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Development of A Highly Effective Premix Based on Local Plant Raw Materials to Stimulate Growth and Development of Growing Calves

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Abstract

This article presents the results of obtaining a nutritional feed additive for cattle. The purpose of the research is to develop and obtain a highly effective premix based on local plant as raw materials for balancing the diet and filling the deficit of nutrients in feed for cattle. Scientific novelty consists in the fact that for the first time the composition of premix is prepared by using wild growing local plant raw materials in combination with biologically active components. To fulfill the tasks as the main component of the premix, wild local plant raw materials (juzgun, topinambur and fodder salt) were used. This study provides a solid foundation of using natural plants to prepare nutritious premix for cattle.

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1. Introduction

One of the main factors in increasing the efficiency of livestock breeding is to provide a balanced fodder base that meets modern scientific and practical requirements. Given that livestock production in farms is based mainly on self-produced fodder, the problem of making a balanced ration is very relevant. Livestock breeding is the leading sector of agriculture, as well as a strategic sector of Kazakhstan's economy. The development of livestock gives a huge role in the formation of food security of our country, a stimulus to the development of light and processing industry, which is the raw material basis for leather, textile production and food products. Assessing the market for finished feed for farm animals, first of all, it is necessary to analyze the composition of animals represented in Kazakhstan.[1]

Agriculture, being the leading and constantly developing sector in Kazakhstan, plays a leading role in ensuring food security of the country. In the early 1990s, Kazakhstan produced 4 million tons of mixed fodder, of which 1.3 million tons for poultry. At the same time, 80% of produced mixed fodders were balanced, while in Russia and Ukraine this indicator was 60% and 50% of the total volume, respectively. The products of feed mills were produced for 45 types of farm animal's cattle, sheep, horses, poultry, fish, rabbits and others. More than 70 types of raw materials were used to produce products intended for animal feed. In the ranking of finished animal feed production, Kazakhstan ranked fourth among the republics of the former USSR and third in terms of poultry feed production. However, at the end of the last century the production volumes of mixed fodder products significantly decreased, amounting to 2.1 million tons - almost 2 times. Such a sharp decline in the production of concentrated mixed fodders also led to a significant reduction in the number of livestock in agricultural enterprises, when the number of sheep and goats alone fell by more than 2 times, and such industries as fish and rabbit breeding practically ceased their activities.[2] Experts note that the cost of production of poultry farms is 60-70% of the cost of feed.[1] And the productivity and efficiency of poultry farms directly depends on what kinds of feeds and of what quality, made according to what formulation and with the addition of what vitamin complexes, are used for poultry breeding.[2] In the issue of quality control of produced feeds at the end of the last century there were changes towards the reduction or complete disappearance of the laboratory for checking the products of the feed industry.[3,4]

Despite the fact that the production of finished animal feed in the Republic of Kazakhstan at the moment is quite

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developed and covers the need of the domestic market by 90%,[5] as well as the fact that the share of imports of this category of goods is quite small, in connection with the plans set by the Government to agrarians to develop animal husbandry and increase livestock, in the coming years there will be a need to introduce additional production capacity for the production of finished animal feed.[6] Moreover, the enterprises to be commissioned should be equipped with the latest technologies, and the products should meet all the norms of a balanced nutritious diet and contain the necessary set of vitamins and mineral elements.[7,8] Kazakhstan in connection with sufficiently developed livestock breeding has a large market for sale of mixed fodder products also within the country.[5] However, at present there is still a deficit of mineral substances in the feeding ration of farm animals, which directly affects the vitality and productivity of farm animals.[6] In the development of the industry it is necessary to introduce the latest technologies that allow not only to preserve the useful components of raw materials used in the manufacture of fodder, but also significantly enrich them with mineral elements.[7] To achieve such results, it is necessary to rely on the experience and achievements of countries that have already achieved a high level of development in this area and to involve experts and countries in mutually beneficial cooperation.[8] It is necessary to develop new technologies of fodder production, which fully take into account the possibilities and peculiarities of local raw material resources.[9] The analysis of scientists and economists says that it is necessary to increase dairy and meat production in the coming years, as the demand and competition among producers will grow. The project offers recipes and technology of production of mixed fodders and fodder additives on the basis of vegetable raw materials to improve the protein value of local forages for livestock. The technology of fodder production provides reception of mixed fodders and fodder additives with high zoo technical and qualitative indicators.[10] The fodder obtained by us is characterized by high nutrition, easier digestibility, biological activity, as well as vitamin and mineral value. In connection with the above, the article shows refined ways and methods to increase the production of livestock products in Kazakhstan, which is an integral part of food security and one of the priority tasks of the country's economy, providing employment and income generation of the population in rural areas.[11,12] The effectiveness of premixes is due to the fact that they contain various macro- and microelements with high binding capacity, adsorption, catalytic and antimicrobial activity.[13] In this case, the complex of macro- and microelements and biologically active substances contained in them can be best assimilated in the gastrointestinal tract of cattle.[14,15]

A special role is given to the search for ways of the most rational use of feed, application of biologically active substances, creation of comfortable conditions of animal housing. Over the last 100 years, the world population has increased 4 times. This requires meeting the needs of the population in scientifically based nutritional standards, in particular, of animal origin.[9-15] At the same time, the issue of protein nutrition as the most important component of human food is very acute, especially with regards to proteins of animal origin.

