

# Laying Egg Production Supplemented with Antioxidants: An Economical View

Christine Laganá<sup>1\*</sup> , Erika Salgado Politi Braga Saldanha<sup>1</sup>, José Roberto Sartori<sup>2</sup>, Elisabeth Gonzales<sup>2</sup>, Patrícia Helena Nogueira Turco<sup>1</sup>, Renato Luis Luciano<sup>3</sup>, Greice Zanatta<sup>3</sup>, Adelina Azevedo<sup>1</sup>

<sup>1</sup>Agência Paulista de Tecnologia dos Agronegócios, Polo Regional do Leste Paulista and UPD Brotas, Secretariat of Agriculture and Supply to the State of São Paulo (SAA), Monte Alegre do Sul, Brazil

<sup>2</sup>Faculty of Veterinary Medicine and Zootechnics, State University of São Paulo, Botucatu Campus, Botucatu, Brazil

<sup>3</sup>Advanced Center for Poultry Agribusiness Technological Research of the Biological Institute (SAA), Descalvado, Brazil

Email: \*christine@apta.sp.gov.br

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## Abstract

A 112-day experiment was conducted to economically evaluate the production of eggs from commercial layers submitted to diets supplemented with levels of plant extracts (dried turmeric powder) added or not to vitamin E. A total of 432 20-week-old white layers were used, distributed in an entirely randomized design, in a 4 × 3 factor scheme (turmeric extract levels and vitamin E levels), with 6 repetitions of 6 birds per cage. The treatments consisted of four levels of turmeric extract inclusion (0; 0.1%; 0.2% and 0.3%) and three levels of vitamin E inclusion (0; 50 and 100 IU/kg). The results calculated at work were favorable to the activity, and the items that most influenced the expenses in the effective production cost were: poultry, feed and labor, respectively. The best economic response in egg production was obtained by layers that consumed 100 IU/kg vitamin E and 0.2% turmeric; because the leveling point represents that the activity equals the revenues with the costs. The best profitability index was found in treatment that contained 50 IU/kg vitamin E and 0.1% turmeric com (16.78%).

## Keywords

Plant Extracts, Phytogetic Additives, Turmeric, Vitamin E

## 1. Introduction

Data from the latest survey by the Brazilian Institute of Geography and Statistics (IBGE) show that the number of laying hens in Brazil in 2017 had an increase of more than 11% compared to 2016. Per capita consumption of eggs reached 192

units per Brazilian each year, according to the Brazilian Association of Animal Protein (ABPA). The index is the highest ever recorded in the history of the sector, due to the price, nutritional quality and ease and speed in preparation [1] [2].

However, the consumer has changed its profile and the producer tends to meet market needs, since the consumer has become increasingly aware of the importance of the relationship between diet and health, which has encouraged researchers and the food industry to develop products enriched with nutrients capable of producing beneficial effects on health.

The storage, heating and processing of eggs, as well as their exposure to light, can result in oxidative damage. Thus, the use of antioxidants in the diet of layers would have a dual purpose to protect the fatty acids present in the yolk against oxidation and enrich this food with vitamin E.

Curcumin, the main bioactive component of saffron, has anti-inflammatory, antioxidant, hepatoprotective, antiviral, anti-carcinogenic and hypolipidemic effects [3]. Due to its biological properties, saffron is a potential substitute for antibiotics that promote growth.

In view of the above, there is an advance in research aimed at including in the diet of layers, viable alternative products such as vegetable extracts and vitamins that have been shown to present antimicrobial and antioxidant action and that promote improvements in the performance, quality and durability of the egg.

The economic analysis of animal production is extremely important, considering that the producer knows the details and uses the production factors in an intelligent and optimized manner [4].

The present study aims to economically evaluate the production of eggs from commercial layers submitted to diets supplemented with levels of plant extracts (dried turmeric powder) added or not to vitamin E.

