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The effectiveness of the acidifier on the productivity of broiler chickens

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Abstract. One of the urgent tasks in modern poultry farming is the search and testing of new, cheap and at the same time environmentally friendly feed additives that positively affect the productivity and health of poultry [1, p. 105]. Such additives include acidifiers, consisting of complexes of organic acids and their salts. The range of organic acids used in our country is large: formic, propionic, acetic, benzoic, butyric, sorbic, fumaric, succinic, citric, ascorbic, tartaric acids and others, as well as their salts [2, p. 81. 3, p. 28. **Scientific novelty.** In the conditions of the "Amur Broiler" poultry farm, studies were conducted on the effectiveness of using the Acidomyx AFG organic acid. The aim of the research was to determine the rational dosage of the medication based on Acidomyx AFG organic acids, as well as to assess its effect on meat productivity and the livability of broiler chickens. **Methodology and research methods.** The productive effect of Acidomyx AFG was assessed by the following indicators: live weight at the age of 7, 15, 25, 35, and 41 days old; daily average increase in chickens; livestock livability, feed costs per 1 kg of live weight gain. **Results.** Studies have shown that the most productive was the use of the studied medication at a dosage of 0.3 % in the starter period, 0.2 % in periods of growth and finish. The effectiveness of the medication turned out to be the best in comparison with the control in terms of live weight by 15.8 %, average daily gain in chickens by 16.1 %, in terms of livestock livability by 8.9 %, and in feed costs per 1 kg of live weight gain by 0.03 kg.
Keywords: broilers, organic acids, acid binding ability, formic acid, propionic acid, chicken live weight, average daily increase, carcass weight, livability.

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Introduction

Recently, in the conditions of industrial poultry farming, the pressure on the poultry body has significantly increased. It is known that during the starter period, the bird has an underdeveloped digestive system. It is during this period that pathogenic microflora may develop in the lumen of the intestinal tract [4, p. 52]. In this regard, the livability of chickens depends on the sanitary state of feed, water and conditions of maintenance [5, p.113]. Chickens are susceptible to a potentially large number of pathogens, such as E. coli, Salmonella and Clostridia. These pathogens are present in the small intestines of birds and compete with the host for nutrients. This leads to a decrease in the absorption of fat and fat-soluble vitamins of the feed, and, as a result, a drop in growth rates and an increase in morbidity. In a struggle against pathogenic microorganisms, feed antibiotics have become widely used, which has led to the spread of drug resistance of pathogens. Therefore, the search for medications that give good results in controlling pathogenic and conditional pathogenic microflora is an urgent task of modern poultry farming [6, p. 1].

Acidifiers based on organic acids and their salts are considered to be one of these medications.

Complexes of organic acids and their salts solve many problems that arise in industrial poultry farming: they are used for environmentally safe conservation of feed, to reduce the acid-binding capacity of feed components and the buffer capacity of feed, as a substitute for feed antibiotics as organic acids inhibit the growth and development of pathogenic microflora, have bactericidal and bacteriostatic properties, and, unlike antibiotics, the use of organic acids does not lead to the adaptation of pathogenic microorganisms [7, p. 36]; they act as a generator of additional energy [8, p. 50; 9, p. 46]; improve the digestibility and assimilation of nutrients; increase poultry productivity and reduce feed costs per unit of production. Salts of organic acids have all the advantages of their acids, but they are more preferable because they do not have an odor; because of their lower volatility they are easier to mix with feed, and they do not cause corrosion of metal equipment [10, p. 192; 11, p. 17].

Methods

The aim of the research was to determine the rational dosage of Acidomix in the feeding of broiler chickens, as well as to assess its impact on the meat productivity and livability of broiler chickens.

The work was carried out from November to December 2019 in the production conditions of the "Amur Broiler" poultry farm and at the Department of Feeding, Breeding and Production Technology of Livestock Products of the Far Eastern SAU.

To fulfill these tasks, a scientific and economic experiment was conducted (table 1), in which 3 groups of broiler chickens of the Arbor Acres cross were formed on the basis of pairs of analogues, 50 chickens each.

