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THE USE OF SOME PREPARATIONS WITH BENEFICIAL MICROORGANISMS IN CUNICULTURE

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CONTENTS

CONCEPTUAL REFERENCE POINTS FOR RESEARCH

The relevance and importance of the topic is the implementation in the Cuniculture domain of preparations with beneficial microorganisms, in order to combat gastrointestinal diseases, optimize the physiological indices of youth and achieve maximum productivity [3, 5, 9, 11, 20, 21], to provide the population of the Republic of Moldova with quality and safe rabbit meat for the consumer.

The economic importance of breeding domestic rabbits arises from the nature, volume, value and diversity of the productions they provide, in a short period of time and at a fairly low cost price [1].

The large-scale production and implementation in cuniculture of feed additives based on living microbial cultures or products of their metabolism is an important task of modern science.

Beneficial microorganisms used as additives in animal nutrition belong to bacterial genera as *Bifidobacterium, Lactobacillus, Bacillus, Enterococcus, Streptococcus* and yeasts of the genus *Saccharomyces.*

Preparations with beneficial microorganisms, used in animal ration, have the following advantages as reduce the risk of infection and spread of infectious diseases; decreases the frequency of development of gastrointestinal disorders in youth; minimize the number of microorganisms, flies and unpleasant odor in the operating environment of animals; decrease in the percentage of their morbidity and mortality; increase metabolic processes in the body and increase the weight of animals; reduces the cost of feed and reduces specific feed consumption; they allow to obtain high quality organic products, safe, both bacteriologically and chemically [2, 4, 8, 11, 13, 14, 17, 21].

The future of the cunicule branch in the Republic of Moldova lies in the efficient technologies of maintenance, exploitation and feeding of rabbits through the implementation of preparations with beneficial mycoorganisms.

The situation in the field of research and the identification of research problems. In recent years, both in the world and in the Republic of Moldova, there has been a sharp worsening of the epidemiological situation regarding agricultural animal diseases [6, 7, 10, 12, 18].

The rabbits, just like other species of animals and birds, are very susceptible to dysbiosis. Most often, the imbalance of microorganisms in the intestinal microbiota in rabbits is disturbed by infectious, non-infectious and parasitic diseases, such as pasteureloza, anaerobic enterotoxemia, coccidiosis, etc. At the same time, the overpopulation of the halls, the non-compliance with the zoohygienic parameters of microclimate, the ignoring of disinfections contribute to the pollution of the rabbit maintenance halls with pathogenic microflora, increasing the risk of morbidity, cullings for slaughter and their mortality. Consequently, these situations cause an essential lost to the Economic Operator [1, 13, 15, 16, 19].

The most accessible and easy way to solve the problems of the cuniculture domain is to balance the food ration of animals, according to age and physiological state, with the mandatory use of supplements based on organic minerals and preparations with beneficial microorganisms [13, 15]. These preparations contain living microorganisms, harmless to the human and animal organism, possess antagonistic properties on pathogenic and conditionally pathogenic bacteria [4].

At the moment, there is not enough information on the impact of preparations with beneficial microorganisms on the growth and development of domestic rabbits or in the prevention and treatment of intestinal infections of them. Therefore, the production of preparations based on beneficial microorganisms and the development of technologies for their implementation in cuniculture, is a very urgent task [13, 15].

Purpose of the present work: evaluation of the impact of the biomass of *Streptomyces levoris* CNMN-Ac-01 and the probiotic *EM-1*® on the microbiota of the gastrointestinal tract, rearing and development of domestic rabbits

Research objectives:

1. Obtaining the biomass of *Streptomyces levoris* CNMN-Ac-01;
2. Inclusion of *Streptomyces levoris* CNMN-Ac-01 biomass in the granulated compound feed recipe and study of its microbiological and chemical composition;
3. Preparation of the working solution of the *EM-1*® probiotic and study of its microbiological composition;
4. Studying the influence of granulated compound feed with and without addition of *Streptomyces levoris* CNMN-Ac-01 biomass and the working solution of probiotic *EM-1* ® on the microflora of the gastrointestinal tract, physiological state and some morphoproductive indicators of rabbits;
5. Calculation of the economic efficiency obtained from the use of *Streptomyces levoris* CNMN-Ac-01 biomass and *EM-1*® probiotic in rabbit breeding technology.

The research hypothesis is based on the fact that beneficial microorganisms balance the composition of the gastrointestinal microbiota in animals, provides permeability of the intestinal mucosa for the absorption of nutrients, they produce antibacterial substances that have antagonistic action on pathogenic and conditionally pathogenic bacteria, reduce the amount of toxins on the receptors of the intestinal mucosa, thus, intensifying metabolic processes in the body increasing the health and productive performance of animals.

The synthesis of the research methodology and the justification of the chosen research methods was based on the implementation in cuniculture (in vivarium and enterprise conditions) of preparations with beneficial microorganisms and the realization of scientific research in laboratory conditions.

As research objects served: the biomass of *Streptomyces levoris* CNMN-Ac-01, probiotic, *EM-1*® , rabbits, hybrids, biracial selected by the ♀ Californian × ♂ New Zealand White, with the age of 60 days, half-breeds, trirasial ♀ (♀ Chinchillas × ♂ New Zealand White) × ♂ California, under the age of 45 days, and the rabbits of the breed Martini (pregnant females and youth of different ages).

Implementations of preparations with beneficial microorganisms were carried out in the vivarium of the Scientific and Practical Institute of Biotechnology in Zootechny and Veterinary Medicine (SPIBZVM) and on LLC "Eco-Fer-Mer" from v. Maximovca, district Anenii Noi.

According to the goal and objectives outlined, in order to demonstrate the expected research hypothesis, classical and modern methods of study were applied as classical microbiological, of cultivation, determination, isolation and identification of micro-organisms in granulated compound feed, of water, working solution of probiotic *EM-1*®, croutons and contents of sections of the gastrointestinal tract of rabbits; biochemicals, investigation of water and blood; chemical, investigation of granulated compound feed and rabbit meat; haematological, of determining the hematological indicators of the blood of rabbits; coproovoscopic, of determining eggs and larvae of helminths in faeces; statistics, analysis of the results and assessment of the economic effectiveness of the use of preparations with beneficial microorganisms studied.

CONTENT OF THE THESIS

In the **Introduction** of this work is argued the timeliness, importance and necessity of conducting scientific research carried out, the scientific novelty of the results obtained is described, the current situation in the field is reflected, the purpose and objectives of the study are formulated, research hypothesis, synthesis of research methodology and justification of the chosen research methods.

1. CUNICULTURE, THE ROLE OF BENEFICIAL MICROORGANISMS IN MAINTAINING THE HEALTH OF THE ANIMAL ORGANISM

In the **Review of the specialized literature** the results of scientific achievements in the field of study and implementation in practice of preparations with beneficial microorganisms are described.

In the first part of the chapter, research on the directions of exploitation and economic aspects of breeding domestic rabbits are described. The most important properties of rabbit meat and its benefits for human consumption, in particular, for children and elderly people, are exposed. According to the data of the National Bureau of Statistics, the dynamics of the herd of rabbits in the territory of R. Molova for 1980-2020 years and the number of rabbits in various regions of the country are indicated.

The second part of the chapter is devoted to the microbiocenosis of the gastrointestinal tract of animals, the classification of microorganisms inhabiting it, their functional properties, clinical manifestation and consequences of gastrointestinal dysbiosis. The role of food factor, cecotrophy, antibiotics, stress and toxicological factors in maintaining intestinal microbiocenosis and body health is described. Special attention in this chapter is paid to the impact of the preparations of microorganisms effective in the genus *Bacillus*, the genus *Streptomyces*, and the additives of microbial origin in the combating and prevention of bacterial infections of the gastrointestinal tract, and enhancing the morfoproductivity indicators in the animals.

Based on the study of the specialized literature, it was argued the importance of the implementation in the cuniculture of preparations with beneficial microorganisms to decrease the percentage of morbidity and mortality of youth and increase some morphoproductive indicators in rabbits.

2. OBJECTS OF STUDY AND METHODS APPLIED IN RESEARCH

The chapter contains a description of the objects and methods used to conduct research.