2. Materials and methods of research.

Juzgun and phytosorbent from plant raw materials were identified as feedstock. Rice husk was selected as an initial raw material, subsequent processing in order to obtain carbon-silicon composite. As a result of laboratory studies, it was found that the sorbent has a pronounced universal sorption property. Juzgun is a genus of perennial deciduous branching shrubs with extensive root system and openwork crown. Leaves are short, needle-shaped, flowers are solitary, small, white to pinkish-purple. Plants of the genus Juzgun have potential hypotensive, choleretic and antitumor effects.

Plants of the genus Juzgun are not pharmacopoeial, are not listed in the Register of Medicines and are not used in either official or folk medicine, but the chemical composition of the plant allows us to say that they have hypotensive, antitumor and choleretic properties.

Samples of veterinary preparation based on plant material Juzgun and phytosorbent for veterinary purposes are photolly shown in Fig. 1.

The main most accurate method of determining the digestibility of feed nutrients is to conduct in vivo experiments - on animals. For this purpose, 20 healthy animals of the same age, live weight and physiological condition of calves of 1-1.5 months of age, located in the conditions of farm "Chance" of Karaganda region were selected.

Conducting experiments on animals to determine the digestibility of nutrients of forages provides the most accurate assessment of their nutritional content compared to the assessment by chemical composition. The object of the study was 1-1.5 month old calves, from which 2 groups were formed: I group-control (n=10); II group-experimental (n=10). Before the beginning of the experiment, we determined the live weight of calves, took blood for determination of baseline parameters. The initial content of hematological and biochemical parameters was determined in blood. Calves of the experimental group (n=10) were administered premix in a dose of 100 g, previously mixed with feed, once a day, for 10 days. Calves of the control group (n=10) were not fed premix (Table 1)

Blood for research was taken before the experiment and on the 10th day of the study, in the morning, before feeding and examined according to the methods accepted in veterinary medicine.

The effect of feed additive on some clinical blood parameters was studied, taking into account that blood, being the internal environment of the body, is in constant contact with all organs and tissues and reflects in its composition those changes that occur in the body.

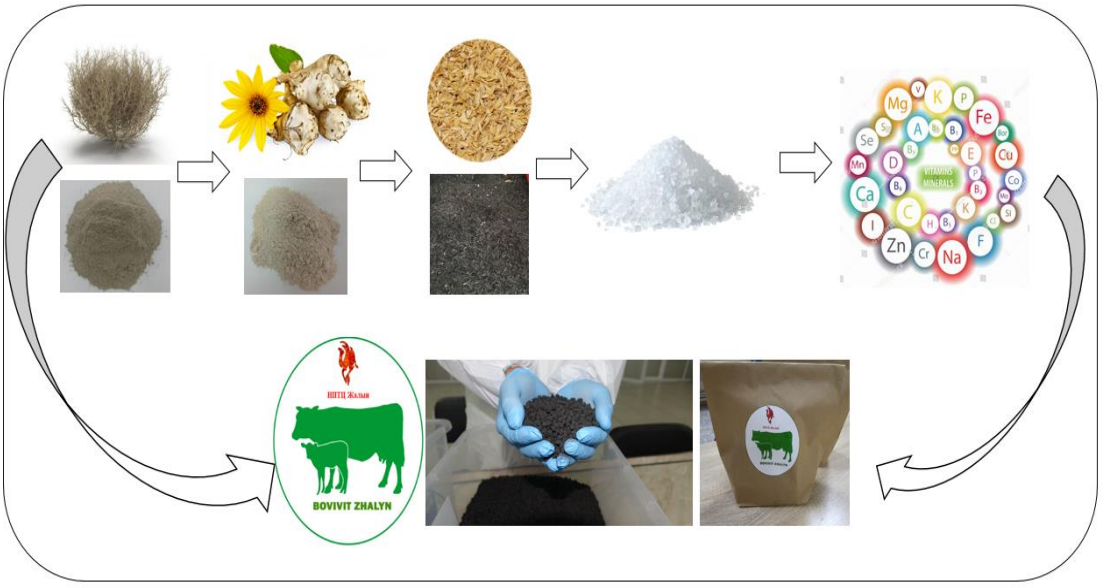

Fig. 1 Natural plants to prepare nutritious premix for cattle.

Table 1. Scheme of premix application.

Group	Type of animal	The drug	Dose	Course of application
I control n=10	Cattle (calves of 1-1.5 months of age)	-	-	-
II experimental n=10	Cattle (calves of 1-1.5 months of age)	Premix	Per os with feed in a dose of 100 g, once a day	10 days

Analyzing the obtained data, we can say that they reflect the processes of organism formation, the formation of dynamic constancy of internal environment, as well as the effect on the organism of calves of the means used by us.

In the content of inorganic blood components - total calcium and phosphorus - differences were found in calves of experimental and control groups: (2,46±0,10; 2,44±0,12 mmol/l and 1,65±0,04 and 1,61±0,05 mmol/l).

The blood glucose content, the main source of energy for many body cells, indicates that premix stimulates energy metabolism. Calves in the experimental group receiving premix had 10.3% higher glucose concentration than those in the control group.

In this case, that the indicators of the experimental group and control group have statistically reliable significant difference. Consequently, application of premix actively influenced humoral and cellular factors of nonspecific defense of animal organism. Based on the conducted studies, we can conclude that premix promotes the activation of metabolism. This is confirmed by our controlled clinical and biochemical blood parameters.

