

«Amilocin» Probiotic Fodder Additive in Laying Hens' Rations

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Abstract—The aim of this work was to study the mechanisms of action and determine the effectiveness of the use of probiotic fodder additives «Amilocin» in the production of food eggs.

In the course of the experiments, we found that the introduction of «Amilocin» supplement with water to laying hens of the cross Hisex Brown in the amount of 0.4 g; 0.5 g; 0.6 g per head per day for 10 days at the beginning of oviposition, the average weight of one egg increased by 0.86 g, 1.98 g and 0.12 g or 1.6%, 3.7% and 0.2 % respectively, in comparison with the control group that did not receive «Amilocin». Egg production per an average layer over the period of the experiment increased by 0.2; 0.6; 0.2 pieces in comparison with the control group.

Keywords—*laying hens, fodder additives, probiotics, Amilocin, Bacillus subtilis, productivity, quality indicators of eggs*

I. INTRODUCTION

The poultry industry is valued for the ability to produce a variety of dietary, nutritious and high-calorie products in short term and at the lowest cost, this gives aviculture competitive advantages over other livestock industries. Over the recent years, poultry industry has actively stepped forward in its development; the main stimulus for this growth was the increase in the level of consumption of these types of products that confirms the prospects of the entire industry for at least the coming years. The volumes of production of poultry industry continue to grow, this allows us to ensure not only the country's food security, but also to increase the production of high-quality valuable food for the population, meanwhile creating additional jobs and improving the social structure of the regions.

According to information of the department of the agro-industrial complex and environmental reproduction of the Belgorod region, the oblast today occupies leading position in Russia in the number of poultry. The average monthly indicator in the region in 2018 reached to almost 51.3 million heads, including about 49.8 million birds of agricultural enterprises, 60 thousand chickens at farms, and up to 1.5 million birds in personal farms.

The production of chicken eggs in the region amounted to 1532.8 million pieces in 2018, or 99.8% compared to 2017.

The average egg production per laying hen was 275 eggs that is 2.2% more than in 2017, i.e. with the decrease of the number of birds, egg production increased, that indicates sufficiently effective development of this industry in our region. The Belgorod Region's share in total egg production in Russia is 3.6%, in the Central Federal District - 17% [1].

According to the forecasts of the All-Russian Scientific and Research Institute of Poultry Processing Industry (hereinafter referred to as RSRPI), the world poultry industry has enormous potential and will develop rapidly in the coming years, and at the same time it will play a great role in providing the growing world population with valuable protein and affordable food products. Thus, according to the estimation of a number of specialists, poultry production will occupy a leading position among other livestock industries by 2022 [2].

Particularly the production of eggs as a sector of the agro-industrial complex is of great importance in the food security of the country and providing the population with valuable protein of animal origin, because eggs are quite nutritious and healthy food.

An egg is one of the most nutritious and valuable in taste food products. The chicken egg is digested by the body good enough; this indicator reaches to 93-97%. It refers to those products that are useful for people of all ages, both in the first years of life and in old age. This is due to the content in chicken eggs of a large amount of fat, valuable proteins, vitamins, and a large number of various trace elements and mineral salts. So, egg is such a product that should be in each person's daily diet [3].

Egg productivity is conditionally divided into two categories: food and breeding, both of these categories play a great role in improving the quality and increasing the number of products received from poultry farming, i.e. creating competitive home products both in the domestic and foreign markets.

Egg productivity is an important economically useful criterion characterizing the quantity and quality of eggs obtained from poultry. Indicators of egg productivity are egg production, egg mass, eggshell strength. The technology of keeping and feeding of the poultry has a huge impact on these

indicators, because the quality and quantity of the finished product, as well as its cost and availability for the population, depend on the quality of the feed received by the birds. Most of modern highly productive crosses are very exacting to these requirements.

Modern science and practice have proved the suitability of using of various biologically active substances in animal husbandry and poultry farming in order to stimulate the productivity. This is one of the ways to implement the State program for the development of poultry farming in 2013-2020, according to which the volume of egg production in the country should reach 50 billion pieces per year, ensuring not only the domestic needs of the population, but also export up to 400 thousand tons of eggs and egg products. This can be achieved only by increasing the egg production of laying hens to 325 pieces per year. At present, various studies are being carried out in our country and abroad concerning the use of new dietary components that are safe both for animals and poultry and for humans, they stimulate the growth and productivity of farm animals and birds [4]. Scientists have proved that antibiotics, which have been actively and widely used in poultry farming recently, have accumulative effect and through the finished products enter the human body that leads to damage. In many foreign countries such additives have already been banned. In our country in this regard special attention is paid to the development of fodder additives and probiotics of domestic production, which could compete with foreign counterparts in the nature and intensity of exposure to the poultry organism on purpose to reduce costs and increase the quality and safety of finished products. Particular attention is paid to probiotics, prebiotics and symbiotics, because they are capable not only antagonize harmful microorganisms, but also activate the beneficial intestinal microflora, supporting and enhancing poultry immunity, stress resistance and improving bird safety, that will naturally affect their productivity and efficiency [5].

