

Productivity and milk quality indicators of cows of the created “Bashkir type” black-and-white breed with the introduction of the balanced energy complex “Felucen K1-2” into the diet

Ildar Akmukhametov¹, Azat Nigmatyanov^{2*}, and Khamit Tagirov¹

¹Bashkir State Agrarian University, Ufa, Russia

²Ufa State Petroleum Technological University, Ufa, Russia

Abstract. The volume and quality of milk are the determining indicators of the efficiency of dairy farming. The diet of dairy cows has a significant impact on the biological parameters of milk productivity and production characteristics of milk. The work was carried out to determine the optimal dosage of the energy complex "Felucen K1-2" in the diet of cows of the created "Bashkir type" black-and-white breed in the conditions of the agricultural production complex "Hero" of the Chekmagushevsky district of the Republic of Bashkortostan. To achieve this goal, milk productivity was determined for 100 days of lactation, for 305 days, and also determined the dynamics of average daily milk yield by month of lactation. For the experiment, 48 cows were selected, divided into 4 groups of 12 animals each. The energy complex “Felucen K1-2” was added to the diet of cows in the experimental groups in the amount of 250 g, 300 and 350 g of the additive per animal per day. The results of the studies indicate an increase in the mass fraction of fat and protein in milk from cows that consumed the energy complex. This is observed both in dynamics over the months of the experiment and in the total amount for the entire period of research. The use of the additive in the diet of animals showed its effectiveness and contributed to an increase in milk yield per cow and improvement in the quality of milk, while the maximum effectiveness was observed at an average dosage (300 g per day per cow).

1 Introduction

Dairy cattle breeding plays a key role in the agricultural economy and provides a significant contribution to the overall structure of agricultural production and plays one of the key roles in ensuring food security of the Russian Federation. Efficient milk production is of significant economic importance and affects the sustainability of agricultural enterprises [1-5]. The problem of balancing diets using feed additives is the focus of attention of all milk producers. One of the key tasks in the cattle feeding system is the development of diets that,

* Corresponding author: nigmatjanov@mail.ru

in combination with other elements of the livestock system, would maximize the potential productive capabilities of cows [1-7].

Supporting cows during periods of increased energy stress by introducing specialized energy supplements helps to increase their productivity [3-5].

In the course of our research, we set ourselves the task of assessing the impact of the new complex additive "Felucen K1-2" and determining its optimal dosage through an analysis of the milk productivity of "Bashkir type" black-and-white cows.

As a working hypothesis, we assumed that the biological effect of the energy feed complex "Felucen K1-2", which includes vegetable proteins, vegetable fats and easily fermentable carbohydrates, is to enhance metabolic processes in the body of animals by providing easily accessible, vital nutrients, which will increase milk productivity of cows. However, the fat and protein content in cows' milk, as well as the dose of energy supplements in the animals' diet, needed clarification.

2 Materials and methods

Object of study: 12 cows of the created "Bashkir type" black-and-white breed, aged 2.5-3 years. The research material was the energy feed complex "Felucen K1-2".

Animal care and experimental research were carried out in strict accordance with the instructions and recommendations of Russian regulations, in particular with Order of the USSR Ministry of Health No. 755 of August 12, 1977 "On measures to further improve organizational forms of work using experimental animals," as well as according to Guide for the Care and Use of Laboratory Animals (National Academy Press, Washington, D.C., 1996). During the research, measures were taken to minimize animal suffering and to optimally reduce the number of prototypes used.

Experimental design. To achieve the intended goal, an experiment was carried out in the production conditions of the agricultural production complex Hero of the Chekmagushevsky district of the Republic of Bashkortostan in the period 2022-2023, according to the scheme presented in Table 1.

Table 1. Scheme of the experiment.