Hematologic studies are a set of diagnostic methods aimed at studying the qualitative and quantitative composition of blood elements. Together with clinical examination allows to determine the general condition and the presence of hidden pathological changes in organs, tissues and systems. Biochemical method - analyzes the composition of substances contained in the body and biochemical reactions occurring in its cells. By this method it is possible to establish gene function, to study metabolic disorders. Blood for research was taken before the beginning of the experiment and on the 10th day of the study, in the morning, before feeding and was analyzed according to the methods accepted in veterinary medicine. The effect of the feed supplement on some clinical blood parameters was studied taking into account that blood, being the internal environment of the organism, is in constant contact with all organs and tissues and reflects in its composition the changes that occur in the organism.

3. Results and discussion

The main task of animal husbandry in Kazakhstan is to produce as much as possible high-quality food products for the population. The technology of livestock production significantly aggravates the problem of adequate feeding, animal housing and obtaining high quality products**.** In modern conditions of decreasing agricultural production, lack of fodder, its high cost, unsatisfactory veterinary and sanitary condition of livestock buildings, the resistance of animals to various diseases decreases. As a result, dysbacteriosis and immunodeficiency states develop, the percentage of morbidity increases, productivity decreases, and mortality increases. In practice, various means, techniques and methods are used to preserve the health of newborn calves, which do not always give the desired results. Therefore, finding new ways to

maintain normal physiological status of newborn calves remains an urgent problem.[17]

At first, the chemical composition and identification of bioactive compounds in the plant raw material of Juzgunum whitebark were investigated.

The scanning electron microscope is a modern device with an increased level of automation of research processes in the field of nanotechnology. It is necessary for obtaining images with a resolution of less than 2.5 nm and for qualitative and quantitative analysis of nanoscale objects.

The elemental composition of Juzgun was determined using a Quanta 200i 3D scanning electron microscope (FEI Company, USA)

Two samples of ground Juzgun were investigated. According to the results in sample No.1: C - 53.53%, O - 31.96%, Ca - 5.56%, K - 4.01%, Na - 2.18%. In the second sample No2: C – 54,97 %, O – 41,50 %, Ca – 1,58%, K – 0,63%, Na – 0,52%. (Table 2)

Studies of morphology of powder samples were carried out using scanning electron microscope (SEM) (Fig. 2). Particle size distribution of Juzgun powders is wide (1.5 - 50 μm), which is typical for powders obtained from plant raw materials. As can be seen in Fig. 2, they are ordered particles with a crystalline structure; the particles have clearly defined boundaries and a roundish shape.

In samples No. 2, there are ordered particles with crystalline structure, from Fig. 3(b), which is due to the presence of Ca in the elemental composition. The particles have clearly delineated boundaries and have rectangular shape. These particles have a narrow size distribution of 0.8 - 3.7 microns. Further the use of feed additive based on topinambur, medicinal plant juzgun and phytosorbent (rice husk), which have the ability to displace pathogenic microorganisms from the intestine, repopulating it with bacterial species that contribute to the formation of normal microflora, was studied. Due to its unique composition, topinambur has an excellent effect on metabolism, activates the release of bile and pancreatic enzymes, reduces blood sugar, relieves inflammation in the stomach, intestines. Plants of the genus Juzgun have hypotensive, antitumor and choleretic properties. Analyzing the obtained data, we can say that feed additives based on topinambour, medicinal plant juzgun and phytosorbent reflect the processes of formation of the organism, the formation of dynamic constancy of the internal environment, as well as the effect on the body of calves of the means used by us. is physiological and promising in combination with means that have a nonspecific effect on the body of animals, vitamin preparations, antioxidants, etc., as it contributes to the successful overcoming of transient dysbacteriosis, activation of the process of nutrient recovery. Complete nutrition increases the intensity of animal growth, productivity, reduces the cost of feed per unit of production.[18]

Table 3 presents hematological parameters characterizing, among others, the state of protein-carbohydrate metabolism, in general corresponded to the physiological norm. In the absence of significant differences between the groups in terms of total protein, albumin, α- and β-globulins, it should be noted a higher level of γ-globulins in the blood of heifers of the control group - more by 3.7 abs.%, which amounted to 12.4% ($p > 0.05$) in relation to the index in the experimental group. As a rule, the concentration of this fraction of immune proteins increases in blood during inflammatory processes, including in digestive organs. According to Table 3, a more intensive protein-carbohydrate metabolism is indicated by a rather high level of glucose and urea in the blood of experimental heifers - more by 10.6 ($p > 0.05$) and 85% ($p \leq 0.05$), respectively, compared with analogous indicators in the control. The level of inorganic phosphorus was also significantly higher - by 17% ($p \leq 0.001$) in relation to the control. The above biochemical parameters indicated normal assimilation of nutrients in animals consuming glauconite as the main raw material of premix consisting of topinambour, medicinal plant

Table 2. Elemental composition of juzgun. A - sample No1, B - sample No 2.