Table 1

Scheme of scientific and economic experience

Group	Number of chickens	Feeding conditions	
		The period of growing, days	
		1–10	11–41
Control	50	Complete feed (CF) in the farm	
I experimental	50	CF + 0.2 % Acidomix AFG	CF + 0.1 % Acidomix AFG
II experimental	50	CF + 0.3 % Acidomix AFG	CF + 0.2 % Acidomix AFG

Table 2

The composition of the acidifiers of the control and experimental groups [12]

Component	Acidomix AFG, %
Formic acid	20.7 ± 5
Propionic acid	12.8 ± 5
Ammonium formate	17.5 ± 5
Ammonium propionate	4.2 ± 5
Filler	44.8 ± 5

Table 3

Dynamics of live weight of broiler chickens during the breeding period (M ± m)

Age, days	Group		
	Control	I experimental	II experimental
At the beginning of the experiment	42 ± 1.50	42 ± 1.19	42 ± 0.98
7	141.0 ± 4.51	165.2 ± 1.88*	175.2 ± 2.12*
15	486.8 ± 6.11	520.1 ± 4.95*	531.00 ± 7.11*
25	1095.5 ± 9.14	1254.1 ± 8.75*	1302.5 ± 7.88*
35	1786.4 ± 10.28	1989.4 ± 11.15*	2049.3 ± 12.65*
41	2170.7 ± 15.2	2454.2 ± 17.2*	2513.5 ± 21.12*
Average daily growth	51.92	58.83	60.28

Note: $p^* < 0.05$.

Table 4

Livability of broiler chicken stock, %

Group	Livability, %	
	In the first week of life	For the entire breeding period
Control	96	90.0
I experimental	100	96.0
II experimental	100	98.0

In the room for keeping broiler chickens, the temperature regime was maintained at the level of +34...+15 °C in accordance with the age of the bird. In the first week of life, the length of daylight was 23 hours, then each week it decreased by 2 hours and in the last week of growing it was 10 hours. The relative humidity was 65 %. The microclimate in the room was regulated using special equipment "Climate-47" and corresponded to generally accepted zootechnical standards. The chickens were kept on a deep, permanent bed.

Feeding and watering of the bird was carried out freely. Chickens of the control group received complete feed taken at the poultry farm, balanced in terms of nutrient content in accordance with the standards. Chickens of the first experimental group were additionally fed 0.2 % Acidomix (2 kg/t) from the 1st to the 10th day of growing, and 0.1 % (1 kg/t) in the remaining period. Chickens of the second experimental group had in their main diet 0.3 % (3 kg/t) of acidifier from the 1st to the 10th day of growing and 0.2 % (2 kg/t) of the medication from the 11th to the 41st day of growing.

Acidomix AFG and Ultracide InU Plus dry belong to the category of feed additives designed to reduce the level of pathogenic microflora in feed and feed raw materials for pigs and poultry.

Acidomix AFG acidifier is produced by the German company "Novus Deutschland GmbH" in the form of brown microgranules that are not completely soluble in water. The manufacturer of the feed additive Ultracide InU Plus dry is the Belgian company "Nutri-Ad International NV". Ultracide is a beige powder with a specific smell; it does not completely dissolve in water. The studied acidifier is compatible with all feed ingredients, medicines and other feed components.

The bactericidal action of acidifiers is associated with non-dissociated acids. Formic acid has a high degree of dissociation. Non-dissociated formic acid molecules, due to their small molecular weight, quickly penetrate the cell membrane of pathogenic microorganisms. Inside the cell, the acid dissociates to form hydrogen protons and some acid residue. Excessive amounts of hydrogen ions act paralytically on the life of the microbial cell, while microbial cells lose a large amount of

Table 5

Feed costs for raising broiler chickens

Group	*Total amount of feed spent for the period of fattening per 1 chicken, kg*	*The cost of feed per 1 kg of increase in live weight, kg*
Control	*3.59*	*1.65*
I experimental	*3.56*	*1.45*
II experimental	*3.56*	*1.42*

Table 6

The economic efficiency of the use of the studied acidifiers in the feeding of broiler chickens

Indicators	*Groups*		
	Control	*I experimental*	*II experimental*
Live weight of chickens at the end of the experiment, g	*2170.7*	*2454.2*	*2513.5*
The number of chickens at the end of the experiment	*45*	*48*	*49*
Feed consumption per 1 chicken, kg	*3.59*	*3.56*	*3.56*
Feed consumption for the whole group, kg	*176.2*	*176.2*	*175.2*
The consumption of preparation, kg / t	–	*0.456*	*0.621*
The cost of 1 kg of medication, rubles	–	*186*	*151.1*
The cost of the medication spent for the entire growing period in the group, rubles	–	*84.82*	*93.83*
The cost of 1 kg of chicken meat, rubles	*114.0*	*114.029*	*114.027*
The selling price of 1 kg of dressed chicken, rubles	*180.0*	*180.0*	*180.0*
Profit received per group, rubles	*6447.0*	*7771.5*	*8125.4*

energy, resulting in the termination of their reproduction and even deat [13, p. 201]. Propionic acid with a low degree of dissociation has an increased ability to form salts with potassium and sodium, which are part of the cell membrane. During this reaction, the stability of the bacterial cell membrane is disrupted, which either leads to its destruction, or to an increase in the permeability for an acid with a high degree of dissociation, in this case, for formic acid [14, p. 20].

