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Investigations

Influence of the M-Feed Additive on Metabolism and Productivity of Laying Quails

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Abstract: The paper shows the impact of the M-feed new generation feed additive in the quail diets on their growth energy, the quality of the egg and the biochemistry of the laying quails. It has been established that of the three feed additive dosages under study the daily dosage of 200 mg/100 g of the combined feed provides the most favorable conditions for the organism of the test quails. This, in turn, contributes to a reduction in feed costs, an increase in growth energy by 7.9%, an improvement in the quality of the eggs. In the test quails who received such quantity of M-feed, the mass of eggs and protein in them was higher than that in the control analogs by 1.7 g. At the same time, the protein index increased by 11.45, the yolk - by 2.1% and the number of carotenoids - by 13.6%. The analyses also showed that the addition of M-feed in the combined feed in such an amount contributed to the improvement of the mineral composition of eggs and the resistance of quails.

Keywords: Additive, Dosage, Quail, Growth, Quality, Egg

Introduction

When organizing the intensive growing of young poultry, the most important role is assigned to the organization of full-fledged feeding, which is mainly achieved by improving the quality of feeds, their optimal combination in the diet and the use of various feed additives.

M-feed is a new universal additive with a high biogenic spectrum of action on the organism of poultry animals, which includes natural inorganic and organic ingredients: montmorolinite, infusorial earth, yeast layers (mannan-oligosaccharides), seaweed extracts (polysaccharides) and essential oils (Yegorov *et al*., 2010; Aduchiyev, 2015; Simonov *et al*., 2016; Ibrakhim, 2017; Gayirbegov *et al*., 2017).

So far, there is little evidence in the literature about the impact of this feed additive on growth energy, egg quality and quail resistance.

The study of these issues is therefore important for science and production.

Methods

With this in mind, we conducted a scientific and economic experiment in the conditions of the veterinary clinic of the Agrarian Institute of the National Research Mordovian State University named after N. Ogaryov. For this purpose, four groups of 24 h manchurian quails were selected, each containing 100 animal units. All groups were kept in identical microclimatic conditions, which corresponded to the recommended norms.

The test quails up to 3 weeks old took a full-feed starter combined feed; from 3 to 5 weeks - the growth feed and starting from 5 weeks old - the finish combined feed.

Quails in the control group took the compound feed without the addition of M-Feed, the analogues from the first experimental group daily administered a dietary supplement in the amount of 200 mg per 100 g of combined feed, the second and third groups - 400 and 600 mg, respectively. The growth energy of quails was determined by weekly individual weighing. On the 35th day, the males from the groups were removed and only females were further weighed.

Morphological quality parameters of the quail eggs were determined in the laboratory of the Atemarskaya Poultry Farm of the Republic of Mordovia and the mineral composition - in the laboratory of the Ogarev Mordovian State University using the ARL Perform X XRF spectrometer manufactured by Thermo Scientific (Switzerland).

In order to study the nature of the action of the M-feed additive on the state of health of the quails, the composition of their blood was studied, which was taken from 3 animal units - the analogues of the 42-day age from each group. The blood analysis of the experimental bird was carried out in the Mordovian Republican Veterinary Laboratory.

The resulting digital material was processed using Excel. The results were compared by the group method and the difference in mean indices among the groups was considered reliable at the probability level -(p = 0.05) determined by the Student's t-test.

Results and Discussion

By the end of the test, the results of the weighing showed that the quails in the experimental groups were distinguished by increased growth energy in comparison with the peers from the control group. At the same time, there were some differences in the live weight of the quails of the experimental groups, depending on the amount of the M-feed additive included in their diets (Table 1).

The best results for live weight were observed in the quails of the first experimental group, whose diet included M-feed in the amount of 200 mg per 100 g of combined feed. Thus, while on the 35th day of the experiment the difference in the live mass between the control group and the first experimental group was 12 g ($p<0.01$), between the second and third experimental groups receiving 400 mg and 600 mg of M-feed per 100 g of the combined feed, it was lower and amounted to only 4 and 3.7 g ($p>0.05$). It should also be noted that compared to the first experimental group, the live weight of quails from these groups was smaller.

In the following two weeks, the intensity of growth of quails from the experimental groups was also higher in comparison with the control analogues. It should be noted that the tendency of excellence of quails from the first experimental group as compared to analogues from all other groups has been preserved. Thus, on the 49th day of the experiment, their living weight was 17.8 g higher than that of the control group ($p<0.05$), by 8.7 g compared to the second experimental group ($p<0.05$) and by 10.8 g compared to the third experimental group ($p<0.05$). The experiment also noted the influence of different amounts of the M-feed additive on the absolute growth of the quails living mass (Table 2). Thus, while in the control group at the end of the 4th week of the experiment an average of 37.96 g of absolute growth was obtained, the M-feed additive in the amount of 200 mg/100 g feed promoted an increase of this value by 2.68 g or by 7% ($p>0.05$). The increase in the dosage of the feed additive to 400 mg/100 g of the combined feed in the diets contributed to a decrease in the absolute growth in comparison with the control analogues by 1.5 g, at the same time, the dosage in the amount of 600 mg/100 g increased the gain by 1.94 g.

