SCIENTIFIC AND ECONOMIC JUSTIFICATION OF APPLICATION OF SYMBIOTIC POLYCOMPONENT FODDER ADDITIVE IN FEEDING HIGH PRODUCTIVE COWS

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Abstract. Research has been carried out on the use of the symbiotic "Rumimaster" in balanced diets of highly productive cows in the conditions of the breeding plant "Kirovskaya meadow-bog experimental station". The experiment was carried out on two groups of animals in the middle of lactation with a duration of 90 days. The inclusion of the feed additive "Rumimaster" in the diet of experienced cows contributed to an increase in the gross production of natural and 4% fat milk by 124.5 kg and 128.4 kg, the yield of milk fat and milk protein by 5.2 and 4.1 kg, respectively. ... The differences between the groups for these parameters were in the range of 5.1-5.7%. The productivity of cows for 305 days of lactation in the experimental group was higher than in the control by 7.5%.

The symbiotic "Rumimaster" promoted the activation of digestion processes, which was reflected in the increase in the time of feed consumption and the duration of the chewing gum. The cows of the experimental group showed an increase in the level of digestibility of the main nutrients. In terms of the digestibility of crude protein and crude fiber, the experimental group of cows significantly exceeded the indicators of the control group by 3.3 and 3 absolute percent, respectively. The blood biochemical parameters of the animals of the experimental and control groups were within the physiological norm. The economic evaluation of the research results showed the effectiveness of the use of the symbiotic "Rumimaster" in the diets of lactating cows, which was expressed in the receipt of additional profit from one cow in the amount of 1,344.79 rubles for the period of experience and an increase in the profitability of milk production by 2.1 absolute percent.

Keywords: highly productive cows, lactation, feeding, feed additive, symbiotic, milk production, digestion, digestibility, blood biochemical parameters, economic efficiency.

1. Introduction

The intensive development of dairy cattle breeding currently creates new requirements for complete and balanced feeding of highly productive cows. Feeding high-yielding lactating cows with balanced diets in accordance with modern detailed norms at different physiological stages allows you to preserve the health of animals, extend the period of economic use, get a healthy offspring and the maximum possible milk production per lactation [3,4,14].
An imbalance in diets can lead to a decrease in the productivity of animals, overconsumption of feed per unit of production, an increase in prime cost and, ultimately, to a decrease in the efficiency of the industry [14, 16].

The use of a limited set of feed, violations in the feed preparation technology, improper grinding of feed means, bad weather conditions, stresses in animals during the cultivation and keeping technology, all this can lead to inaccessibility or poor digestibility of nutrients in the diet [17].

In this regard, the use of feed additives in modern conditions is not only a recommendation, but a prerequisite for the effective operation of the livestock industry [1, 10].

Feed additives replenish missing nutrients, improve the process of digestion of feed by animals, make it possible to obtain healthy, viable offspring from them, and also protect them from many diseases. The inclusion of biologically active additives in the diet stimulates the processes of cicatricial digestion, maintaining the optimal level of metabolism, metabolic processes in the body of animals and, as a result, provides high milk productivity [6, 15].

In numerous experiments, it has been proven that the use of appropriate feed additives for the missing elements of the ration significantly increases the efficiency of the use of feed nutrients and the level of animal productivity [12].

The use of antibiotic feed additives in feeding highly productive animals as growth and productivity stimulants has been banned by the European Union since 2006 [8].

In this regard, the search for alternative antibiotic feed additives to prevent health problems, improve productivity and economic efficiency is devoted to products of the microbiological industry - probiotics, phytopgenic compounds, prebiotics, organic acids and other feed products [5, 13].

In the classification of feed additives, a group of drugs with complex action is distinguished, which contributes to better breakdown and assimilation of nutrients. Combined action drugs include symbiotics - multicomponent complexes that include probiotics and prebiotics, the simultaneous action of which has an enhancing effect on the metabolism in the animal's body [1, 6, 7].