A.	Element	C	O	Na	Mg	Al	Si	S	Cl	K	Ca	Fe
	Wt%	53.53	31.96	2.18	0.82	0.11	0.15	0.40	0.44	4.01	5.56	0.86

B	Element	C	O	Na	Mg	Al	Si	P	S	Cl	K	Ca
	Wt%	54.97	41.50	0.52	0.31	0.16	0.08	0.06	0.12	0.06	0.63	1.58

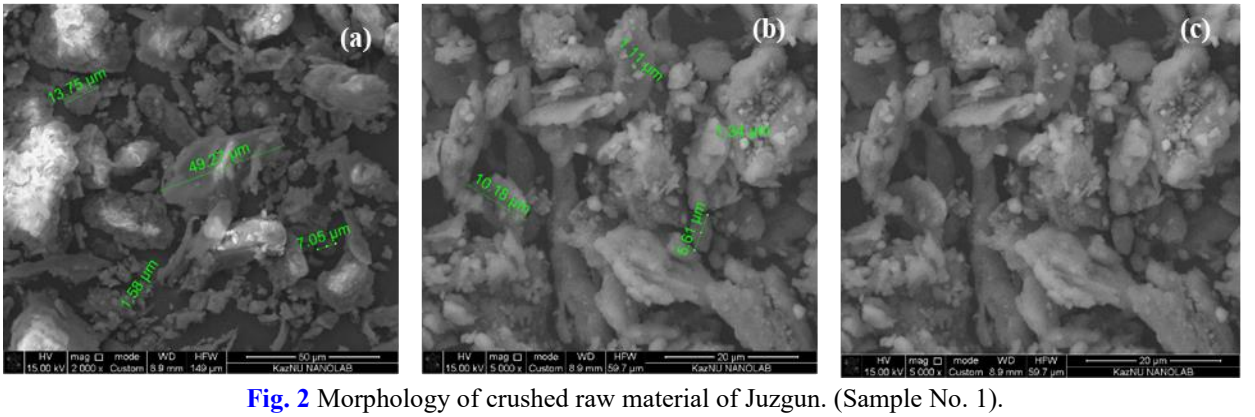

Fig. 2 Morphology of crushed raw material of Juzgun. (Sample No. 1).

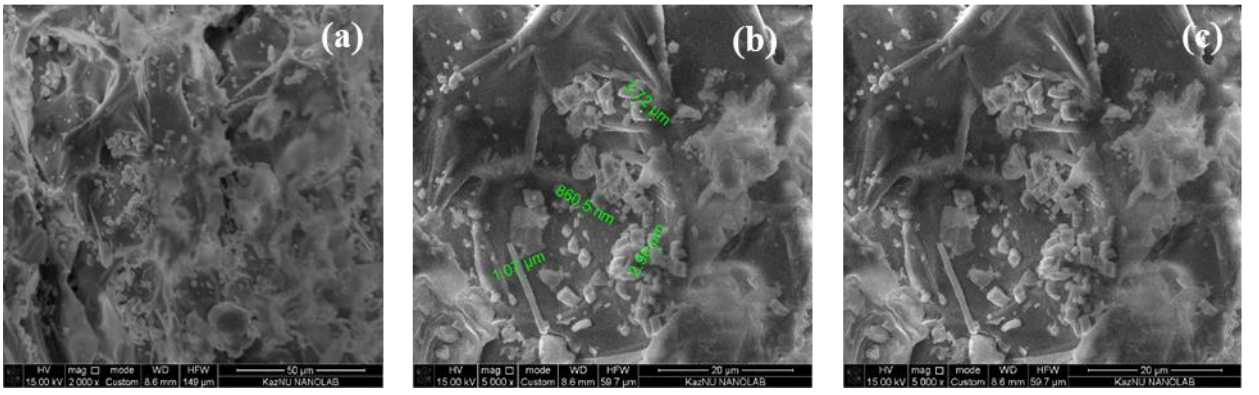

Fig. 3 Morphology of crushed raw material of Juzgun, (Sample No. 2).

Table 3. Dynamics of changes in hematological blood parameters of calves.

Indicators	Normative values	Experimental group		Control group	
	Min-max	Before the beginning of the experiment M±m	After the end of the experiment M±m	Before the beginning of the experiment M±m	After the end of the experiment M±m
Erythrocytes,, 1012/l	5.05-7.50	5.0±0.5	6.0±0.2	5.0±0.1	5.12±0.5
Leukocytes. 109/l	4.5-12.0	8.0±0.15	9.0±0.5	8.3±0.1	8.2±0.5
Hemoglobin g/l	90-120	87.5±1.5	100±1.2	86.9±0.8	93.20.6

juzgun and phytosorbent. The content of inorganic blood components of total calcium and phosphorus showed differences in calves of experimental and control groups: (2,46±0,10; 2,44±0,12 mmol/l and 1,65±0,04 and 1,61±0,05 mmol/l). The blood glucose content, the main source of energy for many body cells, indicates that premix stimulates energy metabolism. In calves of the experimental group that received premix, glucose concentration is 10.3% higher than in the control group. At the same time, we see that the indicators of the experimental group and the control group have a statistically significant difference.

Consequently, premix application actively influenced humoral and cellular factors of nonspecific defense of animal organism. Based on the conducted studies, we can conclude that premix promotes the activation of metabolism. This is confirmed by clinical and biochemical blood parameters controlled by us.

Calves of the experimental group receiving premix had higher content of erythrocytes and hemoglobin in blood than animals of the control group (Table 3). Statistically significant difference was noted between the indices of total protein and albumin. Blood plasma proteins, especially albumin, are a reserve of amino acids for the body. The processes regulated by the enzymes AsAT and AlAT characterize the relationship between protein and carbohydrate metabolism (Table 5). In norm the activity of these enzymes in blood plasma is very low and increases only in some pathological conditions of the organism, when as a result of damage to the cells of the corresponding organ the enzymes are released into the blood.

