The Effectiveness of the Probiotic Additives Use in the Breeding of Broiler Chickens

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Abstract. The research paper presents the results of the use of a new probiotic feed additive containing a dry culture of lactic acid bacteria and fillers of plant origin in the diet of young poultry. The use of probiotics in the diet of broiler chickens showed that outdoor and cage keeping conditions did not significantly affect the economic and productive parameters of poultry, while the use of feed additives in their diet provided an increase in the preservation of Ross 308 cross by 6.0 and 4.0 %, the live weight gain by 5.6 and 5.5 %, and the slaughter yield of gutted chicken carcasses by 3.2 and 4.0%, as well as the decrease in the feed conversion by 4.4 and 3.9 %. In broiler chickens of the Cobb 500 cross, the feed additive provided an increase in the preservation of livestock by 4.0 and 6.0 %, the increase in the live weight by 6.6 %, the slaughter yield of the gutted poultry carcass by 2.1 and 2.7 %, as well as the decrease in feed conversion by 5.9 and 5.4 %. As a result of the research, it is recommended to introduce a new microbial feed additive in the diet at a dose of 0.7 kg per 1 ton of feed additionally throughout the entire growing period to improve the preservation, increase the live weight of poultry, meat productivity and its quality, and reduce the cost of compound feed to obtain a unit of production for broiler chickens of Ross 308 and Cobb 500 crosses.

1 Relevance

The main factor ensuring the effective growth and development of poultry is the feed ration, which must contain the necessary amounts of energy, micro- and macronutrients, as well as various biologically active substances [1-3]. To protect the poultry body from the negative effects of external and internal factors, stimulate its growth and increase productivity, preserve the quality of poultry products, sanitary, veterinary and technological measures are carried out, and feed antibiotics are also used. However, they have a side effect on the quality and safety of products. In this regard, pre- and probiotics, phytobiotics are used as an alternative to feed antibiotics [4–6].

Currently, the development and creation of new probiotic drugs is an urgent direction in poultry farming [7]. As a result of the use of probiotics in the feeding of agricultural

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poultry, a positive effect is manifested in maintaining their normal physiological status and increasing productivity [8].

Thus, the use of new domestic feed additives based on beneficial microorganisms in the technology of growing poultry is relevant and promising.

The purpose of the work is to study the effectiveness of the use of a new probiotic feed additive in the breeding of broiler chickens.

2 Materials and methods

Scientific experiments were carried out on broiler chickens of Ross 308 and Cobb 500 crosses in the farms of Krasnodar Territory. Laboratory studies were carried out on the basis of the research and testing center (SRC "Vetfarmbiocentr"), as well as at the department of Biotechnology, Biochemistry and Biophysics of Kuban State Agrarian University.

A feed microbial additive containing a lyophilized mass of useful crops and fillers of plant origin was determined as an object of research.

When conducting scientific and economic experiments on broiler chickens, two control and two experimental groups were formed depending on the conditions of poultry keeping (Table 1).

Table 1. Scheme of scientific and economic experience on the use of Ross 308 and Cobb 500 probiotic crosses in the ration of broiler chickens

Group	Number of poultry	Conditions of keeping	Diet
1st control	100	in cage	Full diet compound feed
1st experimental	100	in cage	Full diet compound feed + Probiotics (0,7 kg/t of feed)
2nd control	100	outdoor	Full diet compound feed
2nd experimental	100	outdoor	Full diet compound feed + Probiotics (0,7 kg/t of feed)

The duration of the experiment was 42 days. The conditions of feeding and keeping broiler chickens, as well as the methodology of setting up experiments, were agreed with the recommendations of VNITIP [9].

The clinical status of broiler chickens was studied daily by visual inspection, behavior, feather cover of poultry, feed consumption and drinking process were analyzed. The live weight of poultry was taken into account once a week by weighing the livestock individually. Over the entire period of research, growth of poultry, preservation of livestock as a whole during the period of experiments, as well as the conversion rate of compound feed characterizing the effectiveness of fattening were calculated.

