

INDEX OF PRODUCTIVITY LAYING HENS AND THE CHEMICAL COMPOSITION OF EGGS FOR THE USE OF PRO- AND POSTBIOTICSG

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Abstract. The article discusses the efficiency of keeping laying hens in organic farming. The use of prophylactic drugs based on probiotic microorganisms *Lactobacillus plantarum* and postbiotic "Bacteriosan" - the development of employees of the Department of animal hygiene and sanitation. prof. A. K. Skorokhodko.

The research was conducted in a certified organic farm. In one of the premises of the organic farm, experienced chickens were kept, they were fed organic food, and a probiotic drug based on the *Lactobacillus plantarum* strain was added to the water in a dosage of 1 g / l daily, for 7 days, with a week break throughout life. In another room, experienced chickens were also kept, they were fed organic food, and a solution of postbiotic "Bacteriosan" was added to the water (100 ml of 40 % lactic acid + 0.05 g of bacteriocin nisin + 895 ml of H₂O), at a dose of 1 ml / l daily. The third room contained chickens of the control group (K), which received organic food without additives, no preventive drugs were used.

The following parameters were studied in laying hens: live weight, egg laying intensity, weight of the egg and its components (protein and yolk), shell thickness.

Analysis and interpretation of the experimental data obtained prove the positive effect of both these drugs, compared with the control. There was an increase in the live weight of laying hens and the intensity of egg laying, the latter in the first experimental group (probiotic) was 75.09 %, and in the second (postbiotic) - 76.50 %, against 70.30 % - in the control group. Similar changes were found in relation to the weight of eggs and the weight of their components (yolk and protein), as well as the thickness and weight of the shell compared to the control group of birds. Probiotic *Lactobacillus plantarum* and postbiotic "Bacteriosan" are recommended for use by laying hens for their content and production in organic poultry farming.

Keywords: organic eggs, laying hens, productivity, egg mass, protein, yolk, shell

Introduction

All greater popularity in the world is acquired by organic and healthy products. Chicken eggs, however a source of albumen, many important microelements, vitamins and other nutritive is a not exception. However for the receipt of maximal benefit from the consumption of eggs, the last must be from the laying hens grown on an environmentally clean forage, without addition of antibiotics and different synthetic forage additions, in a maximally natural for them environment with many pastures (Kan, 2005).

To every zootechnic parameter of production inherent optimal limits at that a bird shows the proper level to the productivity. Accordance of prosperity of bird, her health and, as a result, it is possible to estimate the productivity on clinical indexes, in particular by original appearance, state of plumage, by living mass and others like that. On the productivity of laying hens quality and full value of forage influence their structure and power level, accordance of parameters of microclimate, in particular ambient temperature, duration and intensity of illumination, absence of viral, bacterial and parasitogenical threats.

Analysis of recent researches and publications

The question of the proper productivity of laying hens at the organic growing presently carries debatable character. In that time as for the commercial cross-country races of laying chickens-hens of traditional intensive production there are the clearly declared parameters of the productivity, at the clear observance of hygiene of animals and sanitation norms and corre-

sponding balanced feeding. An organic production shows the extensive system of manage, as facilities are not used for stimulation of the productivity of animals, intensification of production is shut out and controlled. Thus, there are many limitations in feeding of organic bird, in particular it is not allowed to use the synthetic synthesized amino acids, meat-bones flour, fish flour - with limitations (Burns-Whitmore, 2010; Wilier and Yussefi-Menzler, 2008). And without these components of balancing of part of protein of ration becomes a stumper enough and perceptibly affects the productivity of bird. However even at an extensive manage, it must be cost-effective. One of ways of increase of efficiency of the organic poultry farming there is an improvement of efficiency of mastering of forage. Role of symbiotic microflora in mastering of nutritive of feed well-proven animals by many scientists (Alvarez-Olmos, 2001; Ammoscato, 2013; Saleeva, 2014). It is known that applications of preparations, that contain living microorganisms of symbiotic or optional microflora of gastrointestinal tract, improves metabolism, processes of digestion, regulates water-salt and acid-base balances, prevents to adhesion of pathogenic and conditionally-pathogenic bacteria (Stepanova, 2015). Similar properties are owned by post-biotal preparations - preparations that contain in the composition of metabolite, including the antibiotic substances synthesized by the representatives of symbiotic microflora of digestive channel (Cicenia, 2013). Application of these preparations allows complete, or partial exception of the using of antibiotics-growth factors and the productivity that is the necessary condition of conduct of organic stock-raising.