Formic and propionic acids have different degrees of influence on pathogenic microflora. Formic acid has the most powerful bactericidal effect, in addition, it effectively delays the growth of mold. Propionic acid is the most effective against mold, and it also promotes the growth of intestinal villi [15, p. 205]. Propionate and ammonium formate have all the properties of their acids, from which they are formed, however, due to a lower degree of dissociation, the salts can retain their antibacterial activity up to the large intestine. In addition, salts are more preferable acidifiers because they are odorless, easily mixed with feed due to their lower volatility and solid state, and are less corrosive in nature and better soluble in water.

In the first days of life, the bird has an underdeveloped digestive system that is not able to fully digest food, so the development of harmful microorganisms is possible in the lumen of the gastrointestinal tract [16, p. 56]. In addition, feed starters contain an increased amount of protein, and it is well known that the acid-binding ability depends on its content [17, p. 118]. In this regard, in the initial period of chickens breeding, 1 kg more acidifier was added to the full-ration feed than in the period of growth and finish (1 ton of complete feed).

The productive effect of Acidomix AFG was evaluated by the following indicators: live weight at the age of 7, 15, 25, 35 and 41 days old; average daily growth of chickens; livestock livability, feed costs per 1 chicken and 1 kg of live weight gain.

Results

Live weight is one of the most important indicators that characterize the nutritional value of poultry feeding and health status.

Analysis of the dynamics of live weight of broilers during the experiment showed (table 3) that the chickens of the experimental groups in all age periods have an advantage in this indicator compared to the control. In chickens of the first experimental group, the live weight at the age of 7 days old was higher by 17.2 % compared to the control; at 15th day by 6.8 %; at 25th day by 14.5 %; at 35th day by 11.4 %; at 41st day by 13.1 %.

Indicators of live weight in the second experimental group were higher compared to the control: at 7th day by 24.3 %; at 15th day by 9 %; at 25th day by 18.9 %; at 35th day by 14.7 %, at the 41st day by 15.8 %.

Feeding poultry on a diet with acidifier Acidomix AFG increased the average daily increase in the experimental groups by 13.3 and 16.1 % in the first and second experimental groups, respectively.

Monitoring of birds was carried out by visual inspection throughout the study period, while taking account of mortality and culling with subsequent calculation of the stock livability.

The livability of livestock for the first week of growing in the experimental groups was 100 %, which is 4 % more than in the control group. Over the entire growing period, the livability of the chicken population was the highest in the second experimental group, which was 98 %, which is 8 % more than in the control group.

The addition of new feed products in the diet of broiler chickens contributed to a reduction in feed costs for production (table 5): in the first and second experimental groups by 0.03 kg in both groups compared to the control.

The cost-effectiveness analysis confirmed a positive result of feeding complete feed with the addition of acidifier compared to the control. Thus, after the sale of chicken meat in the first experimental group, the profit was 1324.5 rubles more than in the control group. In the second experimental group, the amount of profit received was 1678.4 rubles higher than in the control group.

Discussion and Conclusion

Based on these studies, it can be concluded that the use of acidifier based on organic acids Acidomix AFG had a positive effect on the productivity of broiler chickens. However, adding an acidifier to the feed of the poultry farm in the amount of 0.3 % during the growing period from 1 to 10 days and 0.2 % during the growing period from 11 to 41 days showed the best result. A possible productive effect is associated with a decrease in the acid-binding capacity of feed components and buffer capacity, resulting in an improvement in the work of secreted enzymes that digest proteins. In addition, due to the action of organic acids, the intestinal villi are stimulated, as a result of which the feed nutrients are absorbed better, and the conversion of feed into products decreases. Bactericidal and bacteriostatic effects of organic acids and their salts contribute to the improvement of chickens' health, as evidenced by an increase in the livability in the experimental groups compared to the control.

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