Immune status, as a complex indicator of the state of the immune system, is characterized by the functional activity of the organs of the immune system and some nonspecific mechanisms of antimicrobial defense. These include the total number of blood leukocytes and their fractions - lymphocytes. neutrophils. eosinophils, basophils and monocytes. The main physiological significance of leukocytes is to perform the protective functions of the body against foreign agents (Table 4).

Table 4. Biochemical parameters of blood of calves before the beginning of the experiment.

No	Indicators	Normative values min-max	Experimental group M±m	Control group M±m
1	Total protein, g/l	60-120	56.7±3.77	57.8±2.0
2	Glucose, mmol/L	2.22-3.33	2.1±0.5	2.1±1.2
3	Calcium, mmol/L	2.4-3.33	2.29±1.2	2.17±1.9
4	Phosphorus, mmol/L	1.4-1.9	1.1±0,5	1.19±0.7
5	Cholesterol mmol/L	4.5-6.0	2±0.33	2.1±0.49
6	AST, ED/L	45-110	49.3±2.7	45.9±7.8
7	AlT, ED/L	6.9-35	9.9±2,7	9.0±3.26
8	Direct bilirubin, mkmol/l	0.06-3.2	1.05±1.2	1.8±0.6
9	Creatinine, mkmol/L	56-162	93.3±8.0	96.5±13.0
10	Urea, mmol/L	2.88-8.8	3.5±1.3	3.27±1.13

The most pronounced changes are noted in the content of total protein in the blood of calves. So, in the calves of the experimental group, this indicator increased by 36.8%,

compared with the background values and by 29.98% higher than in the control calves.

Of great interest are blood enzymes, since all the processes that occur, including those that determine productivity, are catalyzed by enzymes. When using the premix, a higher catalytic activity of AST and ALT, which play an important role in the processes of transamination and protein biosynthesis, was noted: 26.3± 0.02; 24.2± 0.01 units/l, respectively.

In addition, the calves of the control group showed an increase in glucose content- by 32.2%, calcium content - by 4.6%, phosphorus content - by 31.25%.

It follows from the data presented in the tables that calves receiving premix in the diet have more pronounced dynamic changes in metabolic processes in the blood. Consequently, the use of enzyme supplementation in the diets of calves provided them with resistance to various pathogens of infectious diseases without increasing the number of cells performing phagocytic function, especially monocytes. Premix act on animals, affecting metabolism, various physiological and biochemical indicators and causing changes in their behavior. The study of these indicators against the background of the use of biologically active additive shows changes in animal behavior, physiological and biochemical shifts in the body. The most pronounced changes are noted in the content of total protein in the blood of calves. Thus, in calves of the experimental group this indicator increased by 36.8% compared to background values and by 29.98% higher than in control calves.

Table 5. Blood biochemical parameters of calves after premix feeding.

No	Indicators	Normative values min-max	Experimental group M±m	Control group M±m
1	Total protein, g/l	60-120	89.7±3.77	62.8±2.0
2	Glucose, mmol/L	2.22-3.33	3.1±0.5	2.3±0.2
3	Calcium, mmol/L	2.4-3.33	2.4±0.56	2.17±1.9
4	Phosphorus, mmol/L	1.4-1.9	1.6±0.89	1.1±0.45
5	Cholesterol mmol/L	4.5-6.0	2.2±0.27	2.3±0.4
6	AST, ED/L	45-110	45.5±2.7	43.9±0.8
7	AlT, ED/L	6.9-35	12.4±2.8	11.0±1.2 6
8	Direct bilirubin, mkmol/l	0.06-3.2	1.68±1.2	1.8±0.73
9	Creatinine, mkmol/L	56-162	107.2±6.5	102.8±1 3.0
10	Urea, mmol/L	2.88-8.8	3.0±1.4	3.2±1.1

The duration of use of the premix is 10 days. Blood enzymes are of great interest, since all processes, including those that determine productivity, are catalyzed by enzymes. When premix was used, higher catalytic activity of AST and ALT, which play an important role in the processes of overamination and protein biosynthesis, was observed: 26.3±0.02; 24.2±0.01 U/L, respectively.

In addition, the calves of the experimental group showed an increase in glucose content by 32.2%, calcium content by 4.6%, and phosphorus content by 31.25%. Aminotransferases play a key role in o metabolism, integrating protein, carbon, fat o metabolism and tricarbonic acid cycle into a single whole. The activity of AST and AlT is used as a biochemical indicator of the physiological status of animals. The difference in the activity of these enzymes between the groups was insignificant, but in the experiment the values of AST and AlT were higher relative to the control (Table 5).

Thus, the results of hematological studies indicate that the use of protein and mineral supplementation in the diet of calves stimulated the strengthening of protein synthesis in their body, which is consistent with the dynamics of live weight gain. The results of the study of homeostasis of young cattle showed that premix has a positive effect on the course of physiological and biochemical processes in their body, contributes to the elimination of symptoms of digestive disorders.

Digestion is the initial phase of nutrition of an animal and does not give an accurate idea of further utilization of nutrients by the organism. Therefore, the true nutritive value of feed can be determined on the basis of quantitative and qualitative changes in the metabolism of the animal organism, expressed by the state of health, fertility, growth and productivity.