Materials and methods of research

The test of prophylactic preparations (a probiotic is on the basis of strain of *Lactobacillus plantarum* and postbiotic “Bacteriosan”) for growing of organic bird was conducted in the conditions of organic economy (laying hens of cross-country race of Tetra SL).

Some producers of chicken eggs in Ukraine and in Europe, that does not have an own incubation workshop, buy the more adult bird (for a concordance with a certification organ). For a few months, that a bird grows in organic terms, the term of transitional period runs back for such to the bird and when the period of laying eggs begins - eggs can be certified, as organic.

Experience chickens held out in one of apartments of organic economy, an organic feed was fed them, and in water added preparation of probiotic on the basis of strain of *Lactobacillus plantarum* in a dosage a 1 g/l every day, during a 7 days, with an a week’s interruption during all life.

Experience chickens held out in other apartment also, an organic feed was fed them, and in water added solution of postbiotic “Bacteriosan” (100ml of 40 % lactic acid and 0,05g of bacteriocin nisin 895ml of H₂O), in a dose a 1 ml/l every day. The chickens of control group (K), that got an organic feed without additions, held out in the third apartment, no prophylactic preparations were not used.

Results of the research and their discussion

The important index of readiness of laying chickens-hens to яйцекладки is them living mass.

Initial living mass of bird was fixed on 90th day (at entering to economy). The groups of bird were formed by the method of analogues and not for certain differed after living mass (table. 1). At the same time, at the identical amount of feed and food value of ration already through a month looked after the visual difference of height and development of chickens, that was confirmed by weighing of chickens. The greatest living mass was fixed in the first group, where with water a bird got preparation of probiotic on the basis of strain of *Lactobacillus plantarum* and second (E2 - postbiotic “Bacteriosan”), a difference of living mass between experience groups was unreliable. In a counterbalance, control chickens had some more subzero living mass on 6,66 % comparatively to E1 and 5,46 % comparatively to E2.

On 150th day of growing a difference is in mass of chickens experience and control groups increased. However, beginning from 150th day and in future advantage in living mass touched the chickens of the second experience group. And so, already 150th time of maintenance she was on 7,97 % and on 180th day - on 4,76 % higher comparatively with control.

In relation to the chickens of the first experience group, then middle index them living mass on 150th day was higher on 3,79 % and on 180th - differed not considerably, only on 1,47 % comparatively with control.

For period of experience the stored of bird laid down in a group E1 – 100 %, in the group E2 – 100 %, control – 98 %. One hen perished only a control group and on results a section her death is set as a result of inflammation of яйцеводу. By reason of death, to our opinion, could be her physiology development on beginning of laying eggs and insuffi-

1. Living mass of laying hens, $M \pm m$, r , $n = 15$

Age of chickens, days	E1 (probiotic)	E2 (postbiotic)	Control
90	890,67 ± 11,21	883,35 ± 17,84	901,25 ± 15,60
120	1247,40 ± 25,35	1233,33 ± 22,12	1169,47 ± 25,20
150	1648,53 ± 34,84	1715,06 ± 31,99	1588,40 ± 20,02
180	1993,33 ± 28,03	2057,93 ± 30,74	1964,40 ± 26,31

cient living mass, in the control group of chickens fixed living mass loss.

At the same time, the clinical state of bird in a control group marked periodic disorders of digestion (liquid chairs of brown color are with an odor nuisance) watching, something the low-spirited state.

During an experiment every ten days took into account the egg productivity of bird, that was estimated on the gross exit of eggs, mass of egg, bearing intensity. Bearing of bird was determined in every group by the daily account of the taken eggs. Egg mass was determined by weighing on the electronic scales of Tefal.

Chickens began laying eggs in age a 130 days. To 160th day rushed already 100 % hens. Eggs are with a brown shell. After the passport of cross-country race (at the intensive feeding) of laying eggs must begin already on a 118th day. However for the organic growing of bird characteristic extensive physiology development of organism and development of the reproductive system in particular.

Except the genetically stopped up potential the row of ponderable factors influences on the productivity of chickens, in particular terms of maintenance, full value of feeding and absence of diseases. Thus, after intensity of laying eggs it is possible to estimate the physiology state of laying hens and predict them following.

