



# The Influence of Humic Acid Supplement on the Marketable Properties of Hy-Line Laying Hen Eggs

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**Abstract** | The results of the experiment indicate a positive effect of the liquid humic acids supplement Reasil® Humic Vet on the commercial quality of "Hy-Line" laying hens' eggs. The addition of the supplement solution to the diet in an amount of 50 and 75 ml / 100 l water according to the scheme: 14 days of watering per 7 days of break, allows increasing the uniformity and intensity of the egg shell color and thickness and improve the egg weight.

**Keywords** | Humic acids, Laying hens, Egg color and uniformity, Shell thickness

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## INTRODUCTION

Modern industrial poultry farming has become one of the world's leading producers of cheap and biologically complete human food due to high technology, scientific security and dynamic development. Maintaining of this level requires the mobilization of all resources and the maximum use of the genetic potential of poultry; higher level of nutritional value and increased productive longevity of the birds remain the key to profitability of the industry.

The increase in commercial quality and marketability of eggs, as well as the egg weight and shell thickness are of great importance in this respect. At the same time, almost no attention is paid to improving the uniformity and intensity of egg color in hens of brown egg crosses, although these indicators play an important part in adding to the marketability of eggs. There is a subconscious consumer stereotype that the brown tint of eggs is a sign of their

naturality. Although this criterion has no scientific ground, and research has shown that the chemical composition and nutritional value of eggs don't depend on the color of the shell, but on the quality of feeding, the customers are favorably disposed to the eggs with a brown tint (Velichko, 2010; Hunton, 1993; Tsarenko and Vasilyeva, 2009; Kaplan et al., 2017).

It is known that environmental factors such as stress, lighting in poultry houses, air temperature and drinking water can affect the shell color. The production of pigment depends on the length of the day.

It is believed that the pigmentation of eggs is also affected by the age of the bird, diseases and the use of drugs (Rodionova, 2011; Shabanova, 2015). The color of the egg shell is also associated with the nature of inheritance. A sufficiently high coefficient of egg shell color heritability was established from 0.35 to 0.80 (Kochish et al., 2003; Uvarov and Pankratov, 2011; Dunn, 2012).

There is a way to improve the color of eggshell through the use of spores of *Bacillus subtilis* (Danny, 2007). However, in accordance with the sanitary rules and regulations officially operating in the Russian Federation, *Bacillus subtilis* belongs to the type of opportunistic bacteria which makes it difficult for application. There are proposals to ensure the intensive coloring of eggs by introducing corn feed into the diet as one of the components (Fisinin et al., 2000; Arafat et al., 2017). However, its input is not always economically feasible, since the high cost of corn grain in comparison with other grain components of feed increases the cost of feed, and hence the production of poultry in general. In addition, not all varieties of corn can provide a decent level of egg pigmentation.

Conducting research on the use of humic acids as feed supplements for farm animals and poultry has allowed to accumulate extensive experimental material, proving that the use of humates leads to an acceleration of animal growth, a decrease in morbidity and mortality, an increase in the body's resistance to adverse environmental conditions, and also to feed toxins (Vasiliev et al., 2018a, 2018b, 2018c; Korsakov et al., 2018a, 2018c). Experiments on egg crosses of laying hens showed the effect of humic acid supplements both on the productive qualities of poultry and on the marketable properties of eggs the thickness and pigmentation of the shell (Korsakov et al., 2018b). No publications on the use of such additives to improve the uniformity and intensity of eggshell color were found.

The aim of the research was to determine the effect of the humic acid supplement on the weight of eggs, pigmentation and shell thickness.