In the control group in calves during the experiment no deviations were recorded signs of gastrointestinal tract (GIT) dysfunction. In the experimental groups of animals biologically active feed additives contained in compound feed improved the palatability and digestibility of feed, positively influenced the secretory and fermentation activity of the digestive system. The following components, taken in the ratio, wt.%, were included in the recipe: the main raw materials for the production of granular form of premix were topinambur, medicinal plant juzgun and phytosorbent. Knowledge of the chemical composition of forages and digestibility of nutrients in them is of great importance in feeding farm animals.

To date, the nutritive value of feed for cattle is determined by the content of feed units, digestible protein, minerals and vitamins. The chemical composition of forages does not give a complete idea of their nutritional value. More accurately determine the value of feed can only in the process of studying its interaction with the animal's body. Digestion and assimilation of nutrients in the gastrointestinal tract is associated with the specificity of metabolism in different species of animals. Digestibility is understood as a series of hydrolytic cleavage of the constituent parts of the feed proteins, fats and carbohydrates under the influence of enzymes of digestive juices and microorganisms (Table 6).

As a result, the substances in the feed are broken down into amino acids, monosaccharides, fatty acids and salts. All of them are water soluble and therefore easily absorbed in the

digestive tract and enter the blood and lymph. The effectiveness of premixes is due to the fact that, unlike conventional feeds, their composition, in addition to the actual nutrients, includes various auxiliary components, so that the animal body assimilates vitamins, minerals and other components much more effectively.

Premixes containing fat- and water-soluble vitamins, micro- and macroelements, amino acids, contribute to the improvement of the digestive system function, activate metabolic processes, stimulate physiological functions of the body. Therefore, the selection of diluent is of great importance in modern premix production.

Topinambour has a high fiber content. All this makes topinambur just a necessary product for maintaining animal health. Especially valuable in topinambur is the fact that its root crops are rich in the natural analog of insulin - inulin. In addition, plants of the genus Juzgun have high antioxidant properties, which allows us to use the drug under development to prevent the formation of free-radical compounds in the cells of the sick organism. Free radicals, as products of lipid peroxidation, cause premature aging of cells and deprive them of the ability to grow and reproduce. In pathological conditions of the organism it is free-radical compounds that cause their main pathogenesis.[16]

Table 6. Dynamics of live weight increase in calves of experimental and control groups (n=10).

Indicators	Experimental group (n=10)	Control group (n=10)
Live weight, kg First weighing (before the experiment)	25,8±0,5*	25,7±0,5*
After 30 days	50,7±0,5*	44,8±0,7*
After 60 days	74,2±0,7*	68,1±0,7*
For 1 month average live weight gain, g	801±12,3*	618±13,1*

*-P ≤ 0,001

Consequently, juzgun will prevent the accumulation of free under-oxidized products in the body, and therefore will accelerate the recovery process of animals. The complex effect leads to a reduction in the number of microorganisms in premixes and feeds. In turn, reduction of microbiological contamination of premixes and feeds prevents spontaneous increase of their humidity, molding, deterioration of bulkiness and formation of clumps, spontaneous combustion and formation of toxic metabolic products. These compounds provide adaptation and trophic function of the animal organism, counteract inflammatory mediators, increase bile formation, reduce fermentation processes in the digestive tract, have bacteriostatic and fungicidal properties, have immunocorrective effect. Physiological and pharmacological effect of the listed substances on animals is associated with the improvement of digestive processes.[17]

Thus, feeding of biologically active feed additive to growing calves caused stimulation of protein, carbohydrate and mineral metabolism in blood and additional gain in live weight. The complex of biologically active substances of the supplement had a stimulating effect on the growth of the number of immunocompetent cells. Satisfaction of nutritional requirements of animals when they are fed on rations balanced according to the norms significantly depends on the actual digestibility and assimilability of feed nutrition components. In more accurate accounting of these coefficients are hidden reserves of increasing the efficiency of animal feeding.[17] The main purpose of mixed fodders in feeding ruminants - optimization of diets for energy and protein. In this case, the condition for their effective action is the level of nutrients and their ratio. One of the methods allowing to regulate in the ration the ratio of easily and difficult to break down protein is the selection of ingredients with different degree of its breakdown. For comparison purposes, the protein solubility of each of the ingredients included in the compound feeds was odetermined.[18]

The use of premix, based on topinambour, medicinal plant juzgun and phytosorbent including proteins, amino acids, vitamins, macro- and microelements, enzymes and other nutritional elements taking into account the species, level of productivity, sex and age of animals provides maximum healthy hereditary productivity and high reproductive ability. As the obtained data show, feed consumption by animals of experimental groups was at the level of recommended normative indicators. As a result of researches for the whole period of experiment the difference in feed consumption between experimental groups and control group was in 30 days - 50,7±0,5* and in 60 days - 92,05 kg, 74,2±0,7* respectively feed consumption was lower than in experimental groups relative to control. It is known that proteins serve as the main structural material for muscle formation in fast-growing animals, they play a major role in the metabolism of substances and energy, and the performance of physiological functions of the body. Proteins cannot be replaced by other nutrients such as fats and carbohydrates and must be fed to animals. In connection with intensive selection the need of cattle in protein is increasing, and in order to follow the dynamics of growth of experimental animals a control individual weighing was made. According to the results of weighing it was found that the cows of the experimental group during the period of experience the increase in live weight was more by 3.0% compared to control cows.

