



## Heifer Feed Mixes with BVMK Rumimax-C

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concentrate (PVMK).

### Abstract

Earlier studies on heifers from 3 to 6 months of age showed the effectiveness of using BVMK "Rumi-Max-C" in the feed mixture at a dose of 10 g per head per day. Therefore, we continued experiments on older heifers. The scientific and economic experiment was conducted on four groups of heifers from 6 to 12 months of age. The first group (control) received the basic ration without BVMK "Rumi-Max-C", and the second, third and fourth groups received it respectively in the amount of 20, 25, and 30 g per head per day. Feeding BVMK "Rumi-Max-C" to heifers at the age of 6-12 months affected the eating ability of the feed mixture. It was maximal in the third group of animals to which the feed additive was added to the basic diet at the dose of 25 g per head per day. Compared to other groups in the third group of heifers the feed mixture was consumed by 0.3-0.9 kg or 2.0-6.2% more. In the third group of heifers with increased consumption of feed mixture, the number of nutrients was maximum compared to other groups.

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## 1 Introduction

The efficiency of dairy cattle breeding largely depends on targeted intensive breeding of young replacement cattle. This is especially true for replacement heifers, which need to be fully fed to produce strong, healthy animals that can replace the milking herd of cows.

In recent years in cattle breeding began to use in feeding animals feed mixtures of different compositions [7, 8, 16-21].

However, zootechnical analysis of these feed mixtures showed that they lack certain nutrients, which inhibits the growth of animals. Therefore, in such feed mixtures, it is necessary to introduce various feed additives that help to increase the completeness of the diet, feed use efficiency and improve the metabolism in the body of animals. Several scientists have dealt with such issues [1,14].

Our research pays attention to the protein-vitamin-mineral concentrate (PVMK) "RumiMax-C", which was used for feeding heifers from 3 to 6 months of age.

The producer of this additive is CJSC "Premix", which is located in Timashevsk, Krasnodar region. According to the manufacturer's recipe, this BVMK contains, %: moisture - 35, crude protein - 11.66, crude fiber - 12.4, calcium - 4.76, phosphorus - 0.66, sodium chloride - 1.0-1.5, ash insoluble in HCL-0.7.

This supplement has in its composition other substances (probiotic, prebiotic, protected lysine, natural organic mycotoxin sorbent, amino acid regulator of ruminant energy metabolism). They help gastrointestinal tract of cattle to work more intensively.

All of the above-mentioned facts have determined the relevance of this research topic.

Minerals, vitamins, and other constituents of the chemical composition of feed play an important role in the complex of measures aimed at organizing biologically complete feeding of animals. They are involved in metabolism and other biological functions ensuring normal vital functions of the organism and high productivity at low forage consumption per product. S.A. Shevchenko et al. [15] in their studies on fattening stock of young cattle paid attention to the provision of its selenium and iodine. These microelements have a positive effect on the functional activity of the thyroid gland, which regulates many processes in the body of animals.

Simultaneous iodine and selenium deficiency lead to more severe hypothyroidism than iodine deficiency alone. The deficiency of selenium in animals reduces the functional activity of thyroid hormones [3, 23].

The authors mentioned above have established that when separately feeding steers on fattening diet with selenium in the dosage of 0.25 mg/kg of dry matter of sodium selenite in the age period from 6 to 12 months the absolute gain of live weight was 11.5% more than in control ( $p < 0.05$ ). The addition of iodine in the form of potassium iodide – 0.4 mg per 1 kg of dry matter increased the absolute gain by 8.9% ( $p < 0,05$ ), and combined application of these trace elements was most effective - the absolute gain was higher than the control by 15.8% ( $p < 0,01$ ).

The average daily gain of live weight of castrated steers was the highest in the group of animals where selenium and iodine were applied comprehensively - 709.5 g ( $p < 0.05$ ). In other groups this indicator was at the level of 613.0 – 683.5 g with a non-significant difference between the groups ( $p < 0.05$ ).