## MATERIALS AND METHODS

To conduct a scientific and practical experiment 4 groups of laying hens of the Hy-Line cross at the age of 235 days, 100 heads each, were formed on the basis of the FSBEU of HE "Saratov State Agrarian University". The experiment was carried out according to the scheme presented in Table 1. Control group hens received feed mix prepared according to the norms of feeding for this sex and age group of layers. Hens in experimental groups 1, 2 and 3 were fed with a solution of humic acid salts in addition to this diet; in particular, Reasil® Humic Vet at a dose of 25 ml, 50 ml and 75 ml per 100 l of water. This drug is a liquid water-soluble feed supplement of a complex action, produced by «Life Force» Ltd. This is a concentrated solution of the high molecular weight sodium salts of humic acids from Leonardite. Previously, the drug was dissolved in drinking water at a temperature of 18-22 ° C. Watering of poultry was carried out through the free access auto drinkers according to the scheme: 14 days of watering per 7 days

of break. Total 4 cycles of feeding with Reasil® Humic Vet were conducted.

During the experiment, the weight of the eggs, the thickness of the shell and the intensity of its color were taken into account.

## RESULTS AND DISCUSSION

Analysis of the data at the beginning of the experiment shows that eggs of all experimental groups of laying hens had approximately the same weight and thickness of the shell (Table 2). The color of the shell in all experimental groups had almost no differences and was equal to 91.1-91.4 points.

Differences in indicators of egg quality appeared right after the first cycle of watering (Table 3). After 14 days of watering with Reasil® Humic Vet the weight of eggs in experimental groups increased compared to the control by 1.7%, 3.1% and 3.5%; shell thickness increased accordingly by 2.0%, 4.3% and 4.7% compared with the control group. At the same time, there was a decrease by 10% in the number of eggs with a shell thickness below the norm in experimental groups 2 and 3. Also, the uniformity and intensity of the color of the egg shell increased; they became brighter. The greatest changes were in experimental groups 2 and 3. So, compared with the control group, the color intensity in the experimental group 2 increased by 4.9 points and in the experimental group 3 by 4.7 points.

The tendency to improve the quality of eggs persisted throughout the entire period of watering with Reasil® Humic Vet. At the end of the experiment, the egg shell in experimental groups 2 and 3 became brighter and more uniform in color compared with the control group and the 1<sup>st</sup> experimental group. The color was better than in the control group by 6.4 and 5.5 points respectively. They also increased the average egg weight by 4.6 g and 3.3 g, or 8.0 and 5.7%, and the shell thickness by 0.018 mm and 0.015 mm (5.2-4.4%) respectively. The number of eggs with shell thickness below the norm decreased in the 1<sup>st</sup> experimental group by 10%, whereas the 2<sup>nd</sup> experimental group showed the absence of such eggs. The difference between the quality indicators of eggs in the control and the 1<sup>st</sup> experimental group was the smallest.

The results of the experiment indicate the positive effect of the Reasil® Humic Vet supplement in the diet of Hy-Line laying hens, where a solution of liquid preparation of humic acids in the amount of 50 and 75 ml per 100 l of water was used according to the scheme: 14 days of watering per 7 days of break. This scheme made it possible to increase the uniformity and intensity of egg shell color,

**Table 1:** Experimental scheme.

Group	Number of heads	Watering period, days	Feeding scheme
Control	100	56	Feed mix
1-experimental	100	56	Feed mix + Reasil® Humic Vet at a dose of 25 ml per 100 l of water
2- experimental	100	56	Feed mix + Reasil® Humic Vet at a dose of 50 ml per 100 l of water
3- experimental	100	56	Feed mix + Reasil® Humic Vet at a dose of 75 ml per 100 l of water

**Table 2:** Marketable properties of eggs at the beginning of the experiment.

Indicator	Group			
	control	1- experimental	2- experimental	3- experimental
Egg shell thickness, mm	0.342	0.341	0.341	0.342
Number of eggs with shell thickness below the norm, %	20	20	30	20
Egg weight, g	58.9±1.54	58.3±1.56	58.1±1.47	59.1±1.59
Egg shell color, points	91.3	91.4	91.1	91.2