There was a slight increase in the blood of cows of the experimental group in hemoglobin (by 1.2%), erythrocytes (by 1.0%), calcium (by 3.1%), phosphorus (by 2.5%), glucose (by 2.1%), total protein (by 2.0%), and alkaline reserve (by 4.0%) compared to control animals. Hematological parameters showing that metabolism in calves of both groups proceeded in accordance with age features. Normally functioning digestive system provided calves with successful assimilation

of feed nutrients, in particular, proteins and amino acids, as evidenced by the level of albumin content, which in the blood of animals consuming the supplement was higher by 5% ($p \leq 0.03$) relative to the control index.

There was a statistically significant difference in urea content - in the blood of experimental calves its concentration was higher by 3.1% ($p \leq 0.03$). Urea concentration to a certain extent reflects the degree of amino acids degradation, in particular, the less urea in the blood, on the one hand, perhaps, the less amino acids are broken down or, on the other hand, the more active are the processes of protein synthesis in the body. The amount of hemoglobin in the blood of animals of the experimental group was higher by 2.2 % compared to the indicators of control calves.

The dynamics of erythrocytes had a similar character and in the blood of calves of the experimental group increased 6.0%compared to the control group. At the same time, some change in the number of leukocytes was observed. However, these changes, as in previous studies, were insignificant. The results of biochemical analysis of blood of experimental calves showed that in the blood of all experimental animals there was an increase in calcium content by 5.5% ($P < 0.05$) compared to control animals.

The phosphorus content in calves of the experimental group increased by 3.4% compared to the control. A similar trend was observed in the content of total protein. So by the end of the experiment the amount of total protein in blood serum of control calves was 5.7% lower compared to the animals of the experimental group. When studying the balance and utilization of calcium and phosphorus in physiological experiments it was found that the amount of calcium and phosphorus retained in the body of calves of the II experimental group was higher, respectively, compared to the animals of the control group. Before the beginning of the experiment M± m erythrocytes 1012/l corresponded to 5,05-7,50, and after the completion of the experiment had a value of 5,0±0,5, also leukocytes at the beginning of the experiment 4,5-12,0, and after the completion - 8,0±0,15, hemoglobin, g/l at the beginning of the experiment 90-120, and at the end of the experiment 87,5±1,5. In calves of the experimental group, receiving premix, increased content in blood of erythrocytes, hemoglobin was noted than in animals of the control group (Table 2). When calculating the digestibility coefficient, it was found that all nutrients were better digested by calves of the experimental group than their counterparts from the control group. The animals of the experimental group consumed the same amount of premix.

Summarizing the results of our research on the production and introduction of feed additive in cattle feeding, it should be emphasized once again that the study and solution of this problem in this regard favorably affects the metabolism and reproductive properties at the present time.

Feedlot cattle are exposed to several health challenges that directly impact their welfare and productivity throughout the feeding period (Cooke, 2017). These include bovine respiratory disease (BRD) during the initial weeks on feed (Galyean *et al*., 2022), acidosis and its resulting disorders (e.g., bloat, liver abscess, laminitis) with the advance of the feeding period (Nagaraja and Titgemeyer, 2007). For this reason, feedlot diets are often enriched with feed additives that mitigate the occurrence of BRD and digestive-related syndromes (Galyean *et al*., 2022). Monensin and tylosin are examples of feed-grade antimicrobials used in U.S. commercial feedlots to inhibit bacteria that impair rumen and liver function (Samuelson *et al*., 2016). With the increased regulations regarding the use of antimicrobials in livestock nutrition (Cooke, 2017), novel dietary strategies to improve the health and performance of feedlot cattle are warranted.[19] This experiment was representative of the management challenges that feedlot cattle experience throughout the feeding period in commercial U.S. feedyards. Steers were fed traditional high-grain diets with the inclusion of a synbiotic supplement (yeast-derived prebiotic and B. subtilis probiotic) to replace, or fed in conjunction with monensin and tylosin. Steer ADG was not impacted, whereas TMR intake was increased and G:F decreased when the synbiotic supplement replaced monensin and tylosin. Inclusion of the synbiotic supplement improved carcass marbling and Longissimus muscle area, and eliminated the incidence of liver abscesses when fed in conjunction with monensin and tylosin. Despite timely improvements to steer metabolic and innate immune responses when replacing monensin and tylosin, the synbiotic supplement did not reduce BRD incidence. Nonetheless, results from this experiment indicate that synbiotic supplementation of a yeast-derived prebiotic and a B. subtilis probiotic may replace monensin and tylosin without reducing steer ADG, with the potential to improve carcass quality traits.[20]

Currently, more attention is paid to solving problems related to increasing beef production. Over the recent years, due to decrease in the population of dairy cattle, the number of young meat animals for fattening decreased as well. There are reports that more intensive growth of dairy cattle can result in no less heavy carcass and high-quality meat than that from meat cattle (Bown *et al*., 2016). Therefore, study of meat qualities of bulls of modern dairy breeds in the conditions of the region with certain nutrition conditions, advanced cattle breeding, is relevant. Effective development of livestock breeding is possible only in the conditions of rational use of existing fodders in each farm. However, most plant-based fodders do not satisfy the need of animals forthe most essential microelements necessary for the highest parameters of meat productivity, which are important factors of providing complete diet.The source of nutrients for animals in easily-digested form is food additives that can compensate deficiency of elements in diet. According to Fediuchka *et al*., an essential component in the rational diet of young cattle is mineral nutrition. Their study also confirmed the efficacy of using vitaminmineral and protein-vitamin-mineral additives in the diet of calves. We should note that consumption of various

sources of microelements led to different effects on the slaughter parameters, qualitative composition of bulls' carcasses.[21]