Will notice that in all groups chickens were clinically healthy, however intensity of laying eggs was for certain higher

in the first and second experience groups (table. 2), to our opinion, it is related to the best mastering of substances of feed as a result of application of examinee by us microbiological prophylactic preparations, comparatively with control.

In an experiment the positive action of probiotic preparation of *Lactobacillus plantarum* is also postbiotic «Bakteriosan» on the increase of intensity of laying eggs and the masses of eggs. Intensity of laying hens in the first experimental group (probiotic) was 75,09 %, and in the second group (postbiotic) – 76,50 %, against 70,30 % - in a control group.

By the count of gross output of eggs for period of experience for it is set groups, that the their most is taken by hens from the second experimental group (postbiotic «Bakteriosan») – 3825 things, that on 310 things (8,82 %) anymore by comparison to an index in the control group of bird. In the first experimental group this index for period of experience made 3754,5 eggs, that on 239,5 things (6,81 %) more than in control. In default of application in the ration of impurity, microelements, amino acid, is a high enough index.

Egg mass is a major index of the egg productivity which is in close interchange with other economic by the useful signs of chickens. With the increase of mass of eggs content is increased for them basic nutritive – to the albumen and yolk. For the chickens of experimental groups in the peak of laying eggs middle

2. Egg productivity of organic laying hens

Period, age	E1 (probiotic)		E2 (postbiotic)		Control	
	eggs on 1 head/10 days	from 50 eggs	on 1 head/10 days	from 50 eggs	eggs on 1 head/10 days	from 50 eggs
150-160	0,40	20,00	0,40	20,00	0,20	10,00
160-170	1,50	75,00	1,40	70,00	1,10	55,00
170-180	3,60	180,00	3,50	175,00	2,62	131,00
180-190	5,10	255,00	5,30	265,00	4,46	223,00
190-200	5,70	285,00	5,72	286,00	5,10	255,00
200-210	6,00	300,00	6,34	317,00	5,30	265,00
210-220	6,82	341,00	7,00	350,00	5,74	287,00
220-230	6,20	310,00	6,64	332,00	6,06	303,00
230-240	5,91	295,00	6,30	315,00	6,10	305,00
240-250	5,80	290,00	6,14	307,00	5,88	294,00
250-260	5,82	291,00	5,90	295,00	5,80	290,00
260-270	5,70	285,00	5,72	286,00	5,70	285,00
270-280	5,60	280,00	5,62	281,00	5,58	279,00
280-290	5,54	277,00	5,50	275,00	5,42	271,00
290-300	5,40	270,00	5,46	273,00	5,34	267,00
Gross output of eggs		3754,50		3825,00		3515,00
Intensity of laying eggs,%		75,09		76,50		70,30

mass of egg in 200 and 300 days made accordingly: E1 – 55,46 and 56,60 grams; E2 – 56,46 and 58,33 grams, while in a control group 54,13 and 55,57 grams. Higher mass of egg within the limits of standard of S1 is the best index, as it contains the enhanceable amount of basic nutritive. Mass of eggs in an egg production is considered a leading sign, which influences on the egg productivity, commodity and nourishing value of eggs.

Comparing mass of eggs from the laying hens of experimental groups with the index of control group of chickens, a reliable difference is set in an experiment. On 200th day of maintenance mass of eggs of chickens of the first ex-

perimental group was higher from mass of eggs of chickens of control group on 2,45 %, and on 300th day – on 1,85 %. Mass of eggs of chickens of the second experimental group was on 200th day more high on 4,30 %, and on 300th days – on 4,97 % by comparison to control.

Researches of mass of albumen and yolk of eggs are set next advantages of eggs, experimental groups got from chickens (table. 3). So on 200th day of maintenance mass of protein of eggs from the chickens of the first experimental group (E1) grew on 0,79 %, and second group (E2) – on 6,24 %. On 300th days mass of protein in the eggs of chickens of group E1 was higher on

1,17 %, and in a group E2 – on 7,63 % by comparison to a control group.

With age mass of protein of eggs was increased on the average in a group E1 – on 1,95 %, in a group E2 – on 2,04 %, in control – on 0,99 %.

Mass of yolk of eggs got from the chickens of the first experimental group on 200-th day of their growing, made 15,07g, that on 7,41% higher from analogical the index of control group of chickens, mass of yolk of eggs from the chickens of the second experimental group was 14,86, that on 5,92 % higher from analogical the index of control group of chickens in a that period of time (table. 3).