As objects of study served: biomass of *Streptomyces levoris* CNMN-Ac-01, which belongs to the National Collection of non-pathogenic strains of the Institute of Microbiology and Biotechnology; probiotic *EM-1®* intended for phytotechnics, produced by the German company Emico and home rabbits.

The experiments to test the effectiveness of preparations with beneficial microflora, the biomass of Streptomyces levoris CNMN-Ac-01 and the probiotic *EM-1®*, on the animal organism, were carried out on batches of rabbits of different breeds and ages.

The experiments no. 1 and no. 2, with a duration of 78 days, were organized in the conditions of the vivarium within the SPIBZVM.

For the experiment no. 1 "The impact of *Streptomyces levoris* CNMN-Ac-01 biomass on the microbiota of the gastrointestinal tract, growth and development of biracial rabbits" were selected clinically healthy rabbits of the same age and body mass, each in separated metal boxes. In the control and experimental lots were included 5 rabbits (only females) crossbreeds biracial ♀Californian × ♂New Zealand White, aged 60 days.

In the experiment no. 2 "The impact of *Streptomyces levoris* CNMN-Ac-01 biomass on the microbiota of the gastrointestinal tract, growth and development of trirasial rabbits" two batches of rabbits were included. The control and experimental batches of rabbits consisted of 5 heads (only females) crossbred triracial ♀ (♀Chinchilla × ♂New Zealand White) ×♂Californian, aged 45 days.

The biracial and trirasial rabbits from the control batches during the experiment consumed granulated combined fodder produced according to recipe no. 1, and those in the experimental batches consumed granulated combined fodder produced according to recipe no. 2 (table 2.1).

Table 2.1 Structure of granulated combined feed recipes, %

Nr.	Ingredients	Recipe nr. 1	Recipe nr. 2
1	Alfalfa hay flour	34.0	34.0
2	Corn	13.1	13.0
3	Wheat	10.0	10.0
4	Barley	10.0	10.0
5	Sunflower press cake	11.0	11.0
6	Soybean meal	8.0	8.0
7	Alcohol remnants	6.5	6.5
8	Grape marc	3.9	3.9
9	Premix "Bunny"	2.0	2.0
10	Limestone	1.0	1.0
11	Table salt	0.5	0.5
12	Biomass *S. levoris* CNMN-Ac-01	-	0.1

During the experiments no. 1 and no. 2 were determined: the amount of lipids synthesized by *Streptomyces levoris* CNMN-Ac-01 reared in organic liquid culture media; the antimicrobial activity of *Streptomyces levoris* strain CNMN-Ac-01 after long-term storage by subcultivation on different media; the impact of granulated compound feed with and without addition of *Streptomyces levoris* CNMN-Ac-01 biomass on microbiological quality and chemical composition of granulated compound feed; the biochemical indicators of the blood in rabbits; the microbiological composition of hard croutons; the specific feed consumption; the body mass dynamics of rabbits; chemical composition of rabbit meat; the rabbit slaughter yield and values of some slaughter indicators; the microbiological composition of the content of sections in the gastrointestinal tract of rabbits; the economic efficiency of the use of *Streptomyces levoris* CNMN-Ac-01 biomass in cuniculture.

Experiment no. 3. "The impact of probiotic *EM-1*® on the microbiota of the gastrointestinal tract, the growth and development of Martini rabbits", it took place within the rabbit farm LLC "Eco-Fer-Mer", v. Maximovca, district Anenii Noi. During the experiment the rabbits from the control batch (20 females and 5 heads youth) consumed filtered water, and those from the experimental batch (20 females and 5 heads youth) consumed the working solution of the probiotic *EM-1*® (represents 1.5 ml preparation of the probiotic *EM-1*® per 1 liter of filtered water). The Rabbits from both batches consumed the same granulated feed.

For bacteriological research of manure samples, water, working solution of probiotic *EM-1*® and *Streptomyces levoris* CNMN-Ac-01 biomass were used classical methods of isolation and identification of bacteria, carried out in the laboratory Methods of Combating and Prophylaxis of Diseases of the PI Scientific and Practical Institute of Biotechnology in Zootechny and Veterinary Medicine.

The research to determine the chemical indicators of feed and meat, biochemical indicators of water and blood were carried out in specialized laboratories: The Nutrition and Feed Technologies, The Biotechnology in Reproduction and Embryo Transfer, The Sheep and Goats Breeding and Exploitation Technologies within the SPIBZVM, according to the standardized methods stipulated in the technical and regulatory documentation.

3. THE IMPACT OF *STREPTOMYCES LEVORIS* CNMN-AC-01 BIOMASS ON THE MICROBIOTA OF THE GASTROINTESTINAL TRACT, GROWTH AND DEVELOPMENT OF BIRACIAL AND TRIRASIAL RABBITS

The biomass of *Streptomyces levoris* CNMN-Ac-01 was obtained within the National Collection of Non-pathogenic Microorganisms of the Institute of Microbiology and Biotechnology.

The total number of *Streptomyces levoris* CNMN-Ac-01 germs constituted 4.3×10^8 CFU/g of biomass.

In the result of the cultivation of the strain *Streptomyces levoris* CNMN-Ac-01 on complex and synthetic liquid culture media it was found that for the accumulation of biomass of *Streptomyces levoris* CNMN-Ac-01, with an optimal content of total lipids, the most optimal are the liquid media with complex composition M-I and SP-I (table 3.1).

Table 3.1. Biomass quantity and total lipid content in the biomass of *Streptomyces levoris* CNMN-Ac-01 grown on liquid media

Culture medium	Biomass, g/l	Lipids, %
Czapek (control)	4.10	5.10
M-I	5.08	16.05
SP-I	7.76	19.93

The preservation of the strain *Streptomyces levoris* CNMN-Ac-01, for a period of 10 years, decreased its antibacterial activity on conditionally pathogenic bacteria and fungi *Aspergillus spp*., *Fusarium spp*. The decrease in antifungal activity of the studied strain was manifested to a greater extent in cultivation on complex organic media (by 20.0-23.5%) and slightly less on Czapek medium.

The biomass of *Streptomyces levoris* CNMN-Ac-01 was included in the composition of granulated combined feed for rabbits. In the result of microbiological and chemical investigations of the feed, produced for experimental purposes, it was

found that the addition of the biomass of *Streptomyces levoris* CNMN-Ac-01, the temperature and pressure during compaction of the mixed feed friable in granulate, improved its sanitary state, by decreasing the amount of *E. coli* and *Enterococcus spp.* and the total destruction of *Aspergillus niger*, but did not significantly influence their chemical composition.

3.1. The impact of *Streptomyces levoris* CNMN-Ac-01 biomass on microbiota of gastrointestinal tract, growth and development of biracial rabbits

The experiment was organized in the conditions of the vivarium within the SPIBZVM, according to the scheme in figure 3.1.

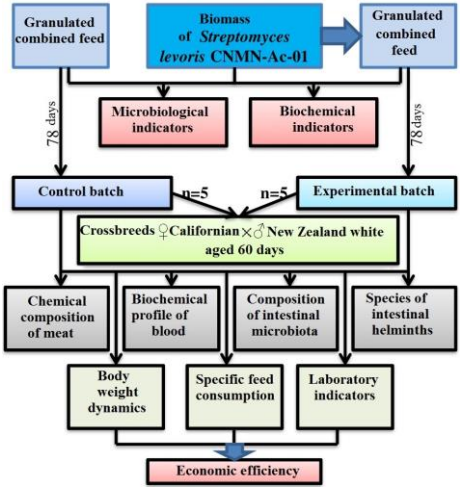


Figure 3.1. Scheme of experiment no. 1 " The impact of biomass of *Streptomyces levoris* CNMN-Ac-01 on the gastrointestinal tract microbiota, breeding and development of biracial rabbits"

Biracial rabbits from the control group, during the experiment, consumed 12.61 kg/head of granulated combined feed, and those from the experimental group - 10.64 kg/head, or by15.62% less. The specific consumption of granulated combined feed by biracial rabbits in the experimental batch compared to those in the control batch was by 23.92% lower.