When analyzing the meat productivity of broiler chickens, poultry slaughter and anatomical cutting of the carcass into component parts were carried out. The slaughter yield of the gutted poultry carcass, the morphological composition of the chest of the poultry body, thighs and lower legs of the experimental crosses were determined.

The obtained digital values of the research results were processed using mathematical statistics using the standard Microsoft Office Excel 2019 program. The reliability criterion was determined by the Student's table. The results were considered reliable at the probability level $P \leq 0.05$.

3 Results of reseach

3.1 Characteristics of the probiotic feed additive

Probiotic feed additive contains a dry culture of lactic acid bacteria: strain Bifidobacterium lactis – 2.5–3.0 %, strain Lactobacillus acidophilus – 2.5–3.0 %, strain Streptococcus thermophilus – 2.5–3.0 %, strain Lactobacillus delbrueckii ssp. Bulgaricus – 2.5–3.0%, as well as fillers of vegetable origin: edible citrus fiber 14.0–15.0 %, maltodextrin 76.0–84.0 %. The total number of lactic acid microorganisms is not less than $1.0 \cdot 10^6$ CFU/g.

Odorless powder from white to beige is produced in multilayer paper bags with a polyethylene liner. The shelf life of the additive is 24 months from the date of manufacture subject to storage conditions.

The mechanism of action of the probiotic is due to the ability of lactic acid bacteria included in its composition to enhance the activity of the intestinal microbiota. Synthesized substances (enzymes, amino acids and other biologically active substances) restrain the development of pathogenic and conditionally pathogenic microflora, activate metabolism, as a result, the digestibility of feed improves, the parameters of preservation, the growth and productivity of agricultural animals and poultry increase.

3.2 The effect of probiotic feed additives on economic indicators in the breeding of broiler chickens of the Ross 308 cross

The economic parameters obtained as a result of the studies of the Ross 308 hybrid cross depending on the conditions of keeping are presented in Table 2.

Table 2. Results of preservation, dynamics of live weight, growth and conversion of feed during the cultivation of broiler chickens of Ross 308 cross during the growing period of 1–42 days, (n = 100)

Parameter	Conditions of breeding			
	Cage keeping		Outdoor keeping	
	Group			
	1st control	1st experimental	2nd control	2nd experimental
Preservation, %	89,0	95,0	92,0	96,0
Dynamics of live weight, g				
35th day	1985,62 ± 6,16	2078,43 ± 6,04*	1993,76 ± 6,32	2083,63 ± 5,85**
42th day	2432,54 ± 6,76	2568,06 ± 6,48*	2440,11 ± 6,37	2574,48 ± 6,28**
Live weight gain of boiler chickens during the growing period (1-42 days), g				
One head, g	2392,75	2527,94	2401,54	2534,72
Poultry feed costs				
One head, g	4365,37	4402,06	4357,23	4420,28
On 1 kg of gain, kg	1,82	1,74	1,81	1,74
* Difference with the 1st control group is reliable ($P \leq 0.05$). ** Difference with the 2nd control group is relaible ($P \leq 0.05$).				

The safety of the poultry of the experimental groups was higher than the control ones by 6.0 and 4.0 %, while the method of keeping did not significantly affect the parameters. On the 35th day of weighing chickens, a statistically significant difference was revealed between the control and experimental groups in terms of the poultry weight, in the first experimental group it was 4.7 % greater than in the first control group, and in the second experimental group by 4.5 % compared to the second control group ($P \leq 0.05$). A similar significant difference was recorded on the 42nd day of weighing, when the weight of chickens of the first and second experimental groups exceeded the live weight of the first and second control groups by 5.6 and 5.5 % ($P \leq 0.05$). The difference of the studied parameter on the 35th and 42nd days of

experiments between the first and second experimental groups was not significant, statistically significant results between groups of poultry were not established.

When calculating the weight gain of broiler chickens during the experiment period, it was found that in the first experimental group it was 5.6 % higher compared to the first control group, and in the second experimental group it was 5.5% higher compared to the second control group. The difference between the growth rates of poultry of the experimental groups was insignificant and amounted to 0.3 %.

