia* **10**, 2-4 (2004)
10. S.Yu. Kharlap, O.V. Gorelik, E.Z. Dolova, *Achievements and prospects of national projects of agribusiness development: collection of scientific papers on the VIII International Scientific Conference in memory of Honored Scientist of Russia and KBR* (Kabardino-Balkarian State Agrarian University, Nalchik, 2020)
11. M.S. Vilver, A.S. Vilver, *Actual issues of biotechnology and veterinary sciences: theory and practice: Proceedings of the National Scientific Conference of the Institute of Veterinary Medicine* (South Ural State Agrarian University, Troitsk, 2019)
12. E.N. Martynova, V.A. Bychkova, E.V. Achkasova, *Zootehnika* **2**, 20-21 (2011)
13. A.V. Mardanova, O.S. Utkina, *Technological trends in the sustainable functioning and development of agriculture: Proceedings of the International Scientific-Practical Conference dedicated to the year of science and technology in Russia, Vol. III* (FGBOU VO Izhevsk State Agricultural Academy, Izhevsk, 2021)
14. E.V. Achkasova, *Scientific innovations in the development of branches of agroindustrial complex: Proceedings of the International Scientific and Practical Conference. In 3 volumes, Volume II* (Izhevsk State Agricultural Academy, Izhevsk, 2020)