The feeding, during 15 days, biracial rabbits with granulated combined feed with the addition of *Streptomyces levoris* CNMN-Ac-01 biomass favored the quantitative increase of *E. coli* microorganisms, *Clostridium spp.*, *Bifidobacterium spp.*, *Bacillus spp.* and fungi in the digestive tract of rabbits from the experimental batch compared to the control, respectively by 33.95% ($P<0.001$), 9.15% ($P<0.05$), 2,18%, 47,64% ($P<0.001$) and 1.29% (table 3.2).

At the end of the experiment, the amount of Bifidobacterium spp. and *Bacillus spp.* in the manure of rabbits from the experimental lot exceeded that of the Control lot by 1.36% and 13.63% (P<0.01) respectively, and the amount of *E. coli*, *Enterococcus spp.* and *Clostridium spp.* it was significantly lower by 40.97% (P<0.05), 38.18% (P<0.001) and 13.06% (P<0.01) respectively.

Table 3.2. Microbiological composition of rough crotins in biracial rabbits (n=5), log CFU/g

Specification	At the beginning of the experiment	After 15 days from the beginning of the experiment		At the end of experiment	
		Control batch	Experimental batch	Control batch	Experimental batch
Age, days	60	75		138	
TNG	10.45±0.17	8.30±0.21	8.86±0.13	7.18±0.11	6.43±0.05***
E. coli	7.28±0.53	5.95±0.14	7.97±0.22***	5.59±0.05	3.30±0.09*
Enterococcus spp.	6.39±0.04	6.43±0.13	5.59±0.14**	5.37±0.10	3.32±0.09***
Clostridium spp.	7.26±0.05	7.43±0.10	8.11±0.24*	6.28±0.08	5.46±0.15**
Lactobacillus spp.	6.75±0.16	5.83±0.22	5.28±0.14	4.43±0.11	2.68±0.06***
Bifidobacterium spp.	8.89±0.24	9.17±0.25	9.37±0.24	7.37±0.35	7.47±0.06
Bacillus spp.	9.00±0.09	6.57±0.11	9.70±0.12***	7.19±0.22	8.17±0.13**
Funguses	8.31±0.30	6.18±0.09	6.26±0.20	10^{-1}-0	10^{-1}-0

Note: *-P<0.05; **- P<0.01;***- P<0.001

The consumption of granulated compound feed recipe no. 2 for the biracial rabbits, over the period of the experiment, increased the metabolism of protein, carbohydrate, and bone in their body, indicating an increase in the synthesis of protein, albumin, glucose, and alkaline phosphatase in the blood serum of the animals in the experimental group, respectively, with the 5.64%, 34.88% (P<0.001), 35.71% (P<0.001), and 55.73% (P<0.001), compared with that in the serum of the animals in the control group (table 3.3).

Table 3.3. The value of biochemical indicators in the blood of biracial rabbits (n = 5)

Specification	At the beginning of the experiment	At the end of experiment	
		Control batch	Experimental batch
Protein, g/l	24.17±0.93	31.40±1.85	33.17±1.37
Albumin, g/l	20.93±0.40	20.93±1.34	28.23±0.25***
Glucose, mmol/l	1.06±0.01	4.06±0.18	5.51±0.09***
Alkaline phosphatase, IU/l	8.07±0.32	6.80±0.46	10.59±0.46***

Note: ***- P<0.001

During the experiment, the biracial rabbits from the control lot gained 1947.00 g in weight, the value of the daily increase was 24.96 g/day, and those from the experimental lot gained 2158.00 g, with the value of the daily increase of 27.67 g/day or by10.86% higher (figure 3.2).

The lowest growth rate was recorded at the age of 125-138 days, being 13.6 g/day for biracial rabbits in the experimental batch and 8.80 g/day (by 35.29% less) for those in the control batch (figure 3.3).

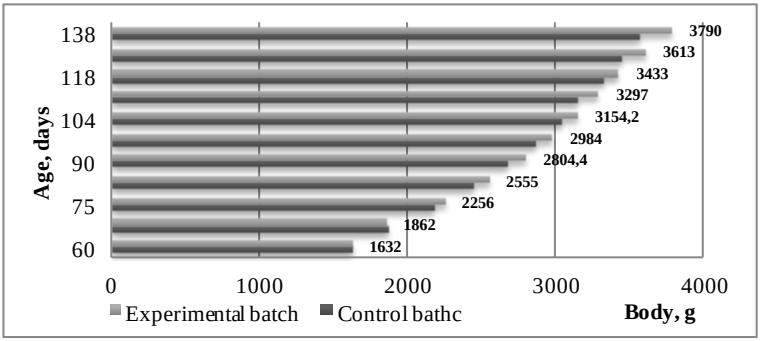


Figure 3.2. Body weight dynamics of biracial rabbits, (n = 5)

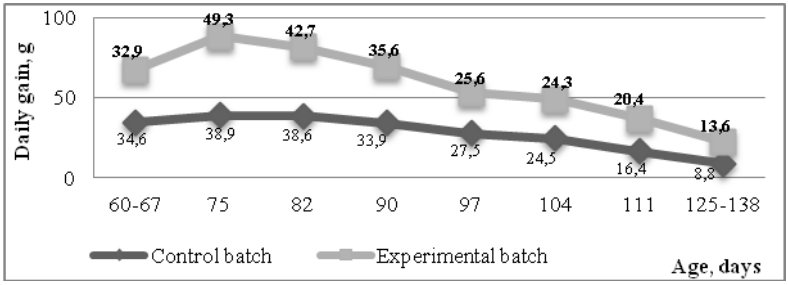


Figure 3.3. Daily gain value of biracial rabbits during the experiment

The biracial rabbits were slaughtered at the age of 138 days. Studying the slaughter indicators of the rabbits it was found that they had good constitution with long, smooth and wide back and hips, covered with firmly and dense muscles. The state of fattening of rabbits was satisfactory.

The yield of slaughter of biracial rabbits was 53.31% for the control batch, and for the experimental batch constituted 52.72%, being by 1.11% lower. The ratio of bones:meat in the rabbit carcass of the experimental batch was 1:5.92 and exceeded that of the control batch by 38.32%.

As a result of studying the microbiological composition of the content of sections of the gastrointestinal tract of biracial rabbits, it was determined that the total number of germs (TNG), *Bifidobacterium spp*., *Clostridium spp*. in the distal portion (caecum, colon, rectum) it was more increased compared to the proximal (stomach, duodenum, ileum). At the same time, the amount of microorganisms determined in the cecum, colon and rectum of rabbits in the experimental batch significantly exceeded that of those in the control batch. TNG in the cecum, colon and rectum of rabbits in the experimental batch exceeded the total number of germs

in the intestinal sections of animals in the control batch respectively by 23.58% (P<0.01), 9.64% (P<0.001) and 22.35% (P<0.001).

In the contents of the stomach, duodenum, jejunum and cecum of rabbits of both batches the amount of *Bifidobacterium spp*. oscillated quantitatively insignificant (figure 3.4) whereas in the colon and rectum their quantity was increased.

Thus, if in the stomach contents of rabbits from the control and experimental batches the beneficial microorganisms *Bifidobacterium spp.* constituted respectively 6.58±0.09 log CFU/g and 6.52±0.06 log CFU/g, then in the cecum their quantity was increased respectively by 11.55% and 14.88%, and in the colon - respectively by 4.56% and 33.13% (figure 3.4).

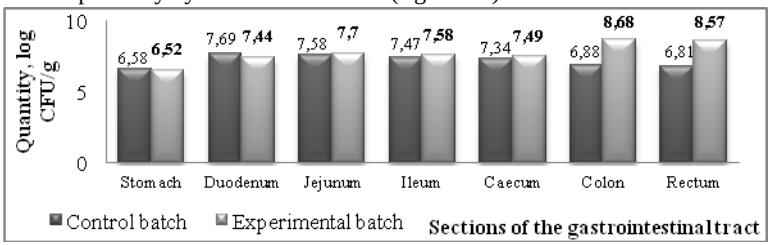


Figure 3.4. Quantity of *Bifidobacterium spp*. in the gastrointestinal tract of rabbits

The amount of beneficial microorganisms *Lactobacillus spp*. from the stomach, duodenum and jejunum of the rabbits in the experimental batch exceeded that of those in the control batch, respectively by 20.84% (P<0.01), 40.18% (P<0.001) and 45.92% (P<0.001).