The parameters of feed conversion in the experimental groups were lower than in the first and second control groups by 4.4 and 3.8 %.

3.3 The effect of a probiotic feed additive on productive parameters in the breeding of broiler chickens of the Ross 308 cross

The results of the study of productive qualities of the broiler chickens of the Ross 308 cross (Table 3) demonstrated that the mass of the gutted carcass of chickens of the experimental groups statistically significantly exceeded the analyzed parameter in the control groups by 10.4 % (in favor of the first experimental compared with the first control) and 11.3 % (in favor of the second experimental compared with the second control) when $P \leq 0.05$. The difference between the experimental groups was minimal and amounted to 0.7 %, which was not significant. The rate of slaughter yield in the first control group was 70.2 %, in the first experimental group – 73.4 % (3.2 % more), in the second control group – 69.7 % versus 73.7 % in the second experimental group (4.0 % difference).

Table 3. Results of meat productivity of broiler chickens of Ross 308 cross (n = 15)

Parameter	Conditions of breeding			
	Cage keeping		Outdoor keeping	
	Group			
	1st control	1st experimental	2nd control	2nd experimental
Mass of the gutted carcass, g	1685,66 ± 6,50	1861,10 ± 6,42*	1683,58 ± 6,73	1874,23 ± 6,77**
Slaughter yield, %	70,2	73,4	69,7	73,7
Chest of the carcass, g	487,68 ± 5,34	547,78 ± 5,51*	482,18 ± 5,07	554,92 ± 5,20**
Mass of thighs, g	329,59 ± 3,37	350,23 ± 3,11*	330,65 ± 3,10	353,47 ± 3,07**
Mass of legs, g	280,48 ± 2,45	310,44 ± 2,56*	282,58 ± 2,55	311,87 ± 2,47**
* Difference with the 1st control group is reliable ($P \leq 0.05$). ** Difference with the 2nd control group is reliable ($P \leq 0.05$).				

The mass of the poultry chest of the first experimental group was 12.7 % more than in the first control group, and in the second experimental group it was 14.5% more than in the 2nd control group ($P \leq 0.05$). The weight of the thighs of broiler chickens in general was 6.3 % higher in the first experimental group compared to the first control group, and in the second experimental group with the same second control group by 6.9 % with significant differences ($P \leq 0.05$). The mass of young chickens in the first experimental group was statistically 10.7 % higher than in the first control group, and in the second experimental group it was 10.3 % higher than in the second control group ($P < 0.05$).

3.4 The effect of microbial feed additives on economic parameters in the breeding of broiler chickens of the Cobb 500 cross

The economic parameters of poultry obtained as a result of the study depending on the conditions of keeping are shown in Table 4.

Table 4. The results of preservation, changes in live weight, growth and feed costs during the cultivation of Cobb 500 cross chickens during the growing period of 1-42 days (n = 100)

Parameter	Conditions of breeding			
	Cage keeping		Outdoor keeping	
	Group			
	1st control	1st experimental	2nd control	2nd experimental
Preservation, %	93,0	97,0	92,0	98,0
Dynamics of live weight of broiler chickens, g				
28th day	1126,14 ± 8,43	1211,27 ± 8,11*	1131,75 ± 7,58	1219,27 ± 8,06**
35th day	1758,43 ± 10,58	1928,98 ± 9,57*	1770,03 ± 9,30	1939,69 ± 9,84**
42th day	2321,48 ± 10,32	2477,87 ± 10,20*	2330,55 ± 9,79	2481,27 ± 10,21**
Live weight gain of broiler chickens, g				
One head, g	2284,23	2439,01	2291,32	2442,72
Poultry feed costs				
On one head, g	4254,03	4287,28	4261,19	4297,31
On one kg of gain, kg	1,86	1,75	1,86	1,76

* Difference with the 1st control group is reliable ($P \leq 0.05$).
** Difference with the 2nd control group is reliable ($P \leq 0.05$).

The preservation index of chickens of analyzed groups in the first control group was 93.0 %, in the first experimental group – 97.0 % (4.0 % difference), and in the second control group – 92.0 % versus 98.0 % in the second experimental group (6.0 % difference). At the same time, the difference between the experimental groups was not significant and amounted to 1.0 % in favor of the second experimental group.

