Dynamics of milk productivity of cows

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Abstract. The research was carried out at the Chutyrsky agricultural production complex in the Igrinsky district of the Udmurt Republic. We considered the milk productivity and quality indicators of milk from Holstein cows. According to the presented results, it was revealed that in the conditions of the Chutyrsky agricultural production complex in the Igrinsky district, the share of cows with a milk yield of 9001–10000 kg of milk is 35.0 %, among first-calf cows it is 22.9 % of the total number of cows tested. In general, the level of milk productivity of the studied herd is assessed as quite high. The mass fraction of fat in the milk of cows varies in the range of 3.20 % - 4.79 %, the mass fraction of protein in the milk of cows varies in the range from 2.7–3.29 % among all tested livestock. The fat and protein content in milk were below the breed standard in 14.7 % and 25.3 % of cows, respectively.

1 Introduction

Dairy cattle breeding is currently focused on the production of high-tech and environmentally friendly food products. Much attention is paid to selection to increase protein in milk. The production of high-quality milk is possible only if conditions such as targeted selection and breeding work, an effective feed production system and balanced feeding are met [1, 2].

Currently, the genetic productivity potential of dairy cows has reached a level of 7000 kg or more. These results were obtained through the use of large-scale selection. Russian dairy farming strives to increase the production of high-quality milk. To increase productivity and improve the economic and hereditary qualities of animals, it requires a combination of external influences with thorough breeding work, subject to livestock farming at a high technical level [2].

Currently, enterprises are intensively working to increase the level of milk productivity by providing animals with optimal living conditions. According to research by many authors, it was found that the milk productivity of cows varies depending on the feeding and maintenance of animals with various technological methods and the level of selection and breeding work with cattle breeds [3,4].

Data obtained by various authors when assessing the level of milk productivity and milk quality show that breed, individual differences, health status, stages of lactation, age, live weight, feeding, keeping the animal, course of lactation, calving period, seasonal changes,

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conditions of obtaining and milk processing on farms have a significant impact on milk productivity and the quality of milk of cows [5-8].

The purpose of the research was to study the dynamics of milk productivity of cows.

To achieve this goal, the following tasks were identified:

1. Study the dynamics of milk productivity of cows;

2. To study the influence of the age of cows (in lactations) on milk productivity and quality indicators of cows' milk.

2 The methodology

The research was carried out in the Chutyrsky agricultural production complex in the Igrinsky district of the Udmurt Republic; the object of the study was Holstein cows. The research was carried out using data from primary zootechnical accounting, the Selex: DAIRY CATTLE program, annual reports on economic activities and the results of our own research.

3 The results of the research

The milk productivity of cows in a herd varies depending on a wide variety of factors. Therefore, dairy producing farms need to take into account the direction in which they need to work in order to identify the influence and significance of some factors that are very important for selection to increase the milk productivity of cattle.

The dynamics of changes in the main indicators of milk productivity are presented in Figure 1.

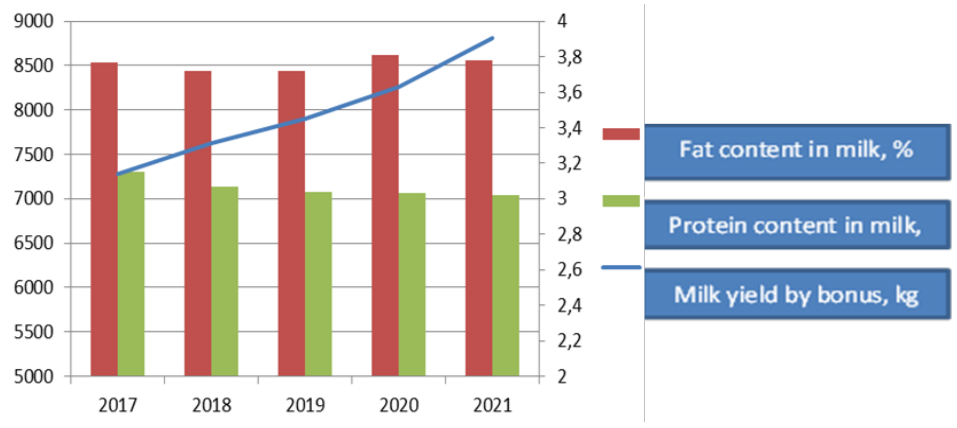

Fig. 1. Dynamics of changes in dairy productivity of cows.

The average milk yield from one cow increases annually, so since 2017, according to the report on breeding work, by 1527 kg (20,96 %) and amounted to 8811 kg of milk. According to the results of the breeding work report, the fat and protein content in milk changed slightly and in 2021 amounted to 3,78 % and 3,02 %, respectively. At the same time, milk fat production over the past five years has increased by 57,7 kg or 20,9 %. In the agricultural production complex "Chutyrsky" of the Igrinsky district, milk yield is systematically increasing, the mass fraction of fat and protein in milk changes slightly.