Group	Number of animals, heads	Features of feeding
		Duration of the experiment – 305 days.
control	12	Basic diet (BD)
I experienced	12	BD + 250 g of energy feed complex "Felucen K1
II experienced	12	BD + 300 g of energy feed complex "Felucen K1
III experienced	12	BD + 350 g of energy feed complex "Felucen K1

To conduct the experiment, control and experimental groups of animals were formed, kept in the same conditions. Feeding of animals was carried out in accordance with the approved scheme on the farm, and the feed used was produced on the territory of the farm. The main diet included mixed grass, alfalfa and forb hay, corn silage, compound feed and molasses. The diets were developed taking into account the milk yield, age and body weight of the cows, as well as with different dosages of the energy supplement "Felucen K1-2". The cows' balanced diets met detailed feeding standards, taking into account the actual energy and nutrient content of the feed.

Monthly in a sample of milk from cows of all experimental groups, selected in accordance with GOST 26809-86. Qualitative indicators of milk, such as fat and mass fraction of protein, were determined on a Clover-2 analyzer.

Statistical processing. To analyze the data obtained as part of the experiment, the software package "Statistica 10" from the company "Stat Soft Inc." was used. (USA). Results are presented in the form of mean (M) and standard error of the mean (m). To assess the statistical significance of differences between the compared indicators, Student's t-test was used. Values were considered statistically significant at a significance level of $P \leq 0.05$.

3 Results

As a result of the studies, it was established that the use of the energy complex "Felucen K 1-2" had a significant impact on the milk productivity of cows and the quality indicators of milk, in particular the mass fraction of protein and fat of cows (Figure 1). The largest volume of milk in the first 100 days of lactation and average daily milk yield were achieved in cows consuming the energy complex "Felucen K1-2". In animals from groups II, III and IV, the level of productivity, in comparison with the control (first) group, was higher by 60.3 kg (2.15%; $P < 0.01$), 112.4 kg (4.00% ; $P < 0.001$) and 98.0 kg (3.49%; $P < 0.001$). At the same time, the quality indicators of milk also improved.

An intergroup analysis of the mass fraction of fat and protein in the milk of experimental animals revealed an advantage for cows consuming the Felucene K1-2 energy complex. So, over 100 days of lactation, the fat content in the milk of cows of group I was 3.91%, in group II 3.93% (an increase of 0.02% to the control group), in group III 3.96% (an increase of 0.05% to control group) and in group IV 3.95% (an increase of 0.04% to the control group).

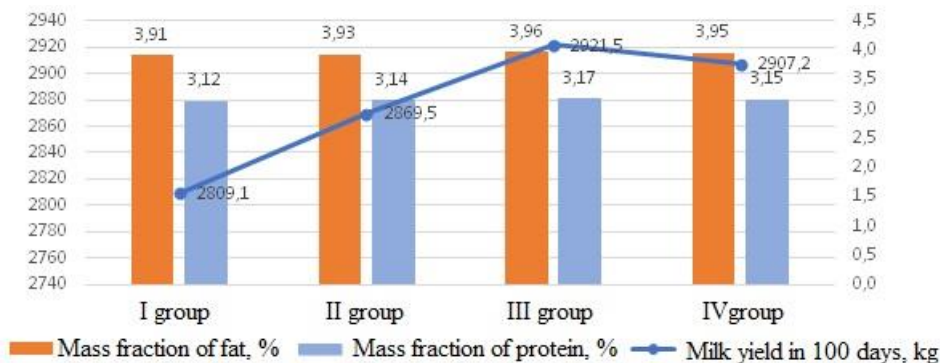


Fig. 1. Dynamics of milk yield and quality indicators of milk depending on the amount of "Felucen K 1-2" in the diet of cows for 100 days of lactation.

Similar dynamics were noted for the mass fraction of protein. Thus, in the milk of group I cows the protein content was 3.12%, and the use of an energy supplement contributed to an increase in milk protein content; in group II the increase was 0.02% compared to the control group, in group III the increase was 0.05% compared to the control group and in IV group 0.03% to the control group.

Further studies showed that the use of the energy supplement "Felucen K1-2" aggravates intergroup differences and over 305 days of lactation the differences between groups were more significant (Figure 2).