In rabbits of the experimental batch the maximum amount of *Bacillus spp*. 8.62±0.11 log CFU/g was found in the cecum, exceeding that of those in the control batch by 16.64% (P<0.001), and in the stomach, duodenum and jejunum of the animals of both batches its amount oscillated insignificantly (figure 3.5).

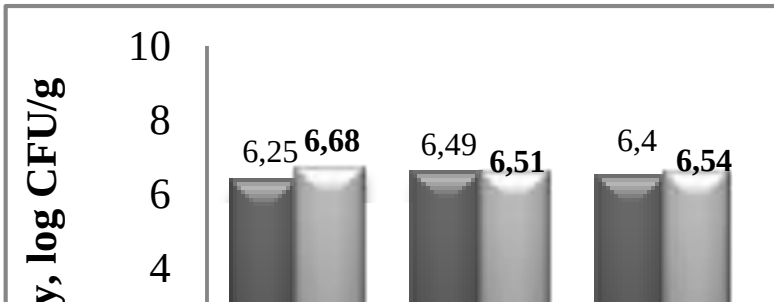
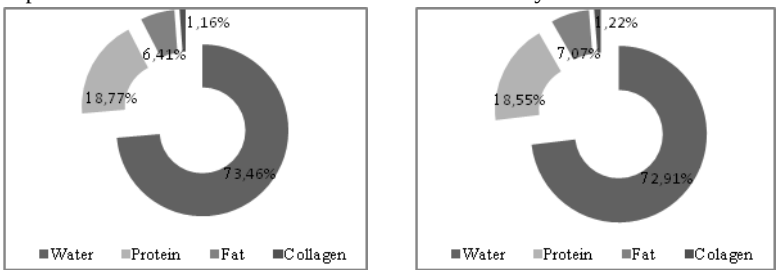


Figure 3.5. Quantity of *Bacillus spp*. in the gastrointestinal tract of rabbits

In the caecum, colon and rectum of rabbits in the control batch the amount of *Clostridium spp*. it was 5.61±0.06 log CFU/g, 5.87±0.17 log CFU/g and 5.31±0.08 log CFU/g, respectively, and the contents of the same sections of the gastrointestinal tract of rabbits in the experimental batch were found to be higher, respectively by 17.47% (P<0.001), 10.39% (P<0.05) and 27.49% (P<0.001).

In the meat of rabbits from the control batch compared to the experimental one, slaughtered at the age of 138 days, the amount of water and protein was insignificantly increased by 0.75% and 1.17% respectively (figure 3.6).

The amount of fat and collagen in the meat of the rabbits of the experimental batch exceeded that of the control batch by 10.30% and 5.17%.



a) Control batch b) Experimental batch

Figure 3.6. Chemical composition of meat in biracial rabbits (n = 3), %

Thus, the biomass of *Streptomyces levoris* CNMN-Ac-01 had an insignificant impact on the amount of water, protein and collagen, and a significant one on the amount of fat in rabbit meat.

The economic efficiency of the use of *Streptomyces levoris* CNMN-Ac-01 biomass in the feeding of biracial rabbits ensured a net profit of 12.86lei/head (table 3.4)

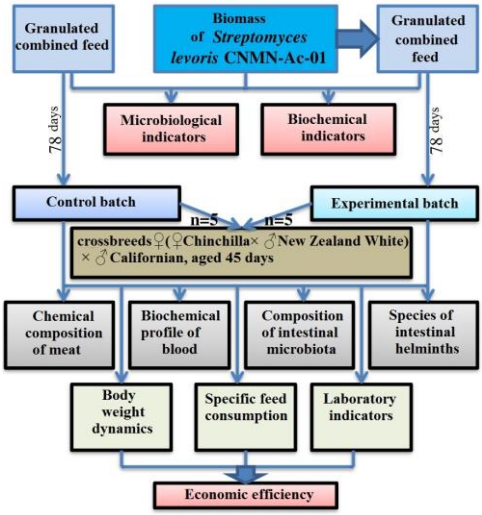
Table 3.4. Economic efficiency of the use of *S. levoris* CNMN-Ac-01 biomass in feeding of biracial rabbits

Specification	Control batch	Experimental batch	Compared to control batch
The cost of 1.0 kg of granulated combined fodder, lei	4.65	6.37	+1,72
The cost of granulated compound feed: Lei / cap / period	58.64	67.78	+9.14
Average body weight of one rabbit at the end of the experiment, g	3570.00	3790.00	+220.00
The price 1,0 kg of living mass, lei	100.00	100.00	
The price of 1 rabbit realisation, lei	357.00	379.00	+22.00
The bruto profit per head, lei	22.00		
The net profit per head, lei	12.86		

In conclusion, the recipe of granulated combined feed with the addition of biomass *Streptomyces levoris* biomass CNMN-Ac-01 - 0,1% represents a prospective nutritional solution for rabbit breeding in order to increase the economic efficiency of this branch.

3.2 The impact of *Streptomyces levoris* CNMN-Ac-01 biomass on the microbiota of the gastrointestinal tract, growth and development of trirasial rabbits

Experiment no. 2, with a duration of 78 days, was organized in the conditions of the vivarium within SPIBZVM, according to the scheme in Figure 3.7.



3.7 Scheme of experiment no. 2 " The impact of biomass of *Streptomyces levoris* CNMN-Ac-01 on the microbiota of the gastrointestinal tract, growing and development of trirasial rabbits"

As a result of the study of the influence of *Streptomyces levoris* CNMN-Ac-01 biomass on the microbiocenosis of the gastrointestinal tract in trirasial rabbits from the experimental batch compared to the control one, was remarked a significant decrease in the amount of *E. coli*, *Enterococcus spp.* and *Lactobacillus spp.* respectively with 49.07%, 42.91%, 46.19%, and increased *Bacillus spp.* with 15.98% in rabbit deljections. The threshold authentication for *E. coli, Enterococcus spp., Lactobacillus spp.* and *Bacillus spp.* constituted $P<0.001$.

In the trirasial rabbit organisms of the experimental batch compared to the control batch, the biomass *Streptomyces levoris* CNMN-Ac-01 intensified protein

metabolism, inducing an increase in protein and albumin synthesis in the blood serum, respectively by 14.52% (P<0.05) and 12.00% (table 3.5)

Table 3.5. Biochemical composition of blood in trirasial rabbits (n = 5)

Specification	Beginning of the experiment	At the end of the experiment	
		Control batch	Experimental batch
Age of rabbits, days	45	123	
Protein, g/l	30.90±2.25	38.83±0.45	44.47±1.93*
Albumin, g/l	20.95±2.21	32.50±0.90	36.40±2.38
Urea, mmol/l	0.48±0.07	0.46±0.05	0.60±0.05
Amylase, IU/l	55.32±17.41	76.00±6.04	129.00±15.11*
Glucose, mmol/l	4.35±0.36	7.89±0.31	5.76±0.39**
Triglycerides, mmol/l	1.16±0.12	0.25±0.03	0.53±0.03***
Cholesterol, mmol/l	1.84±0.18	0.14±0.03	0.35±0.02***
Alkaline phosphatase, IU/l	7.17±0.60	37.33±7.33	87.33±13.03*

Note: *-P<0,05; **- P<0,01;***- P<0,001

The metabolism of triglycerides and cholesterol was also more intense in the experimental rabbits compared to the control group 2.12 times (P<0.001) and 2.43 times (P<0.001) respectively. A significant increase in the amount of amylase by 133.19% in the blood serum of rabbits in the experimental batch compared to that of rabbits in the control batch, indicated the intensification of carbohydrate metabolism in animals.

During the experiment, the rabbits from the control and experimental batches added 1860.8 g and 1978.2 g, respectively, with the daily weight gain of 23.86 g/day and 25.36 g/day. Thus, the value of the average daily increase of rabbits in the experimental batch exceeded by 6.29% that of those in the control batch.

Body mass of rabbits in the experimental batch at the age of 67 days, 75 days, 82 days, 90 days, 97 days, 104 days, 111 days, 118 days exceeded that of rabbits in the control batch respectively with 7.97%, 11.62%, 9.89%, 8.99%, 7.86%, 7.53% (P<0.05), 7.19% (P<0.05), 5.36% (figure 3.8).