## 2. Material and Methods

A total of 432 light layers, Hissex White line 20 weeks old, housed in production cages (100 cm long, 45 cm high and 45 cm deep) with independent front feeders and nipple drinkers were used. The light program adopted was 17 hours daily.

The experimental design was entirely randomized, in a 4 × 3 factorial (turmeric levels x vitamin E levels), totaling twelve combinations with 6 repetitions of 6 birds each. The treatments consisted of four levels of turmeric rhizome powder inclusion (0; 0.1%; 0.2% and 0.3%) and three levels of vitamin E inclusion (0; 50 and 100 IU/kg) mixed with a basal ration. The treatments were: T1, control diet without including turmeric extract and vitamin E; T2, 0 IU/kg vitamin E and 0.1% turmeric extract; T3, 0 IU/kg vitamin E and 0.2% turmeric; T4, 0 IU/kg vitamin E and 0.3% turmeric; T5, 50 IU/kg vitamin E and 0.0% turmeric; T6, 50 IU/kg vitamin E and 0.1% turmeric; T7, 50 IU/kg vitamin E and 0.2% turmeric; T8, 50 IU/kg vitamin E and 0.3% turmeric; T9, 100 IU/kg vitamin E and 0.0% turmeric; T10, 100 IU/kg vitamin E and 0.1% turmeric; T11, 100 IU/kg

vitamin E and 0.2% turmeric; T12, 100 IU/kg vitamin E and 0.3% turmeric. The birds received water and feed at will during the entire experimental period, which was composed of four cycles of 28 days each. All rations used were isoeNERgetic, isoproteic and isoaminoacidic, formulated based on corn, soybean meal and wheat according to the nutritional recommendations proposed by [5] for the laying phase and differed only in relation to the addition of supplementary vitamin E and turmeric extract.

The maximum and minimum temperatures were measured with the help of a mini data logger located in a central point of the aviary and were recorded daily at 8 o'clock. The mean temperatures were  $22.37^{\circ}\text{C} \pm 2.73^{\circ}\text{C}$  and  $15.22^{\circ}\text{C} \pm 4.98^{\circ}\text{C}$  for maximum and minimum, respectively. Daily mortality data and the number of whole and broken eggs collected were recorded in a proper form. The birds were fed twice a day and during the day the feeders were homogenized several times. The eggs were collected and counted daily.

The economic parameters analyzed were:

Effective operational cost (COE): represents the cost effectively disbursed by the producer to generate a certain quantity of a product. This cost includes labor costs, cost of machinery and equipment and expenses with inputs [6].

Gross revenue (GR): represents the monetary value obtained from the sale of production. It was calculated according to the quantity of commercial eggs (Q) and the selling price of the product (PV).

Where: 1)  $\text{RB} = \text{Q} \times \text{PV}$

Gross margin in relation to the effective operating cost (MB): represents the percentage of resources left over after the producer pays the effective operating cost, considering the unit selling price of the product and its production.

Where: 2)  $\text{MB} = (\text{RB} - \text{COE}) / \text{COE} \times 100$

Effective operating profit (LO): represents the profitability of the activity in the short term, showing its economic and operating conditions.

Where: 3)  $\text{LOE} = \text{RB} - \text{COE}$

Profitability index (LI): represents an indicator of the available rate of revenue from the activity, after payment of all operating costs.

Where: 4)  $\text{LI} = (\text{LO} / \text{RB}) \times 100$

Levelling point (BP): represents an indicator of expenditure for a given level of cost of production, which should be the minimum output to cover that expenditure, given the unit selling price of the product.

Where: 5)  $\text{BP} = \text{COE} / \text{PV}$

The prices used were updated for October 2016. The size of the experiment was 36 hens, which makes the activity economically unviable, since it maximizes the effect of diseconomy of scale (high fixed costs), according to [7]. Considering this factor, the results found were extrapolated to 11.000 hens in an area of  $80 \times 10 \text{ m}^2$ . It is worth mentioning that, by increasing the number of hens, there will be a greater dilution of fixed costs, without modifying the trend of the results found in the rearing systems. In calculating the economic indicators, the price of

the dozen eggs sold was R\$ 5.00, thus varying the operational cost of the diets supplemented with turmeric and vitamin E consumed by the layers.