Measuring of mass yolk of eggs of the chickens taken on 300th day of growing advantage for to the experimental groups of bird: in a group E1 mass yolk was higher on 8,36 %, and made 16,07g, and in a group E2 – more high on 10,65 % and made 16,41g, by comparison to control.

Zootechnic indexes are above-mentioned can serve and by the indexes of quality, as an improvement of quality of

eggs is obvious with the increase of their mass and, in particular, mass of yolk.

Increase of mass of shell, which is as a rule stipulated its thickness and closeness, matters very much at the production of eggs. At first, the losses of commodity eggs through bad quality of shell result in their fight notch which reduces profitability of production of egg goods. And secondly, an egg shell is him natural packing, from what an egg is not added falsification and herein his unicity shows up as valuable food stuff.

At the same time, the decline of closeness and thickness of shell can testify to violation of feed of bird, errors in composition of ration and failing mikro- and macronutrients, that can be negatively represented on the state of health of chickens. Eggs which are characterized a greater thickness and closeness of shell own the best properties in relation to a maintainance and the best fitness to transporting.

Mass of shell of eggs from the chickens of all groups on 200th day of growing differed unreliably (table. 3). But on 300th day of life of egg bird from the

3. Mass of organic eggs, $M \pm m$, r , $n = 15$

	E1 (probiotic)	E2 (postbiotic)	Control
Age of chickens, days 200			
Mass of organic eggs	55,46 ± 1,70	56,46 ± 1,53	54,13 ± 1,11
Mass of protein of organic eggs	34,40 ± 1,59	36,26 ± 1,62	34,13 ± 1,76
Mass of yolk of organic eggs	15,07 ± 0,11	14,86 ± 0,24	14,03 ± 0,95
Mass of shell of organic eggs	6,03 ± 0,99	6,01 ± 0,78	5,99 ± 0,84
Thickness of shell of organic eggs	0,362 ± 0,04	0,366 ± 0,04	0,362 ± 0,05
Age of chickens, days 300			
Mass of organic eggs	56,60 ± 1,54	58,33 ± 1,68	55,57 ± 1,13
Mass of protein of organic eggs	34,40 ± 1,59	36,26 ± 1,62	34,13 ± 1,76
Mass of yolk of organic eggs	16,07 ± 0,17	16,41 ± 0,96	14,83±0,13
Mass of shell of organic eggs	6,16 ± 0,77	6,24 ± 0,68	5,91 ± 0,70
Thickness of shell of organic eggs	0,366 ± 0,025	0,373 ± 0,024	0,360 ± 0,02

chickens of different groups had a different thickness of shell. Mass of shell of eggs from the chickens of the first experimental group, to which probiotic preparation was applied was higher on 4,23 %, and in the second experimental group, where tested postbiotic «Bakteriosan» – more high on 5,58% by comparison to mass of shell of eggs got in a control group.

Mass and thickness of shell was increased proportionally (tabl. 3). On 300th day of life the differences were by groups: in a group E1 – on 1,60 %, and in a group E2 – on 3,61 %. It costs also to mark the unreliable diminishing of thickness of shell of eggs of chickens of control group with age from 0,362 to 0,360 mm.

Conclusions and future perspectives

The conducted experiment is set positive influence of probiotic of *Lactobacillus plantarum* and postbiotic «Bakteriosan» on living mass of laying hens and them physiology readiness to the period of laying eggs, in the conditions of organic economy.

Intensity of laying eggs of hens in the first experimental a group (probiotic) was 75,09 %, and in the second group (postbiotic) – 76,50 %, against 70,30 % – in a control group.

In the experimental groups of bird, which drink with water the noted prophylactic preparations higher mass of eggs and mass of their component parts (yolk and albumen), and also thickness and mass of shell, is set, by comparison to the control group of bird.

Probiotic *Lactobacillus plantarum* and postbiotic «Bakteriosan» recommend for application laying hens at their maintenance and receipt of products at the terms of the organic poultry farming.