After the end of the experiment, the effect of selenium and iodine preparations was studied during the period from 13 to 18 months of age. An absolute and average daily gain in live weight were maximum when the above preparations were used in combination. The absolute gain was

10.5% higher than the control and the average daily gain was 769.6 g, compared with 696.3 to 751.8 g in the other groups of the experiment.

Noteworthy are the studies of M.M. Lugovoi et al. [6], conducted on calves of the dairy period of growth when fed the feed additive VISO Lysozyme 20. A peculiarity of this study consists in the fact that the experiment was conducted on calves from cows fed VISO Lizocim 70. Calves received the additive individually 2 times a day at a dose of 30 g per 6 liters of whole milk replacer.

Such supplementation influenced the biochemical blood parameters of calves. In the blood of calves of the third experimental group in subgroups that didn't receive the additive (without L) and those that received VISO Lysozyme 20 (with L) a significant decrease of leukocytes by 1,30 and 1,49 time ( $p < 0,05$ ) was registered, the content of lymphocytes was increased by 12,13 and 20,58% ( $p < 0,05$ ) correspondingly.

After two months of feeding the VISO Lysozyme 20 supplement the content of total protein in the blood was 6.51-7.47% higher ( $p < 0.05$ ), the amount of urea was 1.47 times lower ( $p < 0.01$ ), the activity of ALT, which participates in amino acid metabolism, was 1.27-1.45 times higher than in control, which indicated the activation of protein metabolism.

Calves born to cows that received the supplement 15 and 30 days before calving and before two months of age had fewer digestive disorders. This indicates that the fed supplement has preventive and curative properties. It also contributed to an average daily live weight gain of 572-668 g, compared to 544-565 g in the control without the supplement.

Lugovoi et al. [6] substantiate the use of lysozyme (muramidase) in feeding cows and calves.

The growth of livestock production depends not only on sufficient fodder, improving the quality of fodder and its effective use but also on knowledge of the laws of metabolism and energy in the animal body [2, 4, 5]. It is known that the lack of mineral substances in the diet of animals negatively affects productivity, causes diseases and death of livestock, reduces the quality of production. For this purpose, macro- and microelements are included in rations using various feed additives. Thus, to compensate for the lack of magnesium, magnesium oxide, sulphate and chloride are used: dolomite, bischofite, etc. [12, 13]. Recently, several researchers [12, 13] have paid attention to environmentally safe and effective feed additives that have a positive effect on the metabolism and productivity of animals.

In this regard, the use of natural bischofite of Volgograd deposit in feeding young cattle is of certain interest.

Bischofite belongs to the natural minerals of the Volgograd region. It contains magnesium, chlorine, bromine and other substances [12, 13].

In the experiments of Salomatina et al. [13] studied the effect of bischofite on the digestibility and use of nutrients in the diet in dairy calves. Studies were conducted on three groups of calves. The first group was a control group in which supplements were not fed. But, in the first experimental group calves were fed chemically pure magnesium chloride during the main period of the experiment, and in the second group - bischofite.

It was found that feeding calves with natural bischofit increased the coefficient of dry matter digestibility by 2.80 ( $p < 0.01$ ) and 2.0% ( $p < 0.05$ ), respectively, when compared with the control and the first experimental group. 0.01) 2.0% ( $p < 0.05$ ), organic matter 2.30 ( $p < 0.01$ ) and 1.70% ( $p < 0.05$ ), crude protein 4.50 ( $p < 0.01$ ) and 2.40%, crude fat by 1.90 ( $p < 0.05$ ) and 0.80%, and crude fiber by 4.30 ( $p < 0.01$ ) and 1.70% ( $p < 0.05$ ).