Figure 2 shows a graph of the distribution of cows in the herd depending on milk yield for the last completed lactation.

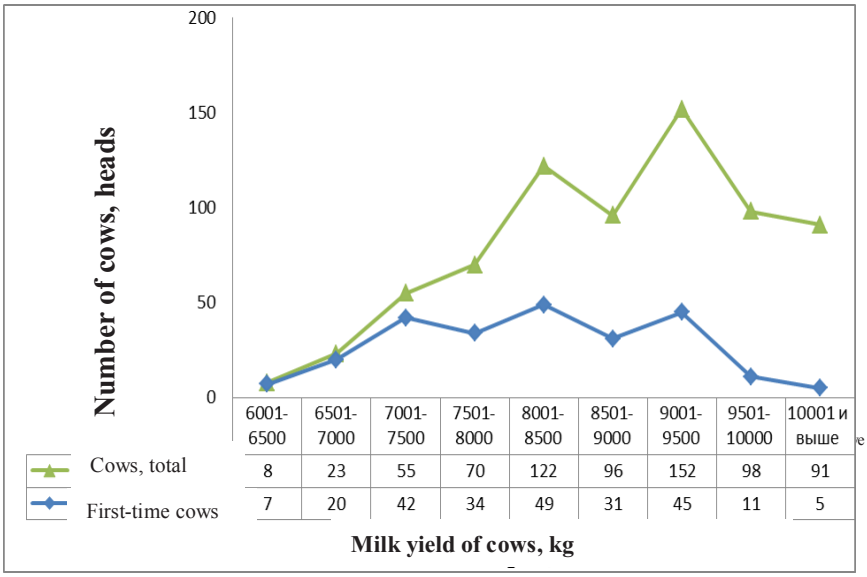

Fig. 2. Distribution of cows in the herd depending on milk yield.

The cow distribution graph shows that the number of highly productive animals in the herd is increasing. The share of cows with a milk yield of 9001–10000 kg of milk is 35,0 %, and with a milk yield of over 10000 kg of milk 12,7 % of the total number of cows tested, among first-calf cows 22,9 % and 6,6 %, respectively.

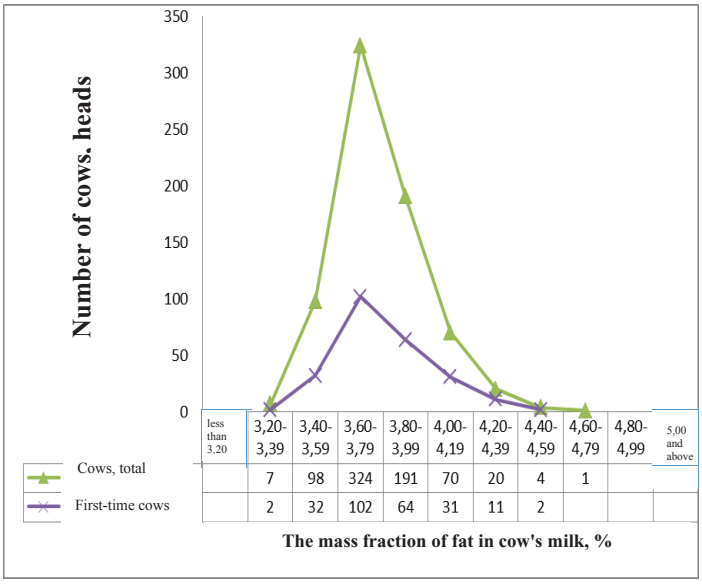

Fig. 3. Distribution of cows in a herd depending on the fat content in milk.

Figure 3 shows the distribution of cows in the herd by fat content in milk. Analysis of the distribution of cows in the herd by fat content in milk showed that this indicator among all tested cows varies in the range of 3,20 % - 4,79 %. According to the last completed lactation, 85,3 % of cows had a mass fraction of fat in milk corresponding to the Holstein

breed standard and above, 14,7 % of cows had fat content in milk below the breed standard. Among first-calf cows, the mass fraction of fat in milk below the standard requirements is observed in 34 heads, which is 13,9 %.

For these animals, it is necessary to select producers with high genetic potential for this indicator and with high breeding value according to MFA. Figure 4 shows the distribution of cows in the herd according to the protein content in milk.