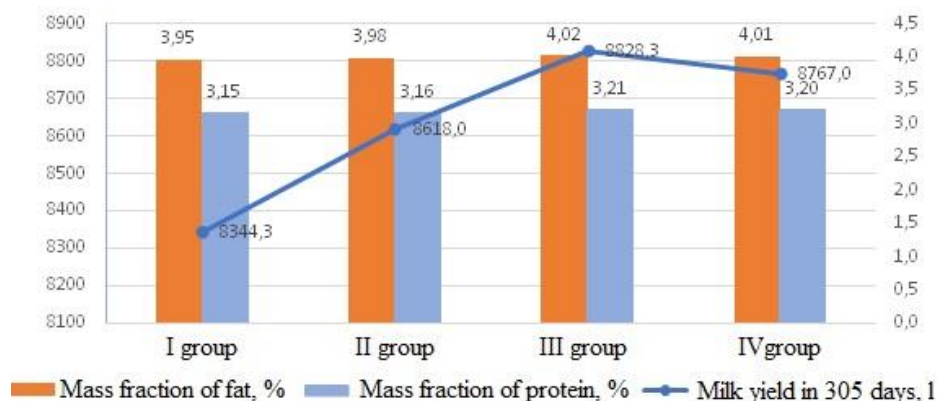


Fig. 2. Dynamics of milk yield and quality indicators of milk depending on the amount of "Felucen K 1-2" in the diet of cows for 305 days of lactation.

The highest milk yield was observed in cows of the experimental groups receiving the energy supplement "Felucen K1-2" in their diet. Milk yield for 305 days of lactation in the first (control) group was 8344.3 kg, in the second group the increase was 273.6 kg (3.28%) compared to the control group, in the third group 484.0 kg (5.80%) compared control group and fourth group 423.3 kg (5.07) compared to the control group. It should be noted that the use of an energy supplement contributed not only to an increase in milk yield, but also to an improvement in the quality of milk. If in the first group the fat content of milk was 3.95%, then in group II its content increased by 0.03%, in group III 0.07% compared to the first group, and in group IV the increase was 0.06% compared to the control . Similar changes were noted in the mass fraction of protein in milk: in group I its content was 3.15%, in the second 3.16%, in group III 3.21% and in group IV 3.20%. The advantage of the third group in both quantity and quality of milk became even more obvious.

The use of an energy supplement in various dosages led to changes in such indicators as average daily milk yield and milk yield ratio (Table 1)

Table 2. Average daily milk yield and milk production rate of cows.

Index	Group			
	I	II	III	IV
Average daily milk yield, kg	27.37±0.30	28.26±0.22	28.95±0.29	28.75±0.23
Milk coefficient	1584.77±20.43	1635.42±13.19	1674.71±13.39	1663.26±14.20

Predictably, in the experimental groups the average daily milk yield was the highest compared to the first (control) group. In group I, for the entire lactation period, the average daily milk yield was 27.37 kg, in the second experimental group this figure increased by 0.89 kg (3.25%), in group III it correspondingly increased by 1.58 kg (5.77%) and in the IV experimental group by 1.38 kg (5.04%).

The milk production rate reflects the amount of milk yield per hundred kilograms of live weight. The calculation showed that cows from the experimental groups demonstrated a higher milk yield compared to animals in the control group. Cows of group II were superior in this indicator by 50.65 kg (3.20%), group III by 89.94 kg (5.68%) and group IV by 78.49 kg (4.95%). The results of the analysis of the milk production coefficient indicate the superiority of cows consuming the energy supplement, which indicates more active metabolic processes in their bodies.

4 Discussion

Of course, dairy farming, like any branch of agriculture, is under significant pressure from external negative factors such as: increased economic costs in the production of feed; climate change, reflected in extremely high variability in ambient temperature, leading to an increase in the frequency of weather anomalies such as droughts or floods, which significantly affects the quality of feed and living conditions of animals; Growing environmental requirements for production create the need to introduce new technologies; instability of wholesale and retail prices for milk and dairy products creates economic uncertainty for milk producers [8-10]. The use of the feed energy additive "Felucen K1-2" allows for more efficient use of existing feed, thereby reducing the cost of feeding animals, which ultimately leads to a decrease in the environmental pressure of dairy farming on the environment, a reduction in greenhouse gas emissions and a reduction in the amount of waste per unit products.