At the same time, calves of the first experimental group, where magnesium chloride was fed, also had a higher coefficient of digestibility of dry matter, compared to control, by 0.80%, organic matter 0.60, crude protein 2.10 ( $p < 0.05$ ), crude fat 1.10, crude fiber 2.60 ( $p < 0.01$ ) and BEV 2.70% ( $p < 0.05$ ).

With a positive balance of nitrogen in all groups of calves, its deposition in the body of animals in the second experimental group, compared to other groups (control and the first experimental group), was higher, respectively, by 4.70 g, or 19.03% ( $p < 0.01$ ) and 2.80 g, or 10.53% ( $p < 0.05$ ).

The data of biochemical studies of calf blood confirmed that nitrogen metabolism was better and more efficient in animals treated with natural bischofit.

Akifieva et al. [1] also paid attention in their studies to the feed additive humiton obtained from natural peat raw materials. It is a dark brown liquid, well soluble in water. Humiton contains not less than 1% of humic acids and up to 1,6% of dry matter, consisting of 80-85% of humic, carbonic amino acids. This feed additive belongs to the class of low-hazard substances, is environmentally friendly, has no acute and chronic toxicity, has no embryotoxic, immunotoxic, allergenic, mutagenic, cumulative, teratogenic effect.

The tests of this feed additive on animals did not reveal its negative effect on the general state, dynamics of live body weight, haemogram, cardiovascular and central nervous system, functional state of the organism.

Akifieva et al. [1] studied humiton on two groups (three heads per group) of black-motley breed steers that had rumen fistulas applied to take samples of rumen content. At the beginning of the physiological experiment, the age of steers was 10 months.

Bulls of the control group (the first) were fed the basic ration used in the farm. It consisted of the following fodder: corn silage, haylage of annual crops, brome hay in the form of feed mixture and concentrated feed. Humiton enriched with selenium 23 ml at the rate of 0.1 ml per 1 kg of live weight was added to the diet of steers of the experimental group (second).

Under this scheme of feeding steers it was found that in the second group where humiton was added, the feed consumption was 96-98% of the set amount, while in the control group it was 91-93%.

The higher feed intake of the main diet in the second group resulted in an average daily gain of live weight of 616 g in steers compared to 592 g in the control group.

The introduction of humiton enriched with selenium into the diet of steers of the second group increased the total amount of volatile fatty acids (VFA) in the rumen fluid.

Application of humiton increased the concentration of total nitrogen in the rumen. Thus, if at the beginning of the experiment, the content of total nitrogen in the rumen fluid of steers of the second group was 92.17 mg%, then at the end of the experiment this indicator increased to 107.26 mg%. This indicates that conditions for active microflora development and better nitrogen use for bacterial protein synthesis were created in the rumen of steers of the experimental group by introducing humiton enriched with selenium.

Obtaining highly productive animals is possible directed by rearing them from an early age. However, during this period calves often have gastrointestinal diseases, which are largely accompanied by imbalance of intestinal microflora, which reduces not only productivity but also the protective properties of the body.

Many researchers and practitioners [4, 5] paid attention to the fact that the use of biologically active feed additives for young cattle allows to influence metabolic processes, functions of individual organs or body systems, manage the growth rate and level of productivity.

However, when using feed additives for animals it is necessary to establish an optimal dose of their application. If the dose is optimal, there is a stimulation of metabolic processes in the organism, and in case of deficiency and overdose has a negative effect both on the health and productivity of animals.

Chernyshkova et al. [14] studied on calves from birth to 6 months of age in experimental groups (the second and third), 0.5 and 1.0%, respectively, of complex sorption-probiotic additive Biopinular were added to the basic diet. Such additive influenced the parameters of the rumen content. Thus, the pH of the liquid part of the rumen contents in calves from experimental groups at the age of 3 and 6 months was 6.195 and 6.083 ( $p < 0.05$ ) in the second group, and 6.035 and 6.051 ( $p < 0.01$ ) in the third group, while it was 6.251 and 6.243 units in the control. As can be seen, the applied feed additive changed the pH of the rumen contents towards an increase in acidity. This suggests that the improved rumen content environment in the second and third groups contributed to an increased level of fermentation of easily and difficult to break down carbohydrates (sugars, starch, and fiber) to the final breakdown products - LFAs. Thus, in calves of the control group the concentration of PLA made up 10.50 mmol/100 ml; in calves of the second and third groups reliable ( $p < 0.05-0.01$ ) increase of their concentration by 5.18 and 14.87% was noted.