Symbiotic microflora is essential in the digestion processes of ruminants, as it facilitates the digestion of bulky feed. The relationship between the microflora and the animal is relatively constant, but its balance depends on the physiological and immune status of the animal, the amount and type of food, and the biochemical activity of microbes [1, 4]. As a result of complex biochemical processes occurring in the gastrointestinal tract of ruminants, microorganisms, assimilating the incoming nutrients, grow and rapidly increase their biomass. Inhabitants of the rumen decompose cellulose and hemicellulose of feed with the formation of energy substrates for their own growth and an increase in the microbial population, the synthesis of volatile fatty acids [1, 2, 5].

According to many authors, the participation of symbiotic microorganisms in nitrogenous (protein) nutrition is one of their main functions. When ingested together with chyme, microbial biomass is digested in the abomasum and absorbed by the body, being an irreplaceable source of amino acids [4, 15].

Being involved in the mechanisms of the animal's own digestion, symbiotic digestion creates conditions for the breakdown of complex carbohydrates, for example, fiber, and non-protein nitrogen-containing substances. Symbionts take root well in the gastrointestinal tract of an animal, have an antagonistic effect on a group of pathogenic and opportunistic microorganisms, and synthesize B vitamins and amino acids [4, 17].

The use of symbiotics contributes to the rapid rehabilitation of animals after diseases of the gastrointestinal tract - acidosis, tympania, atony, rumen dysfunction. When transferring cows to a new diet or changing feed, it helps to prevent a decrease in milk production [3, 4, 12].

Studies have shown that symbiotic drugs allow the animal to reach the peak of lactation faster, reduce the risk of acidosis and negative energy balance [3, 6, 7, 8, 16, 17]. The improvement of the conditions for feeding animals in connection with the changing requirements for the intensification of the dairy cattle breeding industry is in constant development and the search for new feed means to create a stable production system is highly quality milk.
The aim of the research was to study the influence of the symbiotic multicomponent feed additive "Rumimaster" on the zootechnical and biological parameters of the organism of highly productive lactating cows.

2. Materials and methods

The research was carried out in the breeding plant "Kirovskaya meadow-bog experimental station" of the Kirov region on highly productive black-and-white cows during lactation. In the scientific and economic experiment, the animals in the main diet included the domestic symbiotic drug "Rumimaster", produced by OOO PO "Sibbiopharm", Novosibirsk region.

The drug "Rumimaster" is a symbiotic drug and contains a complex of probiotics, prebiotics and enzymes. All biologically active substances in the feed additive are in optimal proportions. The drug has a stimulating effect on the immune system of animals, the processes of cicatricial fermentation and activates the absorption of nutrients in the body of animals. Rumimaster contains the cellulolytic bacteria Ruminococcus albus, which are specific for the rumen of ruminants. Ruminococcus albus bacteria secrete a powerful complex of enzymes that break down non-starchy polysaccharides. In addition, Ruminococcus albus has a high antagonistic (suppressive) activity against Escherichia coli, Salmonella, Proteus and other pathogenic microorganisms [13].

The spore bacteria Bacillus subtilis contained in the feed additive, when it enters the digestive system, is transformed into a vegetative form, multiplies and produces biologically active substances into the environment, under the influence of which the growth and development of putrefactive, pathogenic and opportunistic microflora is restored, the population of lactic acid is restored. and bifidobacteria [10, 15].

The composition of the domestic symbiotic drug also includes enzymes of the above two types of microorganisms - amylase, cellulase, β-glucanase, pectin lyase, which increase the digestibility of fiber and starch in concentrated feed. As a prebiotic component, the sybiotic "Rumimaster" contains mannan-oligasaccharides (MOSs) - substances isolated from the cell walls of yeast as a result of mechano-enzymatic treatment. MOSs bind to bacterial receptors using mannose residues. Pathogenic bacteria with blocked receptors cannot adhere to the surface of epithelial cells and pass through the gastrointestinal tract. The inner surface of the gastrointestinal tract is freed for the development of beneficial microflora, which is expressed in a decrease in the frequency of occurrence and severity of dysbiosis.

To conduct a scientific and economic experiment, 30 cows were selected, which are 4-5 months of lactation. The animals were selected by the analog pair method and distributed into 2 experimental groups of cows, 15 cows each.

The animals of the control group received the basic diet adopted on the farm, the experimental group received 40 g of the symbiotic preparation "Rumimaster" in addition to the basic diet. Animal diets were balanced for all essential nutrients, according to detailed standards (VIZH, 2016). The main ration included: cereal-legume hay, forb silage, green mass of timothy, barley grain, oat grain, sunflower meal, mineral additives and molasses.

