

# Effect of $\beta$ -mannanase on Laying Hen Performance and Egg Quality

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**Abstract:** In this study, a total of 1440 healthy 41-week-old Hy-line brown laying hens were randomly divided into 4 treatment groups. Group I was positive control group, fed with corn-soy meal-mixed meal diet ; group II was fed with diet reduced 0.21MJ/kg, as negative control group; group III, IV were fed with the negative control diet supplemented with 300g/t, 500g/t mannanase. Compared with group II, the feed-egg ratio of group III and IV were decreased 2.82% and 3.29%, respectively ; the misshapen eggs rate were decreased 6.78% and 15.25%. The eggshell thickness of group I and IV was significantly higher than group II( $P < 0.05$ ); the eggshell thickness of group III was increased 5.63%; no significant difference among group I, III, IV ( $P > 0.05$ ). No significant difference in egg shape index, yolk color and Haugh unit between four groups ( $P > 0.05$ ). Decreasing metabolic energy (ME) obviously reduces the thickness of eggshell, but with the supplement of mannanase, the thickness can be significantly improved. The misshapen eggs rate was improved even though the difference was not significant. In sum, the supplement of mannanase can significantly increase energy utilization ratio of feed, increase laying hen performance and improve eggshell thickness.

**Key words:** mannanase, laying hen, performance, egg quality

Mannan has anti-nutrition effects such as increasing the chyme viscosity of animal digestive tract, effecting the secretion of IGF-1, insulin and glucagon, and inhibiting glucose absorption. Mannanase can solve these problems. Because feedstuff is low in mannan, mannanase has been ignored in domestic feed industry and has few applications. With further research, the anti-nutrition effect of mannan received more attention. This study is aimed at researching the effect of mannanase on laying hen performance and providing scientific support for the rational use of mannanase in feed.

## 1 Materials and methods

### 1.1 Enzyme preparation

Test mannanase was provided by Jinan Bestzyme. Enzyme activity is 1000U/g

### 1.2 Animals

The experiment was conducted at a laying hen farm of Liaocheng, Shandong. A total of 1440 healthy 41-week-old Hy-line brown laying hens were randomly divided into 4 treatment groups. Each group has 4 replicates with 90 hens in each replicates. The experiment lasted for 63 days. Group I was positive control group, fed with corn-soy meal-mixed meal diet; group II was fed with diet reduced 0.21MJ/kg, as negative control group; group III, IV were fed with the negative control diet with 300g/t, 500g/t mannanase.

### 1.3 Management and diets

All chickens had free access to feed and water in this experiment. Record the amount of feed and the consumption of feed using replicates as unit. The experimental diet is prepared according to the nutrition requirement standard of Hy-line brown laying hens. See table 1 for formula and nutrition facts.

Group	I	II	III	IV
Corn	62.37	61.9	61.9	61.9
Middling	0	0	0	0
Bran	-	0	0	0
Soy meal	8.27	4.66	4.66	4.66
Stone meal	8.5	8.55	8.55	8.55
Cottonseed meal	5.5	6	6	6
Peanut meal	2	5	5	5
Corn gluten meal	5	5	5	5
DDGS	5	6	6	6
Oil	0.36	-	-	-
Calcium hydrophosphate	1.24	1.23	1.23	1.23
Salt	0.16	0.18	0.18	0.18
Lysine 65%	0.49	0.55	0.55	0.55
Methionine	0.11	0.13	0.13	0.13
Premix	1	1	1	1
Mannanase	0	0	0.03	0.05

Energy level				
Crude protein	16	16	16	16
Metabolism energy	11.13	10.92	10.92	10.92
Calcium	3.5	3.5	3.5	3.5
Salt	0.3	0.3	0.3	0.3
Available P	0.33	0.33	0.33	0.33
Lysine	0.7	0.7	0.7	0.7
Methionine	0.37	0.37	0.37	0.37

#### 1.4 determination of index

Record the number of eggs, egg weights, number of broken eggs and mortality daily. Before the end of the experiment, took 10 eggs in each group randomly in the morning to test the egg quality. Egg weight, egg yolk weight and egg white weight were weighted with electronic balance. The thickness of eggshell, long diameter and short diameter was measured by micrometer.