By the end of the 7th week of the experiment, the absolute gain in the live weight of quails from the first experimental group was higher than that in the control group by 18.34 g ($p<0.01$), from the second group - by 17.69 g ($p<0.01$) and from the third group - by 11.3 g ($p<0.05$).

When assessing eggs, we, first of all, took into account their mass, which was considered to be the main indicator in egg production affecting its commercial value and nutritional level (Table 3).

Table 1: Change in live weight of quails, (g)

	Groups			
Age, days	Control	1st experimental	2nd experimental	3rd experimental
7	33.29±0.60	32.80±0.75	24.76±0.67	29.04±0.61
14	69.61±0.63	73.69±0.79	68.93±1.00	67.59±0.89
21	112.96±0.97	116.00±1.05	113.40±0.92	110.11±0.89
28	150.65±1.50	156.64±1.22	149.84±1.33	150.01±1.14
35	173.43±1.48	185.40±1.16	177.50±1.76	176.86±1.28
42	220.58±2.57	225.18±2.41	220.06±3.01	220.67±3.25
49	226.65±2.60	244.50±2.60	235.81±2.83	233.70±3.03

Table 2: Absolute gain in the live weight of quails, (g)

	Groups			
Age, days	Control	1st experimental	1-nd experimental	3rd experimental
7-14	36.22±0.40	41.20±0.50	44.21±0.64	38.65±0.63
14-21	43.15±1.18	42.31±1.27	44.48±1.24	42.52±1.36
21-28	37.96±1.80	40.64±1.63	36.47±1.61	39.90±1.31
28-35	22.78±1.84	28.76±1.59	27.63±2.09	26.93±1.65
35-42	46.85±3.27	38.54±3.17	40.83±3.09	42.22±3.64
42-49	6.06±0.75	19.36±1.98	15.75±2.11	13.04±2.62
7-49	193.36±2.69	211.70±2.68	211.05±3.00	204.65±3.28

Table 3: Egg Quality Indicators

	Groups			
Indicators	Control	1st experimental	2nd experimental	3rd experimental
Egg weight, g	10.57±0.12	12.27±0.09	12.17±0.08	11.96±0.35
White weight, g	5.73±0.08	7.49±0.07	6.47±0.06	6.58±0.14
Yolk weight, g	3.59±0.02	3.59±0.01	4.10±0.15	3.92±0.03
Shell weight, g	1.25±0.01	1.19±0.01	1.60±0.15	1.46±0.03
Ratio of white weight to yolk weight	1.59±0.02	2.08±0.01	1.58±0.08	1.67±0.02
Shape index, %	81.9±0.55	79.8±0.30	79.1±0.06	82.1±0.55
Shell thickness, mm	0.19±0.01	0.20±0.01	0.19±0.01	0.19±0.01
Egg density, g/cm^3	1.050±0.01	1.050±0.01	1.055±0.02	1.050±0.01
White index, %	11.6±0.11	13.3±0.16	10.6±0.17	13.4±0.11
Yolk Index, %	43.8±0.30	44.75±0.12	40.0±1.28	50.5±0.26
Carotenoids, µg/g	12.50±0.25	14.20±0.20	13.0±0.10	12.8±0.11

The carried out researches have shown that the weight of eggs of quails from the experimental groups slightly exceeds the weight of control eggs.

Thus, the difference in this indicator between the control group and the first experimental group was 1.7 g ($p<0.01$), between the control and the second group -1.6 g ($p<0.05$) and between the control and the third group - 1.39 g ($p<0.05$). The white weight in the first experimental group increased by 1.76 g ($p<0.001$) in comparison with the control group, in the second group - by 1.6 g ($p<0.01$) and in the third experimental group - by 0.85 g ($p<0.05$). It should be noted that although with the increase in egg weight in the first experimental group the M-feed additive promotes for the increase in the white content therein, the weight of yolk and shell decreases. As for the other experimental groups, the weight of the yolk in the quails from the second and third experimental groups was higher than those in the control and the first experimental group by 0.51 and 0.33 g, respectively and the shell weight in the second experimental group was higher than those in the control and in the first experimental group by 0.35 and 0.41 g and in the third group by 0.21 and 0.27 g, respectively.

The quality assessment of eggs led to the conclusion that the inclusion of the M-feed additive in the amount of 200 mg/100 g in the combined feed of quails from the first experimental group had the best effect on the white and yolk index. Thus, in quails from the first experimental group, the white index was higher than that in the control analogues by 11.45% ($p<0.01$) and the yolk index - by 2.1% ($p<0.05$).

In our studies, the egg density in all the experimental groups was approximately the same - (1.050-1.055 g/cm^3).

Carotenoids play an important role in the metabolism of the developing embryo, therefore, they are an important indicator of the quality of the egg. The results of the studies showed that the content of carotenoids in the control quail eggs that were not taking the M-feed additive was 12.50 µg/g, which was 13.6% less than in the analogs from the first experimental group ($p<0.05$), 4% less ($p>0.05$) than in the second group and 2.4% less than in the third experimental group ($p>0.05$).