Such fodder additives are not only therapeutic and prophylactic, stimulating the growth and development of poultry with environmentally friendly and safe components, but they are also easy in use and convenient for group application; they can reduce feed costs when increasing egg production [6]. Their application is not only useful, but also, with a properly made mode of use, rational, efficient and economical, especially in conditions of industrial large-scale livestock and poultry farming [7].

Probiotic fodder additive (PFA) «Amilocin» is an innovative development of domestic scientists, composed of *Bacillus subtilis* and *Bacillus amyloliquefaciens*, possessing of diverse action. In the branches of livestock farming and poultry farming it is used to replace antibiotics for increasing feed assimilability efficiency and animal productivity, for enhancing the digestion and rapid adaptation of animals to new rations [8]. Also «Amilocin» has an inhibitory, antagonistic activity against pathogenic and conditionally pathogenic microorganisms, resulting in increased immunity and the risk of various infectious diseases of animals and birds decreases. Acting adversely to harmful microorganisms, this supplement does not suppress the own intestinal microflora, responsible for its work, but stimulates intestinal work, producing enzymes, vitamins and amino acids. «Amilocin» improves the digestion and conversion of fodder, and consequently the cost of production is reduced. Furthermore,

it is completely safe for humans, it does not accumulate in the animal's body, because in overdose the excess of it is hydrolyzed and excreted from the body without any consequences [9].

The purpose of the study was to determine the effectiveness of the use of the probiotic fodder additive «Amilocin» in the production of food eggs. To achieve the goal, the following tasks were set:

- 1) to study the productive qualities of laying hens using the probiotic fodder additive «Amilocin»;
- 2) to evaluate the quality indicators of food eggs obtained in the experiment.

II. EXPERIMENTAL

For the experiments we have formed 4 analog groups, including 54 heads of laying hens of the Hisex-Brown cross in each group, the age of the birds at the beginning of the experiment was 17 weeks. The experiment was being conducted from June to August 2018. The experimental poultry was kept in three-tiered cages of firm Big Dutchman (6 hens in each) at the Research and Training Center for Poultry Farming of the Educational and Scientific Innovation Center «Agrotehnpark» in Belgorod State Agricultural University named after V. Gorin. The conditions of keeping and feeding were in accordance with standards of All-Russian Research and Technological Institute of Poultry and were equal for all groups. For feeding of laying hens CF 1-1 complete feed was used, which was produced at Belgorod Experimental Fish Compound Feed Plant of Belgorod Region, Rakityansky District, Proletarsky Village. Birds had constant free access to water.

The probiotic additive «Amilocin», dissolved in water, was administered to the birds in different doses according to the following scheme: laying hens of the 1st control group (n = 54) served as general control for all groups and did not receive the studied additive; laying hens of the 2nd group (n = 54) were fed 0.4 g of «Amilocin» per head per day at the beginning of oviposition for 10 days; the 3rd group (n = 54) was given 0.5 g of «Amilocin» per head per day at the beginning of oviposition for 10 days; and the 4th group (n = 54) was received 0.6 g of «Amilocin» per head per day at the beginning of oviposition for 10 days.

III. RESULTS AND DISCUSSION

The main product obtained from the poultry of the egg productivity direction is an egg. This product, like any biological object, has certain morphological characteristics (structure) and certain physicochemical and biochemical composition.

Daily recording of the obtained eggs in the experiment showed that the gross egg collection for three months in the 2nd, 3rd, 4th experimental groups was higher than in the 1st control group (table I).

Most of the eggs were gathered in the third group - 1706 eggs that are 3.0% higher than in the control group. The second and fourth groups also exceeded the control indicators by 0.5% and 1.3% respectively.

TABLE I. GROSS EGG COLLECTION, PIECES

Period	Group of laying hens			
	1- control	2	3	4
June	81	63	50	62
July	569	574	572	589
August	1007	1028	1084	1028
Altogether for the period	1657	1665	1706	1679

One of the most important indicators characterizing the nutritional and commercial value of an egg is its weight, because it affects not only its calorie content, but also its chemical composition (table II).

So, in the course of our studies, we have found that the use of probiotic fodder additives «Amilocin» positively affected the egg mass. The average weight of an egg in the 2nd, 3rd and 4th experimental groups exceeded the values of the 1st control group by 0.86 g, 1.98 g and 0.12 g or 1.6%, 3.7% and 0.2%, respectively.

In addition, the data of table II indicate that the egg production per an average hen in laying hens of the third experimental group was the highest and amounted to 31.0 pcs, it is 2.0% more than in the control group. The egg production per starting layer was also maximum in the third group and amounted to 30.5 pcs, which is 0.9 pcs. or 3.0% higher than that of the 1-control group.