## 2. Result and analysis

### 2.1 Effect of mannanase on laying hen performance

See table 2 for the effect of mannanase on laying hen performance. The data showed that, the laying rate of group I and IV were significantly higher than group II, no significant difference between group II and III( $P > 0.05$ ), but group III had a improving trend; no significant difference between group I, III, IV ( $P > 0.05$ ). Group II had the highest feed-egg ration, group I is significantly lower than group II ( $P < 0.05$ ). Compared with group II, group III and IV decreased 2.82% and 3.29%, respectively, even though the difference is not significant.

For the average egg weight and mortality rate, there's no significant difference ( $P > 0.05$ ) among the groups.

Group	I	II	III	IV
Laying rate	84.42±0.94	81.87±1.24	83.21±0.80	84.34±0.24
Average egg weight	62.38±0.51	62.16±0.35	62.21±0.64	62.35±0.73
Feed-egg ratio	2.05±0.05	2.13±0.04	2.07±0.06	2.06±0.07
Mortality rate	1.50±1.60	1.40±2.80	1.50±2.70	1.80±2.30

The result shows that the decreasing of ME significantly affect laying rate and feed-egg ratio, but the supplement of mannanase can significantly improve the situation.

## 2.2 Effect of mannanase on egg quality

See table 3 for the effect of mannanase on laying hen performance. The data showed that, the misshapen eggs rate were decreased 6.78% and 15.25%. The eggshell thickness of group I and IV was significantly higher than group II( $P < 0.05$ ); the eggshell thickness of group III was increased 5.63%; no significant difference between group I, III, IV ( $P > 0.05$ ).

See table 3 for the effect of mannanase on egg quality. The data showed that, in the aspect of the misshapen eggs rate, there's no significant difference ( $P > 0.05$ ) among the groups. Compared with group II, the rate of group III and IV were decreased 6.78% and 15.25%. The eggshell thickness of group I and IV was significantly higher than group II( $P < 0.05$ ); the eggshell thickness of group III was increased 5.63%; no significant difference among group I, III, IV ( $P > 0.05$ ). No significant difference in egg shape index, yolk color and Haugh unit between four groups ( $P > 0.05$ ).

Group	I	II	III	IV
Misshapen eggs rate	1.59±0.36	1.77±0.63	1.65±0.61	1.50±0.99
Egg shape index	1.31±0.02	1.32±0.04	1.32±0.02	1.32±0.04
Yolk color	9.06±1.07	8.79±0.38	8.56±0.72	8.98±0.78
Eggshell thickness	0.409±0.02	0.373±0.02	0.394±0.01	0.411±0.01
Haugh unit	70.14±4.17	68.37±6.25	71.01±4.53	70.65±4.43

Result shows that decreasing metabolic energy (ME) obviously reduces the thickness of eggshell and has negative impact on the incidence of misshapen eggs; but with the supplement of mannanase, these situations can be improved.

## 3. Conclusion and discussion

### 2.1 Effect of mannanase on laying hen performance

As a kind of special functional protein, mannanase supplements the deficiency of endogenous enzyme; effectively destructs the plant cell wall; increases apparent metabolic energy, nutrient availability and amino acid digestibility; decreases chyme viscosity and the

thickness of the intestinal mucosa; reduces the harmful microorganisms in intestine; reduces the incidence of intestinal diseases; enhances the immunity and improve the production capacity. In this experiment, reducing ME significantly reduces laying rate and increases feed-egg ratio, but the supplement of mannanase can significantly improve the situation. Compared with group I, there's no significant difference. It shows that the adding enzyme can supplement the energy shortage in formula.

### 3.2 Effect of mannanase on egg quality

In this experiment, reducing metabolic energy (ME) obviously reduces the thickness of eggshell but with the supplement of mannanase, these situations can be improved. The misshapen egg rate also improved even though the difference is not significant. Other indicators do not show obvious effect after reducing energy or adding mannanase.

### 3.3 Conclusion

This experiment shows that the supplement of Bestzyme mannanase significantly increases the energy utilization, improves laying hen performance and improves eggshell quality. The result shows that the effect of adding 500g/t Bestzyme mannanase (1000U/g) is better than the effect of adding 300g/t. After reducing 0.21MJ/kg energy in laying hen daily diet, feed egg ratio does not change with the supplement of Bestzyme mannanase. The feed cost is decreased and the economic efficiency of laying hen production is improved.