The effects of feed additives are increasing feed digestibility, balance of rumen microbial community, stimulating the immune response and livestock productivity. This study aimed to determine the effects of feed additives combination in the rumen fermentation. The method used in this study was a block randomized design with 9 treatments and 3 replications. The experiment using Theodorou In vitro method for 48 hours with parameters such as pH, kinetics gas and methane production, DMD, OMD, NH3, and partial VFA. The treatment were P0; control (Basal Diet 70% Concentrate + 30% Forages), P1; P0 + Premix, P2; P1 + Probiotic, P3; P1 + Enzyme, P4; P1 + Plant Extract, P5; P1 + (Probiotics + Enzyme), P6; P1 + (Probiotics + Plant Extract), P7; P1 + (Probiotic + Enzyme + Plant Extract), and P8; P1 + (Enzyme + Plant Extract). The results showed kinetics gas, methane production, NH3, and partial VFA were significantly affected.[22]

However, it should be noted that the premix quality mainly depends on the filler. Due to the above, the authors have performed comprehensive studies of the possibility to use fodder concentrate and the Sarepta vegetable raw material as a filler in the composition of premixes for cattle and poultry diets. In studying the nutritional value and the technological properties, the new filler was favorably different from the one traditionally used (sunflower meal). In the course of the research of using premixes and protein vitamin-mineral concentrates with the new filler in the composition of the fodder for agricultural animals and poultry, the following positive results were obtained: during the main period of experiment, milk yield of the dairy cows increased by 7.40%; milk quality also improved, the value of byproducts from a single animal amounted to 4,928 rubles; the live weight of the dairy calves increased by the age of six months by 1.7%, which amounted to 7,560 rubles of additional growth; during the period of experiment, egg productivity of the laying hens increased by up to 1.73%, and the economic effect was 1,142.73 rubles; the live weight of the broiler chickens increased by 10.2%, the slaughter yield of carcasses increased by 1.9%, with that, the additional profit per animal was about 55.51 rubles. Based on the comprehensive research, one can recommend introducing the premix with the Sarepta concentrate to the diets of cattle and poultry to increase their productivity, improving product quality and economic efficiency of the livestock breeding industry and poultry production.[23]

Although mineral macronutrients are present in the body of animals in smaller proportions than, for example, the protein and lipid fractions, are responsible for functions in the body (Coelho da Silva, 1995). Deficiencies in one or more of these elements may result in disorders serious nutritional problems, causing in the animal performance production and reproduction fall short of their potential. The total requirement of each mineral macroelement is obtained by the sum of the requirements for maintenance andproduction, more often using the method factorial for predicting the needs of minerals for cattle (ARC, 1980). From the correction of the total requirement by the absorption coefficient of the inorganic element in the digestive tract of the animal, the dietary requirement of mineral element. Most of the cattle slaughtered in the Brazil is raised on pasture, usually composed of forage species with high production potential dry matter (C4 plants), which implies low levels in mineral macronutrients, by reason of the dilution factor. Another factor critical to the mineral nutrition of cattle in Brazilian livestock is the location of production systems, marginalized in terms of soil fertility, reflecting negatively on mineral contents in plants, food basic of cattle.[24] The separation of these two factors involved in the control of rumen fermentation is important for a full understanding of rumen function, for developing more accurate mathematical models, and for designing strategies to prevent and control rumen acidosis.Rumen NH3 product depends on dietary protein, the rate of degradation, and time after eating. Feed protein that enters the rumen will be fermented by proteolytic microbes (bacteria and protozoa). Bacteria and protozoa produce proteolytic enzymes such as proteases, peptides and deaminases that digest proteins into amino acids, peptides, and ammonia.[25]

4. Conclusion

The developed premix for improving the protein nutritional value of feed contains organic compounds of small molecular weight - fructooligosaccharides, organic acids that favor the development of beneficial microbes and limit the action of harmful ones, which invariably reach the habitat of the saccharolytic microflora and serve as a food substrate for it, actively stimulating its growth and vital activity and normalizing the microecology of the colon. Based on our data on the increase in the live weight of experimental animals and total serum protein, because in turn, an increase in metabolism increases the oxygen consumption of the animal's body, which results in an increase in the number of red blood cells and the concentration of hemoglobin in the blood. The usefulness of animal nutrition had a positive effect on the content of total protein and protein fractions in blood serum. After the introduction of premix into the diet, the concentration of total protein in the blood of experienced cows significantly increased by 14.55%. In the dry matter of the blood, the protein fraction occupies the largest place. The shifts that occurred in the content of albumins and globulins reflected changes in the level of serum blood proteins, because there is a dynamic balance between the content of tissue proteins and blood serum. The introduction of the premix into the diet of lactating cows after 10 days of the experiment caused an increase in the fat content of milk by 17.6% compared with control animals. The use of a premix containing phytoextracts, has a corrective effect on metabolic processes in the body, increases metabolism in the blood and stimulates immune

properties.

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Conflict of Interest
There is no conflict of interest.

Supporting Information
Not applicable

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