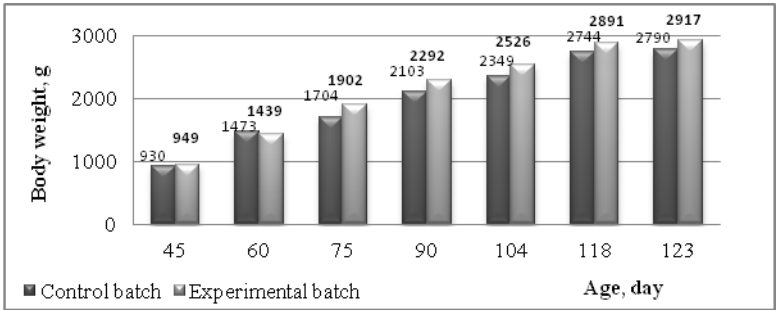


Figure 3.8. Body weight dynamics of triracial rabbits, (n = 5)

Thus, the feeding of rabbits with granulated feed combined with the addition of *Streptomyces levoris* CNMN-Ac-01 biomass favored the average daily weight gain, respectively the growth and development of domestic rabbits.

The trirasial rabbits were slaughtered at the age of 123 days respectively. The yield of slaughter of rabbits from the control batch was 51.50%, and of those from the experimental batch constituted 54.20%, being increased by 5.24%. The ratio bone:meat in the rabbit carcasses of the experimental batch was 1:3.43, being 31.92% higher than the ratio in the rabbit carcasses of the control batch.

In the proximal segment of the digestive tract (stomach, duodenum and jejunum) of slaughtered rabbits, both in the control and experimental batches, the TNG varied within 5.31 - 5.82 log CFU/g. In the ileum and cecum of the rabbits in the control batch, the total number of germs was 7.75±0.08 log CFU/g and 7.41±0.10 log CFU/g, respectively, and exceeded that of the experimental batch by 28.13% ($P<0.001$) and 24.29%.

In the cecum, colon and rectum of rabbits in the experimental batch the amount of *Bifidobacterium spp*. it was respectively 6.46±0.13 log CFU/g, 6.61±0.09 log CFU / g and 6.45±0.09 log CFU/g, exceeding that of the control batch by 18.53%, 20.84% and 17.92%.

In the meat of rabbits in the control compared to the experimental batch, slaughtered at the age of 123 days, the amount of water and protein was 1.55% and 1.05% lower respectively, and the amount of fat exceeded that of the experimental batch by 12.98%.

Thus, the biomass of *Streptomyces levoris* CNMN-Ac-01 had an insignificant impact on the amount of water, protein and collagen in the meat but a significant one on the amount of fat in the rabbit carcasses.

The economic efficiency of the use of *Streptomyces levoris* CNMN-Ac-01 biomass in the feeding of triracial rabbits ensured a net profit of 9.06 lei/head.

In conclusion, the use in rabbit feed of granulated compound feed with the addition of 0.1% of *Streptomyces levoris* CNMN-Ac-01 biomass, at industrial level, will contribute to increase the annual profit of the economic agent.

4. THE IMPACT OF PROBIOTIC *EM-1*® ON THE MICROBIOTA OF THE GASTROINTESTINAL TRACT, THE GROWTH AND DEVELOPMENT OF MARTINI RABBITS BREED

The experiment was carried out in the rabbit farm LLC "Eco-Fer-Mer", v. Maximovca, district Anenii Noi, according to the scheme in Figure 4.1.

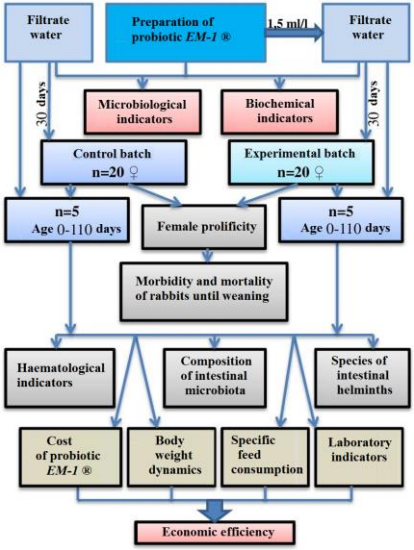


Figure 4.1. Scheme of experiment no. 3 "The impact of probiotic *EM-1*® on the microbiota of the gastrointestinal tract, growth and development in Martini rabbits"

During the experiment, the rabbits in the control batch (20 females and 5 young heads) consumed filtered water, and those in the experimental batch (20 females and 5 young heads) consumed the working solution of the probiotic *EM-1*®. The working solution of the *EM-1*® probiotic was obtained by diluting 1.5 ml of the *EM-1*® preparation to one liter of water. The *EM-1*® preparation was obtained in the laboratory of Methods in Combating and Prophylaxis of Diseases, using 500 ml of *EM-1*® concentrate, 22.0 liters of non-chlorinated water with a temperature of 25°C, and 2.5 liters of molasses. All components were placed in an airtight vessel, which maintained a constant temperature of 33ºC during 7 days of fermentation. Thus, the preparation of the probiotic *EM-1*® with a specific sour smell, with brown color and pH ≤ 3,6 was obtained.

The granulated feed was the same for both batches of animals.

The probiotic *EM-1*®, according to the package leaflet, contains: photosynthesizing bacteria, lactic acid bacteria, fermenting fungi, all of which are in

the state of anabiosis. In the microbiological composition of *EM-1®* concentrate, a small amount of microorganisms was found. The bacteria *Lactobacillus spp.*, *Bifidobacterium* spp., *Bacillus* species and yeasts did not exceed 10^3 CFU/ml.

In the composition of the preparation of the probiotic *EM-1®*, the amount of *Lactobacillus spp.* and *Bifidobacterium spp.* it was higher compared to the other species of microorganisms and was $5.53\pm2.67\times10^6$ CFU/ml and $1.07\pm0.27\times10^7$ CFU/ml, respectively.

The result of the biochemical analysis in the concentrate and in the preparation of the probiotic *EM-1®* were found the lack of nitrocompounds and the insignificant variation of the active acidity (5.00±0.03 - 5.02± 0.02 c.u.).

The water that provided the TES "Maximovca", during the conduct of the experiment, was supplied from the artesian well. According to the results of microbiological testing, in unfiltered and filtered water, the total number of germs (TNG) was $8.80\pm2.50\times10^4$ CFU/ml and $1.33\pm0.15\times10^3$ CFU/ml, respectively. No *E. coli, Enterococcus spp. Staphylococcus spp*. microorganisms were detected in the tested water samples.

During the experiment, the amount of TNG, *Bifidobacterium spp., Lactobacillus spp., Bacillus spp*., in the solution of the probiotic *EM-1®*, oscillated within 5.34 – 5.90 log CFU/ml, and the amount of fungi was between 4.26-4.83 log CFU/ml (figure 4.2).

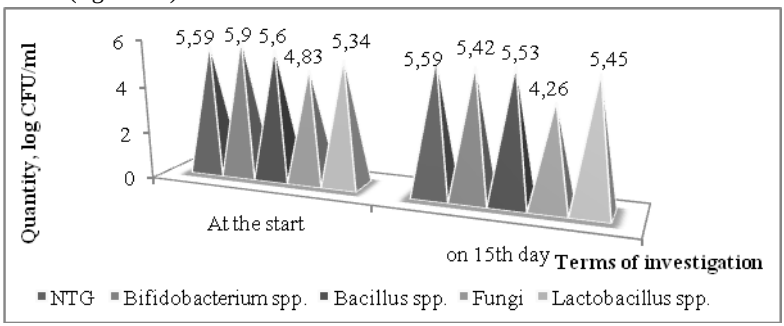


Figure 4.2. Microbiological composition of the working solution of the probiotic *EM-1®*

In the composition of the granulated compound feed was determined: TNG - $5.31\pm2.32\times10^3$ CFU/g and fungi were $2.57\pm0.59\times10^3$ CFU/g. According to biochemical and microbiological indicators, the granulated feed used for feeding rabbits in the experiment met the requirements permissible by legislative norms.