References

- Alvarez-Olmos, M. I. (2001). Probiotic agents and infection diseases: a modern perspective on a tradition therapy. *Clin. Infect. Dis.*, 2(11):1567–1576.
- Ammoscato, F., Scirocco, A., Altomare, A. (2013). *Lactobacillus rhamnosus* protects human colonic muscle from pathogen lipopolysaccharide-induced damage. *Neurogastroenterol Motil.*, 25:984–777.
- Burns-Whitmore, B. L., Haddad, E. H., Sabaté, J., Jaceldo-Siegl, K., Tanzman, J., & Rajaram, S. (2010). Effect of n-3 fatty acid enriched eggs and organic eggs on serum lutein in free-living lacto-ovo vegetarians. *European journal of clinical nutrition*, 64(11):1332–1337.
- Cicenia, A., Scirocco, A., Carabotti, M., Severi, C. (2013). Postbiotic Activities of Lactobacilli-derived Factors. *Journal of Clinical Gastroenterology* 48 Suppl 1, Proceedings From The 7th Probiotics, In Rome On September 8-10, Prebiotics & New Foods Meeting Held, 1:18–22. DOI: 10.1097/MCG.0000000000000231
- Kan, C.A. (2005). Chemical residues in poultry and eggs produced in free-range or organic systems. In *Proceedings of the XVII European Symposium on the Quality of Poultry Meat and X European Symposium on the Quality of Eggs and Egg Products*, Doorwerth, 28–36.
- Rizzi, C., Marangon, A. (2012). Quality of organic eggs of hybrid and Italian breed hens. *Poultry science*, 91(9):2330–2340.
- Wilier, H., Yusefi-Menzler, M., Sorensen, N. (2008). *The world of organic agriculture: statistics & emerging trends 2008 / International Federation of Organic Agriculture Movements (IFOAM) Bonn, Germany and Research Institute of Organic Agriculture (FiBL), Frick, Switzerland.*
- Saleeva, I.P. (2014). Novye probioticheskie komplekxy (preparaty) i ih primenenie pri vyrashhivanii brojlerov. [New probiotic complexes (preparations) and their use in

growing broilers]. Pticevodstvo, 12:29–35. (in Russian)
Stepanova, A.M. (2015). Formirovanie mikrobiocenoza cypljat pri primenenii

bakterij Bacillus subtilis. [The formation of microbiocenosis of chickens with the use of bacteria Bacillus subtilis]. Pticevodstvo, 5:47–52. (in Russian)

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Анотація. У статті обговорюються питання ефективності утримання курей-несучок в умовах органічного господарства. Запропоновано використання профілактичних препаратів на основі пробіотичних мікроорганізмів *Lactobacillus plantarum* та постбіотику «Бактеріосан» - розробка співробітників кафедри гігієни тварин та санітарії ім. проф. А. К. Скороходька. Дослідження проводились у сертифікованому органічному господарстві. У одному з приміщень органічного господарства утримувались дослідні курчата, їм згодували органічний корм, а у воду додавали пробіотичний препарат на основі штаму *Lactobacillus plantarum* в дозуванні 1 г / л щоденно, протягом 7 діб, з тижневою перервою впродовж всього життя. У іншому приміщенні утримувались також дослідні курчата, їм згодували органічний корм, а у воду додавали розчин постбіотику «Бактеріосан» (100 мл 40 % молочної кислоти + 0,05г бактеріоцину нізину +895 мл H₂O), в дозі 1 мл / л щоденно. У третьому приміщенні утримувались курчата контрольної групи (К), які отримували органічний корм без добавок, не застосовувались жодні профілактичні препарати. У курей-несучок вивчали такі показники: живу масу, інтенсивність яйцекладки, вагу яйця та його складових частин (білка та жовтка), товщину шкаралупи. Аналіз та інтерпретація отриманих експериментальних даних доводять позитивний вплив обох зазначених препаратів, порівняно з контролем. Відмічено підвищення живої маси курей-несучок та інтенсивність яйцекладки, остання у першій дослідній групі (пробіотик) складала 75,09 %, а в другій (постбіотик) – 76,50 %, проти 70,30 % – у контрольній групі. Аналогічні зміни встановлено і щодо ваги яєць та маси їх складових частин (жовтка і білка), а також товщини і ваги шкаралупи порівняно з контрольною групою птиці. Пробіотик *Lactobacillus plantarum* і постбіотик «Бактеріосан» рекомендуємо для застосування курам-несучкам за їх утримання та одержання продукції за умов органічного вирощування.

Ключові слова: органічні яйця, кури-несучки, продуктивність, маса яйця, білок, жовток, шкаралупа

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