**Table 3:** Marketable properties of eggs during the experiment.

Indicator	Group			
	control	1-experimental	2 - experimental	3 - experimental
1 <sup>st</sup> watering cycle				
Egg shell thickness, mm	0.342	0.349	0.357	0.358
Number of eggs with shell thickness below the norm, %	20	20	10	10
Egg weight, g	58.4±1,53	59.4±1,51	60.5±1,45	60.2±1.58
Egg shell color, points	91.5	93.4	96.4	96.2
2 <sup>nd</sup> watering cycle				
Egg shell thickness, mm	0.343	0.351	0.361	0.359
Number of eggs with shell thickness below the norm, %	20	10	0	10
Egg weight, g	58.9±1.51	59.7±1.45	61.3±1.21	60.9±1.47
Egg shell color, points	91.2	94.4	97.3	96.5
3 <sup>rd</sup> watering cycle				
Egg shell thickness, mm	0.341	0.349	0.362	0.358
Number of eggs with shell thickness below the norm, %	20	10	10	10
Egg weight, g	58.2±1,51	59.5±1,45	61.1±1.21	60.6±1.47
Egg shell color, points	91.4	94.1	96.9	96.1
4 <sup>th</sup> watering cycle				
Egg shell thickness, mm	0.342	0.350	0.360	0.357
Number of eggs with shell thickness below the norm, %	20	10	0	10
Egg weight, g	57.5±1.51	59.8±1.45	62.1±1.21	60.8±1.47
Egg shell color, points	90.8	93.9	97.2	96.3

egg weight, and shell thickness (Kochish et al., 2003; Kochish and Fat Swan, 1993; Shabanova, 2015).

Production experiment on the use of humic acid was held at the poultry farm “Krasnodarskaya” of the JSC “Agrocomplex” named after N.I. Tkachev (Krasnodar, the village of Loris). Two houses of laying hens of the Hy-Line cross at the age of 270 days took part in the experiment: the control group amounted to 36,546 heads and the

experimental group included 35,582 heads. The experiment was carried out according to the scheme presented in Table 4. Laying hens of the control group received feed mix as part of the ration, which corresponded to the norms of feeding, age and productivity of poultry. Hens from the experimental group received the same feed and, additionally with water, liquid supplement Reasil® Humic Vet, which was previously dissolved in drinking water at a temperature of 18-22 ° C in the amount of 50 ml per 100

l of water and was fed through automatic waterers freely available for 14 days of feeding with a break of 7 days.

**Table 4: Scheme of the experiment.**

Group	Period of the experiment, days	Feeding scheme
Control	14	Feed mix
Experimental	14	Feed mix + Reasil® Humic Vet at a dose of 50 ml per 100 l of water

**Table 5: Results of the experiment.**

Indicator	Group	
	control	experimental
The beginning of the experiment		
Egg shell thickness, mm	0.350±0.0077	0.337±0.0065
Number of eggs with shell thickness below the norm, %	20	40
Egg weight, g	60.9±1.67	60.4±1.66
Egg shell color, points	92.3	92.1
The end of the experiment		
Egg shell thickness, mm	0.346±0.0085	0.360±0.0054
Number of eggs with shell thickness below the norm, %	40	10
Egg weight, g	60.5±1.65	61.3±1.68
Egg shell color, points	92.1	96.2

The experimental data show that the shell thickness of the experimental group eggs at the beginning of the experiment was 0.013 mm or 3.7% less than in the control group (Table 5). Therefore, in the control group, the number of eggs with shell thickness below the norm was 20% less than in the experimental group. The weight of eggs and their shell color did not significantly differ in groups.

At the end of the experiment, after 14 days of drinking Reasil® Humic Vet, the eggshell thickness in the experimental group increased by 0.023 mm and became 0.014 mm more than in the control group. At the same time, the number of eggs with shell thickness below the norm in the experimental group decreased by 30%.

The color of the eggshell also changed. If at the beginning of the experiment, the eggs in the experimental group varied in color as the control ones, from white-brown to pale brown and their color was almost the same (92.1-92.2 points), after 14 days of experimental feeding of eggs they became brighter and more uniform in color, their color increased by 4.1 points.

## CONCLUSION

The results of the experiment indicate a positive effect of

adding 50 ml of liquid Reasil® Humic Vet per 100 l of water to the ration of laying hens. This allowed increasing the thickness of the shell, the uniformity and intensity of its color, and, consequently, the marketable properties of eggs.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest

## AUTHORS CONTRIBUTION

All authors contributed equally.

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