The female rabbits in the control batch (20 heads), during the study, consumed filtered water, and those in the experimental batch (20 heads) consumed the working solution of the probiotic *EM-1®*. Subsequently, only females with 7 and more bunnies in the nest were selected for research, the rest were excluded. Thus, it

was found that in the control batch 65.00% 13 heads of females gave birth to more than 7 bunnies, and in the experimental one 75.00% about 15 heads of females, or 15.38% more (table 4.1). The female prolificity in the experimental batch was 12.24% (P<0,01) higher, obtaining on average 10.27 bunnies/head, and in the control one-only 9.15 bunnies/head.

Table 4.1. Number of rabbits in the nest by age

Indicators	Age	Control batch	Experimental batch
Number of pregnant females	1 year	20	20
Number of females with more than 7 bunnies in the nest		13	15
Number of bunnies in the nest	1st day	9.15±0.27	10.27±0.25**
	15th day	8.69±0.36	10.00±0.24**
	30th day	8.31±0.44	9.27±0.23
	50th day	7.38±0.58	9.00±0.28*

Note: *-P<0,05; **- P<0,01

The mortality of rabbits in the control batch from birth to weaning was 19.34%, and in the experimental batch – 12.37%, or 36.04% less.

The mortality of rabbits in the control batch, during the periods 1-15 days, 15-30 days and 30-50 days in the experimental batch was respectively 5.03%, 4.37%, 11.19%, respectively 2.63%, 7.30%, 2.91% (figure 4.3).

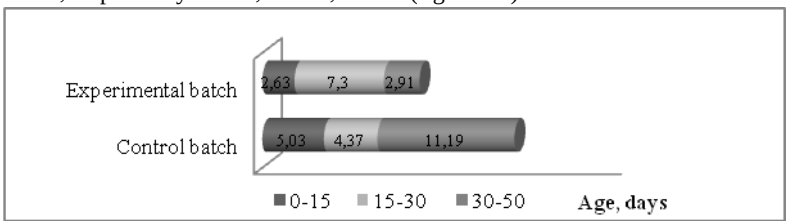


Figure 4.3. Mortality of rabbits until weaning, %

Thus, the daily administration of the working solution of probiotic *EM-1®* in the diet of pregnant and lactating females influenced their prolificity and decreased the mortality rate of newborn rabbits.

In rabbits of the experimental batch, at 24 days of age (table 4.2), compared to the control one, the amount of *E. coli, Enterococcus spp., Clostridium spp., Lactobacillus spp., Bifidobacterium spp., Bacillus spp*. and fungi in the manure was more increased, respectively with 7.57%, 12.63%, 16.11%, 24.05%, 8.43% 12.52% and 4.12%. Authenticity being P<0.001, and for *Bacillus spp.* is P<0.01.

During the experiment, the amount of *E. coli* in the manure of the rabbits of the control batch increased by 43.03% until the age of 38 days and subsequently decreased significantly by 42.01% towards the end of the experiment. The same

legality was found in rabbit manure from the experimental batch, but the increase and decrease in the amount of *E. coli* was slower and insignificant.

Until weaning rabbits, in the critical period of development of gastrointestinal diseases of bacterial or parasitic origin (eimeriosis), at the age of 31 days and 38 days, the amount of conditionally pathogenic microorganisms *Clostridium spp*. and *Enterococcus spp*. it was the most increased in the manure of both batches of rabbits, reaching maximum values.

Table 4.2. Microbiological composition of rabbit manure, log CFU/g (n = 5)

Batch	Age, days					
	24		31		38	
	Quantity	%	Quantity	%	Quantity	%
TNG						
c.	7.54±0.10	100	9.20±0.04	100	9.35±0.11	100
exp.	8.42±0,10***	111.67	8.51±0.18**	92.50	8.22±0.11***	87.91
E. coli						
c.	6.74±0.05	100	8.46±0.06	100	9.64±0.12	100
exp.	7.25±0.06***	107.57	8.39±0.14	99.17	8.24±0.09***	85.48
Enterococcus spp.						
c.	5.86±0.11	100	8.12±0.15	100	7.13±0.04	100
exp.	6.60±0.07***	112.63	7.40±0.08**	91.13	7.51±0.19	105.33
Clostridium spp.						
c.	6.58±0.15	100	9.17±0.08	100	9.66±0.06	100
exp.	7.64±0.10***	116.11	8.59±0.07***	93.68	8.54±0.15***	88.41
Lactobacillus spp.						
c.	4.20±0.05	100	2.62±0.10	100	<2,0	100
exp.	5.21±0.07***	124.05	2.47±0.09	94.27	4.32±0.14	>200
Bifidobacterium spp.						
c.	7.59±0.13	100	8.67±0.17	100	9.57±0.15	100
exp.	8.23±0.03**	108.43	8.53±0.18	98.38	8.57±0.11***	89.55
Bacillus spp.						
c.	7.43±0.05	100	9.23±0.08	100	9.50±0.13	100
exp.	8.36±0.06***	112.52	9.47±0.11	102.60	10.50±0.18**	110.53
Fungi						
c.	6.31±0.06	100	5.42±0.18	100	5.44±0.17	100
exp.	6.57±0.05*	104.12	5.48±0.13	101.10	5.32±0.12	97.79

Note: *-P<0,05; **- P<0,01;***- P<0,001

Quantity of beneficial microorganisms *Bifidobacterium spp.* was more constant in the manure of rabbits in the experimental batch, the maximum quantity being 8.57±0.11 log CFU / g, and in the control one it oscillated within the limit of 5.57±0.08 log CFU/g - 9.57±0.15 log CFU / g.

The greatest amount of helminth eggs was found in the droppings of rabbits aged 84 days, with *Eimeria spp*. oocysts predominant. The intensity of the invasion in the manure of the rabbits of the control group constituted 25-43 oocysts in the field of view and in the experimental group 3-20 oocysts in the field of view, being

considered small invasions. At the same time, the invasion with eggs of *Passalurus ambiguus* and *Strongyloides spp* was insignificant.

In the result of hematological investigations it was found that in rabbits from the control group, the mean leukocyte value exceeded that of animals from the experimental group by 4.96%. Haematocrit showed higher mean values in the blood of rabbits in the experimental batch compared to the control one, the difference being 17.32% ($P<0.05$). With regard to erythrocyte indicators: mean red blood cell volume, mean haemoglobin content in erythrocytes, mean haemoglobin in erythrocytes was found to have an insignificant difference in the blood of rabbits in both batches with a difference of 5.02% ($P<0.05$), 2.02% and 3.32%.

The working solution of the probiotic *EM-1®* favored increasing the number of red blood cells by 14.89%, the total amount of hemoglobin by 16.30% and the hematocrit by 20.95% in the blood of rabbits, thus intensifying the metabolic processes in the body and their growth and development respectively. During the period of the experiment, the difference in the consumption of granulated feed by rabbits from the control and experimental batches was insignificant (figure 4.4). In the calculation, only the period of 55-109 days of life was taken.

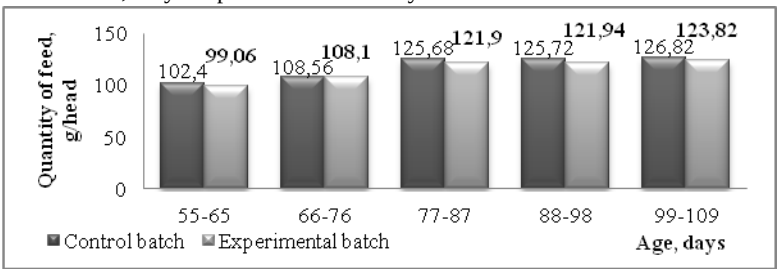


Figure 4.4. Quantity of granulated feed consumed daily by rabbits (n = 5) during the experiment

The growth rate of rabbits in both batches up to 54 days of age was the same (table 4.3). During this period, the growth and development of rabbits was dependent on the concentration of nutrients in breast milk and less on that of granulated feed.

Table 4.3. Body mass of rabbits during the experiment, (n = 5)

Indicators		Body mass, g	
		Control batch	Experimental batch
Age	24 days	376.00±8.86	369.00±2.92
	54 days	2112.00±24.01	2112.00±23.70
	74 days	2616.00±30.31	2633.00±54.42
	90 days	3065.00±38.11	3159.00±68.95
	110 days	3143.00±45.54	3420.00±88.16
Mass of cooled carcass(with kidney and internal fat)		1784.00±15.12	2020.00±56.63

After weaning, the growth intensity of rabbits in the experimental batch was higher compared to those in the control batch. The difference in body mass of rabbits in the control and experimental batches at the age of 24 days, 60 days, 90 days and 100 days constituted, respectively 1.89%, 0.69%, 3.07%, 8.81%.