One of the most important indicators, which characterizes the efficiency of the use of feed nitrogen by animal organisms, is the rate of formation and degree of utilization of ammonia, which is the main product in deamination reactions and synthesis of microbial protein.

Ammonia nitrogen in rumen fluid was used differently in the calf groups. In the experimental groups (second and third), ammonia nitrogen concentrations decreased, compared to control, by 7.27 and 11.53%, respectively.

Optimization of enzymatic processes in the rumen of calves by adding Biopinular feed additive to the basic diet influenced the growth of experimental animals. Calves' live weight of the



second and third groups by the end of the experiment was 12.2 and 15.8 kg or 7.98 and 10.34% ( $p < 0.01$ ) more than that of the control variant.

From the literature review, it can be seen that some probiotic supplements have been studied. These include the following: "Biodarin", preparation A, "Baikal EM-1", "Bacell", "Monosporin", "Prolam-2", "Vetom", "Sahabaktisubtil", "Lactobifadol", "Lactosept" and "Zoostim-M". They have some actions that have a positive effect on the body of animals. For example, produced a variety of antibiotic compounds that inhibited pathogen growth, prevented gastrointestinal tract diseases, increased the activity of digestive enzymes, promoted the formation of antimicrobial proteins produced by one *Escherichiacoli* strain to inhibit the growth of other strains of *E. coli* and feed quality parameters - species-specific probiotic *Lactobacillus animalis* SB310, *Lactobacillus paracasei* subsp, *Paracasei* SB 137 and *Bacillus coagulans* in a ratio of 30:35:35, respectively, Prolam, *Bacillus* probiotic etc.

Protein digestibility coefficient of calves with probiotics "StimixZoostim" and "Normosil" was 84.9 ( $p < 0.05$ ) and 85.2% ( $p < 0.01$ ), which was higher by 3.8-3.1 abs. % than in control group calves.

Inclusion of the above additives in the diet of calves had a positive impact on the intensity of animal growth. With one hundred percent saved calves in the experimental groups, the average daily gain of young animals was higher by 8.9-7.4% with a simultaneous reduction of feed expenses per 1 kg of live weight by 8.1-7.4% compared to the control groups. The economic effect per 1 head was 149.23 and 157.0 rubles, respectively

## 2 Materials and Research Method

The research was conducted under the conditions of Belgrankorm - Holding MTK "Tsentralnoe" of Rakityansky district. The scientific and economic experience was carried out on repair heifers.

The scientific-economic experiment was carried out according to the following scheme (Table 1).

**Table 1:** Scheme of scientific and economic experience.

Group	Number of animals, heads	Experiment periods, days		Feeding pattern
		Equalization	Main	
1 (control)	15	15	183	OR (grass-legume hay, barley straw, corn silage, molasses fodder, mixed fodder) in the form of feed
2 (experimental)	15	15	183	As part of the BVMK PR "Rumimax-C" at a dose of 20 g on top of
3 (experimental)	15	15	183	As part of the BVMK PR "Rumimax-C" at a dose of 25 g on top of
4 (experimental)	15	15	183	As part of the BVMK PR "Rumimax-C" at a dose of 30 g on top of

For the scientific and economic experiment, 4 groups of heifers at the age of 6 months, 15 heifers in each group, were selected by the group-period method. Heifers of Holsteinized black-motley breed were used in the study.