To study the digestibility and use of nutrients in the diet against the background of scientific and economic experience, a balance experiment was carried out according to generally accepted methods [9]. During the period of the balance experiment, the amount of given feeds, their residues, the amount of daily milk yields of cows and the amount of excreted feces and urine for the reporting period were taken into account daily.

During the experiment, the feeding behavior of the cows, the biochemical composition of the blood, and milk production for the entire lactation were studied.

The chemical composition of feed, non-consumed residues, and feces was determined according to the generally accepted methods of zootechnical analysis [11]. The quantitative and qualitative indicators of milk were recorded every ten days of the month. The content of milk fat and protein was determined on a high-speed infrared milk analyzer "Bentley-2000" manufactured in the USA in the laboratory of JSC "Kirovplem".
The biochemical parameters of the blood of the experimental animals were studied on the basis of the Kirov regional veterinary station according to the methods of clinical diagnostics.

3. Results of the research

The most important reserve in the development of the industry of dairy cattle breeding is the realization of the genetic potential of cow productivity by improving the technology of animal feeding. According to many researchers, feed additives are topical products that help to compensate for the lack of nutrients, smooth out the inevitable imbalance in the body of animals, and stimulate digestion [12, 13]. Indicators of milk productivity of animals for the period of research are shown in table 1.

Table 1. Milk productivity of cows (n = 15) for 90 days of lactation

| Indicator                        | Group (\(\overline{X} \pm S^2\)) | ± in relation to control, % |
|----------------------------------|-----------------------------------|----------------------------|
|                                  | control                           | experimental               |
| Gross yield of milk (kg):        | 2441.8±93.97                      | 2566.3±80.86               | 105.10                     |
| natural fat content              |                                   |                            |
| 4% fat content                   | 2351.8±86.70                      | 2480.2±82.91               | 105.46                     |
| Average daily yield milk (kg):   | 26.5±1.02                         | 27.9±0.88                  | 105.10                     |
| natural fat content              |                                   |                            |
| 4% fat content                   | 25.6±0.94                         | 27.0±0.90                  | 105.46                     |
| Mass fraction of milk (%):       |                                   |                            |
| fat                              | 3.73±0.103                        | 3.76±0.088                 | +0.03                      |
| protein                          | 3.05±0.047                        | 3.02±0.070                 | -0.03                      |
| Gross yield of milk (kg):        | 91.7±3.56                         | 96.9±3.65                  | 105.71                     |
| fat                              | 75.3±2.55                         | 79.4±1.66                  | 105.44                     |
| protein                          |                                    |                            |

According to the research results, it was found that the daily milk productivity in the experimental group differed significantly from the control already in the second month of the experiment. During the third month of research, the maximum differences between the groups were noted and amounted to 26.4 kg of milk in the experimental group versus 24.2 kg in the control (P≤0.05). On average, for the entire period of the experiment, the average daily milk yield of natural fat content in the experimental group was 1.4 kg higher than the control indicators. The inclusion of the feed additive "Rumimaster" in the diet of experienced cows contributed to an increase in the gross production of natural and 4% fat milk by 124.5 kg and 128.4 kg, the yield of milk fat and milk protein by 5.2 kg and 4.1 kg, respectively. The differences between the groups for these indicators were in the range of 5.1-5.7%.

When analyzing milk productivity for the entire lactation, the advantage of the group of cows that received the symbiotic "Rumimaster" was established (Table 2).

Differences in the gross milk yield of natural fat milk per lactation between the groups amounted to 660.2 kg or 7.5%. There were no significant differences in the content of milk fat and protein.

Table 2. Milk productivity of cows (n = 15) for 305 days of lactation

| Indicator                        | Group (\(\overline{X} \pm S^2\)) |
|----------------------------------|----------------------------------|
|                                  | control                           | experimental               |
| Gross yield of milk              | 8815.7±362.6                      | 9475.9±222.3               |
| with natural fat content         | 100                               | 107.5                      |
| Content, %:                      |                                   |                            |
| fat                              | 4.1±0.05                          | 4.1±0.05                   |
| protein                          | 3.1±0.06                          | 3.05±0.03                  |
On the basis of the data of individual registration of a given feed and excreted feces and urine, the coefficients of digestibility of nutrients in the diet and the balance of nitrogen were calculated in 6 cows from the control and experimental groups (Table 3).