The rabbits were slaughtered at the age of 110 days. The body mass of rabbits in the control slaughter batch was 3143.00±45.54 g, and of those in the experimental lot was 8.81% higher. In the period 54-110 days the rabbits from the control and experimental batches gained weight, respectively 1031 g/head and 1308 g/head. Analyzing the results of weight gain and consumption of granulated feed, it was found that for each kilogram of body mass the rabbits of the control and experimental batches consumed, respectively, 5715 g/head and 4395 g/head of granulated feed. Thus, the specific feed consumption of rabbits in the control batch, compared to the experimental one, was 23.10% higher.

The yield of slaughtering rabbits from the control batch was 56.76%, and the experimental ones 59.06%, being 4.05% higher.

Thus, the consumption by rabbits of the working solution of the probiotic *EM-1*® favored the increase of body mass and yield at slaughter.

According to the scheme of the experiment, for rabbits in the experimental batch 1.5 ml of probiotic preparation *EM-1*® was added to each liter of water, which is equivalent to 0.026 lei.

In the period 55-110 days (after weaning and until slaughter), rabbits consumed, on average, 380 ml of water/day/head, or 20.9 liters/head. Given that 1.5 ml of *EM-1*® preparation was added to each liter of drinking water, it follows that during 55 days each rabbit consumed 31.35 ml of *EM-1*® preparation, equivalent to 0.55 lei/head. Thus, the economic efficiency of the use of the working solution of probiotic *EM-1*® in the daily ration of Martni rabbits, in the period of age 54-110 days, ensured the economic agent obtaining a net profit of 27.77 lei/head.

GENERAL CONCLUSION AND RECOMMENDATIONS

Carrying out the research and analyzing the results obtained in the doctoral thesis "The use of preparations with beneficial microorganisms in rabbit farming" led to the formulation of the following conclusions:

1. The use of culture media with complex composition M-I and SP-I ensured the obtaining of the maximum amount of biomass of *Streptomyces levoris* CNMN-Ac-01, respectively of 5.08 g/l and 7.76 g/l, with an optimal total lipid content of 16.05% and 19.93%. To maximize the shelf life of antimicrobial activity, the strain *Streptomyces levoris* CNMN-Ac-01 should be stored on Czapek synthetic medium.

2. Daily administration of granulated compound feed with the addition of 0.1% biomass of *Streptomyces levoris* CNMN-Ac-01 to biracial rabbits resulted in a

quantitative decrease in some conditioned pathogenic microorganisms in the gastrointestinal tract microbiota such as *E. coli, Enterococus spp.*, and *Clostridium spp.*, respectively by 40.97%, 38.18% and 13.06%, simultaneously stimulating the numerical increase of beneficial microorganisms, especially *Bifidobacterium spp.* and *Bacillus spp.* respectively by 1.36% and 13.63%, compared to the indices from the control group.

3. Daily supplementation of the ration of Martini rabbits with the preparation of the probiotic *EM-1*®, in a ratio of 1.5 ml per liter of water, stimulated the quantitative increase of microorganisms as *E. coli* by 38.10%, *Enterococcus spp.* by 46.76 %, *Clostridium spp.* by 13.76%, *Lactobacillus spp.* by 43.57%, *Bacillus spp.* by 30.43% and fungi with 21.21% in the microbiota of the gastrointestinal tract compared to the same indices of the control group.

4. The biomass of *Streptomyces levoris* CNMN-Ac-01 and the working solution of the probiotic *EM-1*® had a positive impact on the growth and development of birasial, trirassial and Martini rabbits by intensifying protein, carbohydrate, lipid and bone metabolism in the body, and increasing mass body, respectively by 4.55%, 6.16% and 8.81%, compared to the control group.

5. The economic efficiency of the use of *Streptomyces levoris* CNMN-Ac-01 biomass in the feeding of birasial and triracial rabbits was 12.86 lei/rabbit and 9.06 lei/rabbit, respectively, and the use of the probiotic *EM-1*® in the ration of Martini rabbits ensured a net profit at the level of 27.77 lei/rabbit.

Practical recommendations

1. In order to reduce the specific consumption of fodder, regulate the gastrointestinal microbiota, stimulate health, growth and development of domestic rabbits, it is recommended to include the biomass of *Streptomyces levoris* CNMN-AC-01 in the compound feed in a concentration of 0.1%.

2. The probiotic *EM-1*® is necessary to be used in rations of rabbits of various ages and physiological conditions, in order to improve water quality, increase female prolificity, reduce the percentage of morbidity and mortality of newborns and increase muscle mass in youth.

Suggestions for future research

The extending of the research on studying the impact of various strains of beneficial microorganisms from the National Collection of Non-Pathogenic Microorganisms or from the collection within the laboratory Methods of Combating and Prophylaxis of Diseases on the body of rabbits of various ages.

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1. BOORTSEVA, S., BYRSA, M., **CARAMAN,** M., ACHIRI, I. Antimicrobial activity of *Streptomyces levoris* CNMN-Ac-01 after longterm storage by subculturing on different composition media. In: *Analele Universităţii din Oradea, Fascicula Biologie*. 2020, vol. XXVII, Issue 1, pp. 43-49. ISSN 1224-5119.

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15 **CARAMAN, Mariana**, MAȘNER, Oleg, MOSCALIC, Roman, COȘMAN, Sergiu, BURȚEVA, Svetlana, BÎRSA, Maxim, STARCIUC, Nicolae, PETCU, Igor. *Nutreț combinat granulat pentru iepurii de casă.* Brevet de invenție MD 1455 Z. Nr. depozit s 2019 0075. Data depozit 2019.07.15. Publicat 2020.09.30. In: BOPI, 2020, nr. 9, pp. 56.

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ADNOTARE

CARAMAN Mariana „Utilizarea unor preparate cu microorganisme benefice în cunicultură”, teză de doctor în ştiinţe medical-veterinare, Chișinău, 2021.

Structura tezei: introducere, 4 capitole, concluzii generale şi recomandări, bibliografie cu 260 titluri, 6 anexe, 123 pagini de text de bază, 35 figuri, 34 tabele. Rezultatele obţinute sunt publicate în 14 lucrări ştiinţifice şi un brevet de invenţie.

Cuvinte-cheie: microorganisme benefice, microbiotă, disbioză, biomasa de *Streptomyces levoris* CNMN-Ac-01, probioticul *EM-1®*, iepuri, cercetări microbiologice, indicatori biochimici, mediu nutritiv, tractul gastrointestinal, indicatori morfoproductivi.

Scopul lucrării: evaluarea impactului biomasei de *Streptomyces levoris* CNMN-Ac-01 şi a probioticului *EM-1®* asupra microbiotei tractului gastrointestinal, creşterii şi dezvoltării iepurilor de casă.

Obiectivele cercetării: obţinerea biomasei de *Streptomyces levoris* CNMN-Ac-01; includerea biomasei de *Streptomyces levoris* CNMN-Ac-01 în reţeta nutreţului combinat granulat şi studierea componenţei microbiologice şi chimice a acestuia; prepararea soluţiei de lucru a probioticului *EM-1®* şi studierea componenţei microbiologice a acesteia; studierea influenţei nutreţului combinat granulat cu şi fără adaosul biomasei de *Streptomyces levoris* CNMN-Ac-01 şi a soluţiei de lucru a probioticului *EM-1®* asupra microflorei tractului gastrointestinal, stării fiziologice şi a unor indicatori morfoproductivi a iepurilor; calcularea eficienţei economice obţinute în rezultatul utilizării biomasei de *Streptomyces levoris* CNMN-Ac-01 şi a probioticului *EM-1®* în tehnlogia de creştere a iepurilor.

Noutatea şi originalitatea ştiinţifică: pentru prima dată, în condiţiile R. Moldova, a fost studiat rolul biomasei de *Streptomyces levoris* CNMN-Ac-01 şi a probioticului *EM-1®* asupra legităţii de formare şi reglare a microbiotei tractului gastrointestinal la iepuri, stimulării sănătăţii, creşterii şi dezvoltării tineretului, calităţii chimice a cărnii de iepure şi propunerea acestor preparate pentru implementare în cunicultură.