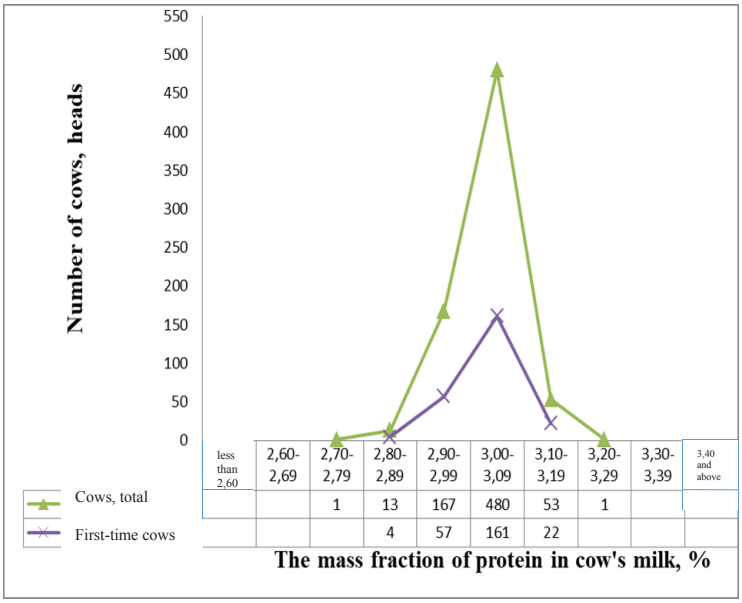

Fig. 4. Distribution of cows depending on the protein content in milk.

The mass fraction of protein in milk varies among all tested livestock ranging from 2.7–3.29%, while 25.3% of cows have this indicator below the requirements of the breed standard. Among first-calf cows, the mass fraction of protein in milk varies between 2.8–3.19%; in 75.0% of first-calf heifers this indicator is within the breed standard or higher.

Subsequently, an analysis of milk productivity was carried out depending on the age of the cows (based on the last completed lactation), the results are presented in Table 1.

Table 1. Milk productivity of cows depending on age (according to the last completed lactation).

Age in lactation	Number of cows	Milk yield, kg	Fat content		Protein content	
			%	kg	%	kg
1	280	8009.7 ±57.6	3.80 ±0.01	304.7 ±2.4	3.01 ±0.003	241.3 ±1.7
2	212	8856.8 ±80.4	3.75 ±0.01	332.7 ±3.0	3.02 ±0.004	267.6 ±2.4
3	175	9113.3 ± 86.9	3.77 ± 0.02	343.8 ± 3.4	3.02 ± 0.01	275.0 ± 2.6
4	106	9352.7 ± 105.0	3.74 ± 0.02	349.0 ± 4.0	3.00 ± 0.01	280.5 ± 2.9
5	63	9248.7 ± 143.5	3.76 ± 0.02	347.2 ± 6.1	3.01 ± 0.01	278.1 ± 4.3
6	33	8839.2 ± 180.8	3.76 ± 0.03	331.6 ± 6.2	3.01 ± 0.01	265.9 ± 5.4
7	13	8410.1 ± 239.5	3.79 ± 0.07	318.8 ± 9.7	2.98 ± 0.02	250.8 ± 7.8
8	2	7291.0 ± 1764.0	3.95 ± 0.15	280.1 ± 125.8	3.01 ± 0.05	213.9 ± 64.5
9	3	8117.5 ± 1824.5	3.89 ± 0.13	317.9 ± 81.3	3.00 ± 0.04	244.2 ± 57.9
The average for the herd	887	8707.4 ±40.6	3.77 ±0.007	328.4 ±1.6	3.01 ±0.002	262.3 ±1.2

An analysis of the milk productivity of the herd cows depending on their age during lactation showed that milk yield for 305 days of lactation increases with age and the maximum milk yield was obtained from cows in the 4th lactation - 9353 kg, and from these cows the largest amount of milk fat (349 kg) and milk protein (280.5 kg). Starting from the 6th lactation, there is a gradual decrease in milk productivity, and the number of cows at the age of 7-9 lactation is minimal. The milk yield of first-calf heifers in the herd is 92% of the average milk yield for the herd and 85.6% of the milk yield of cows of the fourth lactation, this indicates the good productive qualities of the animals of the new generation of the herd. In general, the level of milk productivity of the studied herd is assessed as quite high.

4 Conclusion

Thus, the research carried out allowed us to conclude that in the conditions of the agricultural production complex “Chutyrsky” of the Igrinsky district of the Udmurt Republic, the share of cows with a milk yield of 9001–10000 kg of milk is 35,0 %, among first-calf cows 22,9 % of the total number of cows tested. The mass fraction of fat in milk among all tested cows varies in the range of 3,20 % - 4,79 %. At the last completed lactation, 85,3 % of cows had a mass fraction of fat in milk corresponding to the standard of the Holstein breed and higher. The mass fraction of protein in milk varies among all tested livestock ranging from 2,7–3,29 %. Among first-calf cows, the mass fraction of protein in milk varies between 2,8–3,19 %; in 75,0 % of first-calf heifers this indicator is within the breed standard or higher. The fat and protein content in milk were below the breed standard in 14,7 % and 25,3 % of cows, respectively. The highest milk yield was obtained from cows of the 4th lactation – 9353 kg; these cows also produced the largest amount of milk fat (349 kg) and milk protein (280,5 kg). According to the nature of the lactation curve, the cows of the herd belong to type I - with high stable lactation; in the first 1-2 months after calving, maximum productivity is achieved, which persists for a long time; its decline before launch is slow, the lactation curve is smooth. In general, the level of milk productivity of the studied herd is assessed as quite high.

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