### Table 3. Digestibility coefficients of nutrients, % (n = 3)

| Indicator                 | Group (\(X \pm S^2\)) | control       | experimental  |
|---------------------------|-------------------------|---------------|---------------|
| Dry matter                | 68.8 ± 0.26             | 69.7 ± 0.63   |
| Organic matter            | 70.5 ± 0.13             | 71.1 ± 0.23   |
| Crude protein             | 65.9 ± 0.90             | 69.2 ± 1.43   |
| Crude fat                 | 55.0 ± 1.40             | 56.0 ± 1.46   |
| Crude fibre               | 62.8 ± 0.13*            | 65.8 ± 0.66   |
| Nitrogen-free extractives | 75.5 ± 0.80             | 74.7 ± 1.10   |

*Note: * - hereinafter, the difference is significant to the control group at \(P>0.95\)

As a result of the research, it was found that practically all nutrients were better digested by the animals of the experimental group. Thus, the digestibility of dry matter was higher than that of the control group by 0.9 absolute percent, organic matter - by 0.6, crude protein - by 3.3, crude fat - by 1.0, crude fiber - by 3 absolute percent, respectively. It should be noted that the differences in the digestibility of crude protein and crude fiber were statistically significant (\(P\leq0.05\)).

Analyzing the results of studies on the use of nitrogen for productive purposes, it was found that more intensive metabolic processes took place in animals that received the drug Rumimaster in their diet. The digestibility of nitrogen in the experimental group was 3.3 absolute percent higher than the control values.

The feed additive promoted the activation of digestive processes and positively influenced the food activity of animals. The cows of the experimental group showed an increase in the duration of feed intake and was 363 minutes versus 284 minutes in the control (\(P\leq0.05\)). The duration of chewing and the number of chewing movements per minute in the cows of the experimental group was significantly higher than in the control and amounted to 329 minutes and 130.3 times, respectively.

The biochemical parameters of the blood of cows were within the physiological norms in all animals with a slight deviation downward in the content of phosphorus and carotene in the control group.

On the basis of accounting data and milk production of cows for 90 days of lactation, the economic efficiency of using the feed additive "Rumimaster" in the diets of cows in the middle of lactation was calculated (Table 4).

### Table 4. Economic efficiency of milk production for 90 days of lactation (per head), rub.

| Indicator                                      | Group               |
|------------------------------------------------|---------------------|
|                                                | control             | experimental       |
| Received milk of basic fat content, c          | 24.58               | 25.95              |
| Selling price of 1 centner of milk             | 2 238.00            | 2 238.00           |
| Sales amount                                   | 55 010.00           | 58 076.1           |
| Total costs:                                   | 45 634.49           | 47 355.8           |
| incl. "Rumimaster"                            | –                   | 864                |
| Cost price of 1 centner of milk basis fat      | 1 856.57            | 1 824.88           |
| Profit from sales                              | 9 375.51            | 10 720.3           |
| Additional profit                              | –                   | 1 344.79           |
| Profitability, %                               | 20.5                | 22.6               |

From the animals during the period of the experiment, 24.58 centners of milk were obtained in the control, in the experiment - 25.95 centners, which is more by 1.37 centners. In the experimental group,
due to the inclusion of the drug "Rumimaster", the cost of milk production was 1,721.3 rubles more than in the control group. Despite this, the cost of milk with basic fat content due to higher productivity was 31.7 rubles lower, and the profit from the sale of milk was higher by 1344.79 rubles more. The profitability of milk production per head was 2.1 absolute percent higher in animals that received the feed additive "Rumimaster" in their diet, which indicates the high efficiency of its use when feeding highly productive cows.

Thus, the use of the symbiotic Rumimaster in an amount of 40 g per head per day during the second phase of lactation helps to increase the milk production of cows per lactation, while ensuring good health of the animals. The inclusion of a feed additive in the diet of animals allows you to get additional profit and help to increase the profitability of production.

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