### 3. Results and Discussion

The expenditure in the effective cost of production between the highest and the lowest calculated value varied (2.75%) the results in other treatments, the variations in spending were close, even working with differentiated spending for each treatment (**Table 1**).

While in gross income, it varied (4.67%), between the highest and lowest calculated value, the best economic result was in treatment 6, with a supplementary diet of 50 IU/kg vitamin E and 0.1% turmeric.

To analyze the operating profit, the treatments were observed individually. In the treatments where only turmeric was added, the best operating profit was T3 in the amount of R\$ 7548.58. In the treatments using 50 IU/kg of vitamin E with variations in turmeric percentage, the best treatment was T6; adding 0.1% of turmeric to the feed for layers, obtaining an operating profit of R\$ 7896.32. Finally, in the treatments using 100 IU/kg vitamin E, the T9 treatment obtained the highest operational profit value of R\$7005.97 not using turmeric in the feed composition.

The highest profitability index (16.78%) was found in T6 treatment (50 ppm vitamin E and 0.1% turmeric) and the lowest (14.40%) in T12 treatment (100 ppm vitamin E and 0.3% turmeric), the profitability index expresses the proportion of gross revenue remaining after payment of operating costs. This finding is justified by the fact that the T6 treatment feed had less inclusion of antioxidant

**Table 1.** Estimated production cost, profitability of production of eggs from commercial layers submitted to diets supplemented with turmeric and vitamin E.

Treatments	Cost of Feed (R\$)	Effective operating cost (R\$)	gross revenue (R\$)	gross margin in relation to COE (%)	levelling point (dozen eggs)	effective operating profit (R\$)	profitability index (%)
T01	13,151.16	39,179.63	46,858.33	19.60	7835	7678.70	16.39
T02	12,874.41	38,899.50	46,093.33	18.49	7779	7193.83	15.61
T03	12,903.93	38,930.75	46,478.33	19.39	7786	7547.58	16.24
T04	13,085.97	39,114.59	46,539.00	18.98	7822	7424.41	15.95
T05	12,632.10	38,656.30	45,968.33	18.92	7731	7312.03	15.91
T06	13,121.64	39,152.68	47,049.00	20.17	7830	7896.32	16.78
T07	12,874.41	38,902.05	46,733.33	20.13	7780	7831.28	16.76
T08	13,400.85	39,430.42	46,858.33	18.84	7886	7427.91	15.85
T09	13,448.82	39,472.36	46,478.33	17.75	7894	7005.97	15.07
T10	12,680.07	38,705.31	45,458.33	17.45	7741	6753.02	14.86
T11	12,388.56	38,416.90	45,333.33	18.00	7683	6916.43	15.26
T12	12,446.37	38,474.94	44,948.33	16.82	7694	6473.39	14.40

Source: Research data.

additives, reflecting a lower cost and T12 had more inclusion of additives, therefore, less profit. The inclusion of antioxidant additives in greater quantities did not improve the gross income, since the eggs were sold at the same price. If we consider the cost of feed and egg production, the amount of 50 ppm vitamin E and 0.1% of dry powder of turmeric rhizome included in the layer feed was the one that provided a better profit margin in egg production (T6 treatment).

The leveling point in relation to the effective operational cost revealed the highest value for T9 treatments (7894/dz) during the experimental phase. These results mean that there is a need to produce more to pay the actual operating costs.

#### 4. Conclusions

The results calculated at work were favorable to the activity, and the items that most influenced the expenses in the effective production cost were: poultry, feed and labor, respectively.

The best economic response in egg production was obtained by layers that consumed 100 IU/kg vitamin E and 0.2% turmeric, because the leveling point represents that the activity equals the revenues with the costs.

The best profitability index was found in treatment that contained 50 IU/kg vitamin E and 0.1% turmeric com (16.78%).

#### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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