The productivity of cows and the quality of the resulting milk naturally changed under the influence of the Felucen K 1-2 additive, which had a positive effect due to the enrichment of the diet with the necessary energy components, essential amino acids, vitamins, macro and microelements contained in the additive.

5 Conclusion

Thus, the energy feed complex "Felucen K1-2", introduced into the diet, improves the productive performance of the created "Bashkir type" black-and-white breed, increases the fat content and protein content of milk. In this case, the most optimal dosage of the tested additive is 300 g per 1 animal per day.

References

1. I.Yu. Kuzmina, L.S. Ignatovich, Enrichment of young cattle diets with natural biologically active feed additive, *Agricultural Science of the Euro-North-East*, **22**, **1**, 94-103 (2021) DOI 10.30766/2072-9081.2021.22.1.94-103
2. E.Kh. Latypova, I.V. Mironova, The influence of vitamin and mineral supplements in the diet of cattle feeding on the quality of milk and dairy products, *Equipment and technologies in animal husbandry*, **4**, **52**, 42-47 (2023) DOI 10.22314/27132064-2023-4-42
3. Kh.Kh. Tagirov, I.V. Mironova, I.F. Vagapov, E.Kh. Latypova, Milk productivity of cows of the created type "Bashkir" of the black-and-white breed when fed the premix "Megamix-Optilak", *Zootechnics*, **11**, 10-12 (2023) DOI: 10.25708/ZT.2023.16.46.003
4. I.M. Faizullin, E.R. Khalirahmanov, Productivity of cows when included in the diet of the energy feed complex "Felucen", *Materials of the 1st International Scientific and Practical Conference "Status and Prospects for Increasing the Production of High-Quality Agricultural Products" jointly with the Institute of Livestock Husbandry of the Tajik Academy of Agricultural Sciences and the Bashkir State Agrarian University*, Ufa, 187-190 (2017)
5. E.R. Khalirahmanov, I.M. Faizullin, R.R. Sayfullin, The influence of the energy feed complex "Felucen" on the protein content in the milk of black-and-white cows, *Materials of the 1st International Scientific and Practical Conference "State and Prospects for Increasing the Production of High-Quality Agricultural Products" jointly*

- with the Institute of Livestock Husbandry of the Tajik Academy of Agricultural Sciences and the Bashkir State Agrarian University, Ufa, 206-209 (2017)
6. M. Ahmad, Effect of Different Vitamins and Mineral Premix Supplementations on Milk Yield and Composition in Dairy Cows, *Jammu Kashmir Journal of Agriculture*, **2, 2**, 23-32 (2022)
 7. V. Bhatshwar, Raw Milk Quality and Udder Health Status of Lactating Crossbred Sahiwal Cows Supplemented with β -carotene Enriched Mineral-Vitamin Premix (2021)
 8. J.B. Daniel, S.K. Kvidera, J. Martin-Tereso, Total-tract digestibility and milk productivity of dairy cows as affected by trace mineral sources, *Journal of dairy science*, **103, 10**, 9081-9089 (2020)
 9. E.S. Houdek, A.R. Hazel, N. Lopez-Villalobos, L.B. Hansen, B.J. Heins, Lactation curves of Montbéliarde-sired and Viking Red-sired crossbred cows and their Holstein herdmates in commercial dairies, *Journal of Dairy Science* In Press Accepted Manuscript Published online: January 19 (2024)
 10. S. Sterup Moore, A. Costa, M. Penasa, M. De Marchi, Effects of different temperature-humidity indexes on milk traits of Holstein cows: a 10-yr retrospective study, *Journal of Dairy Science* In Press Accepted Manuscript Published online: January 19 (2024)