On the 28th day in the first and second experimental groups, the mass of broiler chickens became statistically quite higher than in the first and second control groups by 7.6 and 7.7 % ($P < 0.05$), while the difference between the experimental groups remained insignificant and amounted to 0.6 % in favor of the second experimental group. On the 35th and 42nd days, the difference between the first experimental and the first control groups was 9.7 and 6.7 %, and between the second experimental and the second control groups – 9.6 and 6.5 %, respectively ($P < 0.05$). The difference between the experimental groups was insignificant and during the study period amounted to 0.5 and 0.1 % in favor of the second experimental group.

In the first and second experimental groups, the increase in live weight of poultry over the entire study period was greater than in the control groups by 6.6 %. Due to the large increase in live weight in the experimental groups, a lower feed conversion rate was established which in the first and second control groups was 1.86 kg, compared to 1.75 and 1.76 kg in the first and second experimental groups which corresponds to 5.9 and 5.4 %.

3.5 The effect of microbial feed additives on productive parameters in the breeding of broiler chickens of the Cobb 500 cross

The results of studying the meat productivity of broiler chickens of the Cobb 500 cross in a scientific and economic experiment are presented in Table 5.

Table 5. Results of meat productivity of broiler chickens of the Cobb 500 cross (n = 15)

Parameter	Conditions of breeding			
	Cage keeping		Outdoor keeping	
	Group			
	1st control	1st experimental	2nd control	2nd experimental
Mass of the gutted carcass, g	1645,88 ± 7,11	1800,29 ± 6,87*	1644,69 ± 7,04	1812,38 ± 7,17**
Slaughter yield, %	70,7	72,9	70,4	73,1
Chest of the carcass, g	444,47 ± 4,95	506,74 ± 5,07*	442,33 ± 4,89	511,76 ± 4,92**
Mass of thighs, g	304,78 ± 2,65	331,46 ± 2,47*	303,49 ± 2,38	335,11 ± 2,42**
Mass of legs, g	240,75 ± 2,68	271,20 ± 2,10*	242,58 ± 2,49	274,30 ± 2,61**
* Difference with the 1st control group is significant (P ≤ 0.05). ** Difference with the 2nd control group is reliable (P ≤ 0.05).				

The rate of slaughter yield in the first experimental group was 2.1 % higher than in the first control group. The slaughter yield in the second experimental group was 2.7 % higher compared to the second control group.

It was found that the breast weight in the experimental groups of chickens compared to the control groups was higher by 14.0 and 15.6 % (P ≤ 0.05), while the difference between the first and second experimental groups is insignificant. The total thigh mass in the first experimental group was statistically greater than in the first control group by 8.7 % (P ≤ 0.05); in the second experimental group it was also significantly greater than the second control group by 10.4 % (P ≤ 0.05). The mass of all the components of the lower leg of the poultry in the first experimental group was significantly higher than in the first control group by 12.6 %, and in the second experimental group it was 13.1 % more than in the second control group (P ≤ 0.05).

4 Conclusion

The results of the conducted scientific and economic studies have demonstrated that the use of Ross 308 and Cobb 500 crosses in the diet of broiler chickens of a new probiotic feed additive has a positive effect on the safety of young poultry and this parameter has increased by 4.0–6.0 %, as well as the increase in live weight of broiler chickens by 5.5–6.6 %, reduced feed costs by 1.0 kg of increase by 3.9–5.9 %, the slaughter yield of the gutted carcass of the experimental groups increases by 2.1–4.0 %. At the same time, the difference in the conditions of keeping (outdoor and cage) experimental broiler chickens did not have a significant impact on the studied parameters.

Thus, to improve the preservation, increase the live weight of poultry, meat productivity and its quality, reduce the cost of compound feed to obtain a unit of production of broiler chickens of Ross 308 and Cobb 500 crosses, it is recommended to introduce a new microbial feed additive in the diet additionally at a dose of 0.7 kg per 1 ton of compound feed throughout the growing period.

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