The analysis of the mineral composition of the egg also showed that the addition of the M-feed additive to the combined feed contributed to a decrease in the concentration of calcium in the white of the quail eggs from the first experimental group by 0.003%, from the second - by 0.024% and from the third experimental group - by 0.019% (Table 4). The concentration of phosphorus had also decreased in the egg whites of the quail experimental groups. With regard to potassium, in the first and second experimental groups, its amount decreased and in the third experimental group, the quails in which received an increased amount of the M-feed additive - the amount of potassium increased.

In the first experimental group, which received M-feed in the amount of 200 mg per 100 g of the combined feed, a decrease in the concentration of calcium, phosphorus, chlorine, sulfur, iron, zinc and an increase in the amount of silicon in the yolk were observed.

With regard to the shell, in the first experimental group, there was an increase in calcium accumulation and a decrease in the remaining macro and microelements compared to the control group.

The blood test of the test quails showed that the blood parameters studied were within the permissible limits (Table 5), which indicated the normal physiological state of all control and test quails. However, it should be noted that in the blood of quails from the first experimental group that received the M-feed additive in the amount of 200 mg per 100 g of combined feed, a significant increase in the number of erythrocytes compared with the analogues from the control group was observed - by 38.6% ($p<0.05$), from the second experimental group - by 21.4% ($p>0.05$) and from the third - by 9.6% ($p>0.05$). As for hemoglobin, its amount in the blood of quails from the first experimental group was higher by 23.1% ($p>0.05$) than in the control analogs, from the second experimental group - by 5.9 and from the third experimental group - by 7.5% ($p>0.05$).

Table 4: Mineral composition of quail eggs, (%)

		Groups		
Elements	Control	1st experimental	1-nd experimental	3rd experimental
White				
Calcium	0.110	0.107	0.086	0.091
Phosphorus	0.079	0.072	0.073	0.075
Potassium	1.150	1.140	1.130	1.170
Sodium	Traces	Traces	Traces	Traces
Magnesium	Traces	Traces	Traces	Traces
Chlorine	0.894	0.920	0.942	0.914
Sulfur	0.715	0.707	0.718	0.688
Silicon	0.049	0.049	0.050	0.052
Bromine	0.001	Traces	0.001	Traces
Yolk				
Calcium	0.5710	0.4760	0.6220	0.4340
Phosphorus	0.7460	0.6660	0.8270	0.7850
Potassium	0.1270	0.1500	0.1770	0.2420
Sodium	Traces	Traces	Traces	Traces
Magnesium	Traces	Traces	Traces	Traces
Chlorine	0.2470	0.2280	0.2330	0.2800
Sulfur	0.1900	0.1840	0.1440	0.1610
Ferrum	0.0297	0.0210	0.0296	0.0233
Zink	0.0132	0.0111	Traces	0.0099
Manganese	Traces	Traces	0.0018	Traces
Silicon	0.0684	0.0977	0.1240	0.0570
Bromine	Traces	0.0013	0.0017	Traces
Shell				
Calcium	88.910	89.3600	90.780	90.210
Phosphorus	0.983	1.2300	0.852	0.926
Potassium	1.110	0.9550	0.558	0.703
Sodium	0.169	0.1800	0.147	0.160
Magnesium	0.130	0.1250	0.125	0.113
Chlorine	0.851	0.7470	0.435	0.537
Sulfur	1.480	1.1000	0.886	1.010
Ferrum	0.0288	0.0212	0.0126	0.0245
Zink	0.0711	0.0226	0.0354	0.0673
Silicon	0.1380	0.1370	0.1270	0.1240
Manganese	Traces	Traces	0.0121	Traces

Table 5: Morphological parameters of quail blood

Groups	Erythrocytes, million/μm	Leukocytes thousand/μL	Hemoglobin, g%
Control	3.03±0.37	24.90±2.66	12.40±1.32
1st experimental	4.20±0.25	20.43±2.16	15.27±0.46
2nd experimental	3.46±0.24	22.00±1.95	13.13±0.35
3rd experimental	3.83±0.20	22.17±2.16	13.33±0.56

When optimizing the dosage of the M-feed additive in diets, the blood of the quail of the first experimental group showed a tendency to reduce the number of leukocytes by 18% ($p>0.05$).

The approbation of the optimal M-feed dosage in the amount of 200 mg/100 g feed in the conditions of the Kalderkin farm of the Republic of Mordovia on 600 animal units allowed us to receive additional revenues of up to 9.06 rubles through the sale of their live weight gain and the eggs from one unit.

Conclusion

Thus, on the basis of the data obtained in the experiment, it can be concluded that the new M-feed

additive in the amount of 200 mg per 100 g of combined feed exerts a higher biological effect on growth energy, the morphological parameters of egg quality and health of quails and also improves the mineral composition of eggs.

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Author's Contributions

All authors contributed equally.

Ethics

Authors declare no conflicts of interest.

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