Rezultatul obţinut, care contribuie la soluţionarea unei probleme ştiinţifice importante: elaborarea şi argumentarea ştiinţifică a două tehnologii de administrare (în hrană sau apă) a preparatelor cu microorganisme benefice, pentru echilibrarea microbiotei intestinale şi combaterea bolilor gastrointestinale, optimizarea indicilor fiziologici, hematologici, biochimici, productivi şi economici în creşterea tineretului cunicul.

Semnificaţia teoretică: elaborarea unui concept nou în reglarea microbiotei intestinale, creşterii şi dezvoltării iepurilor de casă prin utilizarea preparatelor cu microorganisme benefice (biomasa de *Streptomyces levoris* CNMN-Ac-01 şi a probioticului *EM-1®*) şi argumentarea ştiinţifică a perspectivei utilizării acestora în cunicultură.

Valoarea aplicativă: rezultă în utilizarea în cunicultură a biomasei de *Streptomyces levoris* CNMN-Ac-01 şi a probioticului *EM-1®*, care asigură sporirea eficienţei economice a ramurii.

Implementarea rezultatelor ştiinţifice: rezultatele obţinute au fost implementate în vivariul din cadrul IŞPBZMV - actele de implementare din 03.09.2018 şi din 17.09.2018 şi SRL „Eco-Fer-Mer” rl Anenii Noi, s. Maximovca – act de implementare din 20.11.2020.

АННОТАЦИЯ

Караман Мариана «Использование препаратов полезных микроорганизмов в кролиководстве», диссертация на соискание ученой степени доктора ветеринарных наук, Кишинев, 2021.

Структура диссертации: введение, 4 главы, общие выводы и рекомендации, библиография 260 источников, 6 приложений, 123 страницы основного текста, 35 рисунков, 34 таблицы. Полученные результаты опубликованы в 14 научных работах, получен один патент.

Ключевые слова: полезные микроорганизмы, микрофлора, дисбиоз, биомасса *Streptomyces levoris* CNMN-Ac-01, *EM-1*® пробиотик, кролики, микробиологические исследования, биохимические показатели, питательная среда, желудочно-кишечный тракт, показатели продуктивности.

Цель работы: оценка влияния биомассы *Streptomyces levoris* CNMN-Ac-01 и пробиотика *EM-1*® на микробиоту желудочно-кишечного тракта, сохранность, рост и развитие домашних кроликов.

Задачи исследования: получение биомассы *Streptomyces levoris* CNMN-Ac-01; включение биомассы *Streptomyces levoris* CNMN-01 в рецепт гранулированного и комбинированного корма и изучение его микробиологического состава; приготовление рабочего раствора пробиотика *EM-1*® и изучение его микробиологического состава; изучение влияния комбинированного гранулированного корма с и без добавления биомассы *Streptomyces levoris* CNMN-Ac-01, а также влияние рабочего раствора пробиотика *EM-1*® на микрофлору желудочно-кишечного тракта, физиологическое состояние и морфопродуктивные показатели кроликов; расчет экономической эффективности полученных результатов при использовании биомассы *Streptomyces levoris* CNMN-Ac-01 и пробиотика *EM-1*® в технологии выращивания кроликов.

Научная новизна и оригинальность: впервые в условиях Республики Молдова была изучена роль биомассы *Streptomyces levoris* CNMN-Ac-01 и пробиотика *EM-1*® в отношении закономерности формирования и коррекции микробиоты желудочно-кишечного тракта кроликов, стимуляции здоровья, роста и развития животных, химического показателя качества мяса кроликов и предложение этих препаратов для использования в кролиководстве.

Полученный результат, способствующий решению важной научной проблемы: научная разработка и аргументация двух технологий применения (с кормом или водой) препаратов полезных микроорганизмов, для коррекции микрофлоры кишечника, борьбы и профилактики желудочно-кишечных заболеваний, оптимизации физиологических, гематологических, биохимических показателей организма продуктивности и экономичности при выращивании кроликов.

Теоретическое значение: разработана новоя концепция коррекции кишечной микробиоты, роста и развития кроликов с использованием полезных микроорганизмов (биомассы *Streptomyces levoris* CNMN-Ac-01 и пробиотика *EM-1*®) и научная аргументация их применения в кролиководстве.

Прикладная ценность работы: использование биомассы *Streptomyces levoris* CNMN-Ac-01 и пробиотика *EM-1*® в кролиководстве обеспечивает повышение экономической эффективности ведения отрасли.

Внедрение научных результатов: полученные результаты внедрены в виварии ISPBZMV – акты о внедрении от 03.09.2018 и от 17.09.2018 и SRL «Eco-Fer-Mer» р. Анений Ной, с. Максимовка - акт о внедрении от 20.11.2020.

ANNOTATION

CARAMAN Mariana „Use of preparations with beneficial microorganisms in rabbit farming”, doctoral thesis in veterinary medical sciences, Chișinău, 2021.

Thesis structure: introduction, 4 chapters, general conclusions and recommendations, bibliography with 260 titles 6 annexes, 123 pages of basic text 35 figures, 34 tables. The obtained results are published in 14 scientific papers and a patent obtained.

Keywords: beneficial microorganisms, microbiota, dysbiosis, microbiological research, biomass, *Streptomyces levoris* CNMN-Ac-01, probiotic *EM-1*®, rabbits, biochemical indicators, nutrient environment, gastrointestinal tract, morph productive indicators.

Purpose of the research: evaluation of the impact of *Streptomyces levoris* CNMN-Ac-01 biomass and probiotic *EM-1*® on the microbiota of the gastrointestinal tract, growth and development of domestic rabbits.

Objectives of the research: obtaining biomass of *Streptomyces levoris* CNMN-Ac-01; inclusion of *Streptomyces levoris* CNMN-Ac-01 biomass in the recipe of granulated compound fodder and study of its microbiological composition; preparation of the working solution of the probiotic *EM-1*® and study of its microbiological composition; study of the influence of granulated combined fodder with and without the addition of *Streptomyces levoris* CNMN-Ac-01 biomass and the working solution of the probiotic *EM-1*® on the microflora of the gastrointestinal tract, physiological condition and morph productive indicators of rabbits; calculation of the economic efficiency obtained as a result of the use of *Streptomyces levoris* CNMN-Ac-01 biomass and the probiotic *EM-1*® in rabbit breeding technology.

Scientific novelty and originality: for the first time, under the conditions of the Republic of Moldova, it was studied the role of *Streptomyces levoris* CNMN-Ac-01 biomass and probiotic *EM-1*® on the legality of formation and regulation of gastrointestinal tract biocenosis at rabbits, health stimulation, animal breeding and development, the chemical quality of rabbit meat and the proposal of these preparations for implementation in rabbit farming.

The obtained result, which contributes to solving an important scientific problem: the elaboration and scientific argumentation of two technologies of administration (in food or water) of preparations with beneficial microorganisms, in order to balance the intestinal micro flora and combat gastrointestinal diseases, optimize the physiological, hematological, biochemical, productive and economic indices in the growth of the rabbit youth.

Theoretical significance: elaboration of a new concept in the regulation of digestion, growth and development of domestic rabbits through the use of beneficial microorganism preparations (biomass of *Streptomyces* levoris CNMN-Ac-01 and probiotic *EM-1*®) and the scientific argumentation of the perspective of their use in rabbit farming.

Applicative value of the work: results in the use in rabbit of the biomass of Streptomyces levoris CNMN-Ac-01 and of the probiotic *EM-1*®, which ensures the increase of the economic efficiency of the branch.

Implementation of scientific results: the results obtained were implemented within the vivarium within SPIBZVM – acts of implementation of 03.09.2018 and of 17.09.2018 and JSC „Eco-Fer-Mer” d. Anenii Noi, v. Maximovca - act of implementation of 20.11.2020.

KARAMAN MARIANA

THE USE OF SOME PREPARATIONS WITH BENEFICIAL MICROORGANISMS IN CUNICULTURE

431.03 – Microbiology, virology, epizootology,
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