The housing for all the experimental groups was the same, but the feeding differed. The animals of the first control group were fed a basic ration (OR) consisting of the following feedstuffs: grain-legume hay, barley straw, corn silage, molasses and mixed fodder. The animals of the first group were fed the feed mixture without inclusion of the above feed additive. In the experimental groups of the second, third and fourth, the feed additive RumiMax-C was fed in addition to OD at the dose of 20, 25 and 30 g per head per day, respectively.

When conducting research, the following indicators were taken into account: feed assimilability, animal growth, feed consumption and digestible protein per 1 kg of live weight gain.

### 3 Research Results

Feeding BVMK "RumiMax-C" to heifers at the age of 6-12 months affected the eating capacity of the feed mixture. It was maximum in the third group of animals, which added the feed additive at a dose of 25 g per head per day to the basic diet. Compared to other groups in the third group of heifers the feed mixture was consumed by 0.3-0.9 kg or by 2.0-6.2%. Naturally, in the third group of heifers with increased feed mixture intake, the amount of nutrients was maximal compared to other groups.

**Table 2:** Results of heifers' breeding from 6- to 12-months of age with BMC "RumiMax-C" in the feed mixture (per 1 head).

Indicator	Group			
	1	2	3	4
Live weight at the beginning of the main experimental period, kg	151.2± 2.12	150.8± 1.98	151.5± 2.17	150.9± 2.81
Live weight at the end of the experiment, kg	280.5 ± 2.23	288.6 ± 3.02*	296.6 ± 2.45***	290.3 ± 3.12*
Gross growth for 183 days, kg	129.3 ± 2.95	137.8 ± 3.10	145.1 ± 2.61**	139.4 ± 2.80*
Average daily gain, g	707± 20.2	753± 30.8	793±29.2*	762±30.1
as % of control	100	106.5	112.2	107.8
Spent per 1 kg of live weight gain:				
EKE	8.84	8.45	8.42	8.57
digestible protein, g	920.9	876.8	855.4	878.3

Note: hereinafter \* - p<0.05; \*\* - p<0.01; \*\*\* - p<0.001

Live weight of heifers at the beginning of the main period of the experiment by groups differed insignificantly (Table 2). However, at the end of the experiment, this indicator differed markedly and in the second, third and fourth groups there were significant differences compared to the first group (control). At the same time, the heifers of the third group grew more intensively than the other groups (p1-3<0.001). Correspondingly, the gross live weight gain in the third group of animals fed BWMK "Rumi-Max-C" at the rate of 25 g per head per day was higher than in other groups (p1-3<0.01). Significant differences in average daily gain of live weight were observed only in the third group of heifers (p1-3<0.05) who were fed the above dose of feed additive. Compared to

the control, this indicator was 12.2% higher in the third group of animals, while in other groups it was 6.5% (in the second group) and 7.8% (in the fourth group). The costs per kg of live weight gain in the third group of heifers were lower than in other groups: in terms of ECU and digestible protein by 0.36-4.75 and 2.44-7.11%, respectively.

## 4 Conclusion

As a result, raising heifers at the age of 6-12 months is more efficiently carried out on feed mixtures with the inclusion of RumiMax-Ts BVMK in their composition in the amount of 25 g per head per day. With such a dosage of a feed additive, the highest average daily gain in live weight (793 g) can be obtained, which exceeds the control variant and other groups of animals by 4.1-12.2%. In the second, third and fourth groups, a significant difference was established in comparison with the first group. Heifers of the third group grew more intensively than other groups. The gain in live weight in the third group of animals fed with "RumiMax-C" in the amount of 25 g per head per day was higher than the other groups. The average daily gain in live weight was established only in the third group, which were fed the above dose of the feed additive as part of the feed mixture.

## 5 Availability of Data and Material

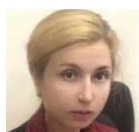
Data can be made available by contacting the corresponding author.

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