The total number of egg mass was the most in the third group and reached to 94802.4 g.

Also, during the experiment, a positive effect of probiotic fodder additives «Amilocin» on the egg production rate and quality indicators of eggs of laying hens of the cross breed Hisex Brown was noted (table III, IV)

At the peak of oviposition (table III), which in the 1st control group was reached at the age of 31 weeks, and in the 2nd, 3rd and 4th groups at the age of 30 weeks, the egg production rate in the experimental groups was 0.9-2.1% higher than in the control group. At the same time, greater superiority was noted in the 3rd group, here the egg laying peak was fixed at the level of 98.9%.

In the experiment the effect of the introduction of «Amilocin» into the diet on the quality indicators of food eggs was studied (table IV).

TABLE II. EGG PRODUCTIVITY OF LAYING HENS

Indicator	Group of laying hens			
	1- control	2	3	4
Gross egg collection, pcs	1657	1665	1706	1679
Egg production per an average layer, pcs	30.4	30.6	31.0	30.6
Egg production per starting layer, pcs.	29.6	29.7	30.5	30.0
Average weight of an egg, g	53.59±1.44	54.45±1.50	55.57±1.43	53.71±1.29
Total amount of egg mass, g	88798.6	90659.3	94802.4	90179.1

TABLE III. EGG PRODUCTION RATE

Indicator	Group of laying hens			
	1- control	2	3	4
Age of egg production intensity, days				
50 %	163	161	157	158
Oviposition peak,%	9.8	97.7	98.9	98.5
Age of oviposition peak, weeks	31	30	30	30

TABLE IV. EGG QUALITY INDICATORS

Indicator	Group of laying hens			
	1- control	2	3	4
Shape index, %	74.77±1.07	74.52±1.33	76.20±0.84	74.19±1.07
HU (Haugh Unit)	82.8±0.95	81.4±0.48	83.25±1.068	75.5±2.09
Protein index	0.094±0.005	0.092±0.005	0.092±0.007	0.086±0.006
Yolk index	0.47±0.04	0.44±0.02	0.45±0.01	0.45±0.03
Ratio of yolk and protein	1:2.63	1:2.45	1:2.35	1:2.32
Shell thickness, mm	0.44±0.004	0.43±0.002	0.52±0.006	0.48±0.006
Protein, pH	7.6±0.06	7.7±0.12	7.85±0.16	7.64±0.07
Yolk, pH	5.9±0.37	6.2±0.19	5.9±0.22	6.2±0.20

One of the important indicators characterizing the quality of the obtained eggs is their shape, the requirements of which are high, because standard eggs are better preserved during transportation. The shape of the eggs is characterized by the shape index (it is expressed as percentage of the small diameter of the egg to the large) and for the eggs of the regular shape it is 70–78%.

As can be seen from the data in table 4, the shape index of the eggs of all groups is in the range of 76-78%, therefore, all the eggs are full-fledged food of the regular shape. Meanwhile, we observed that with an increase in the egg mass the shape index decreased, i.e. the eggs became longer and smaller in diameter.

Analyzing the obtained values of the protein and yolk indices, as well as the concentration of hydrogen ions (pH) of the protein and yolk, we can conclude that the eggs obtained from birds of all groups have high quality indicators. The optimal values of HU (Haugh Unit) for chicken eggs are in the range of 65–87. Determining this indicator in our experimental groups, we found that the highest indicator of HU was in the 3rd group and came to 83.25, which is 0.54% and 9.3% higher than in the first and fourth groups respectively. This indicator is an important one because with an increasing of protein density, the content of essential amino acids in it increases, its taste and nutritional qualities improve.

Studying the indicators of shell thickness, we can conclude that this additive has an influence on this indicator. So, the thickness of the shell in the control group was 0.44 mm, while in the third group this indicator was 0.52 mm, which shows that the eggs of the experimental groups are firmer and their safety during production, transportation and sale will be higher.

The ratio of yolk and protein is the least in 3d and 4th groups (1: 2.35; 1: 2.32), this indicates that the calorie content of chicken eggs in these experimental groups is higher than in the 1st group. Also, the yolk of an egg is nutritionally more valuable than protein due to the fact that it stimulates the digestive system, contains hormonal substances, and is also well assimilated by our body.

IV. CONCLUSION

According to the results of using in diets of chicken crosses of the domestic probiotic fodder additives «Amilocin», created on the basis of *Bacillus subtilis*, tendencies of improvement of a number of technological and productive indicators were recorded; in particular, the use of this additive contributed to an increase in egg production, an increase in egg mass, an indicator of HU (Haugh Unit) and shell thickness. The best results were obtained by feeding 0.5 g of «Amilocin» per head per day at the beginning of oviposition for 10 days.

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