









# 2nd ICSAE 2015

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## PREFACE

Sustainable agriculture is "a way of practicing agriculture which seeks to optimize skills and technology to achieve long-term stability of the agricultural enterprise, environmental protection, and consumer safety. It is achieved through management strategies which help the producer select hybrids and varieties, soil conserving cultural practices, soil fertility programs, crop rotations, weed, pest and disease biological management programs, and strategic use of animal and green manures and use of natural or synthetic inputs in a way that poses no significant hazard to man, animals, or the environment. The system is envisioned in its broadest sense, from the individual farm, to the local ecosystem, and to communities affected by this farming system both locally and globally. The goal of sustainable agriculture is to minimize adverse impacts to the immediate and off-farm environments while providing a sustained level of production and profit. Sound resource conservation is an integral part of the means to achieve sustainable agriculture.

Sustainable agriculture integrates three main goals--environmental health, economic profitability, and social and economic equity. A variety of philosophies, policies and practices have contributed to these goals. People in many different capacities, from farmers to consumers, have shared this vision and contributed to it. Despite the diversity of people and perspectives, the following themes commonly weave through definitions of sustainable agriculture.

Sustainable agriculture presents an opportunity to rethink the importance of family farms and rural communities. Economic development policies are needed that encourage more diversified agricultural production on family farms as a foundation for healthy economies in rural communities. In combination with other strategies, sustainable agriculture practices and policies can help foster community institutions that meet employment, educational, health, cultural and spiritual needs. By helping farmers to adopt practices that reduce chemical use and conserve scarce resources, sustainable agriculture research and education can play a key role in building public support for agricultural land preservation. Educating land use planners and decision-makers about sustainable agriculture is an important priority.

Consumers can play a critical role in creating a sustainable food system. Through their purchases, they send strong messages to producers, retailers and others in the system about what they think is important. Food cost and nutritional quality have always influenced consumer choices. The challenge now is to find strategies that broaden consumer perspectives, so that environmental quality, resource use, and social equity issues are also considered in shopping decisions. At the same time, new policies and institution must be created to enable producers using sustainable practices to market their goods to a wider public.

We are yet a long way from knowing just what methods and systems in diverse locations will really lead to sustainability. In many regions of the country, however, and for many crops, the particular mix of methods that will allow curtailing use of harmful farm chemicals or building crop diversity, while also providing economic success, are not yet clear. The stage is set for challenging not only farm practitioners, but also researchers, educators, and farm industry.

New policies are needed to simultaneously promote environmental health, economic profitability, and social and economic equity. For example, commodity and price support programs could be restructured to allow farmers to realize the full benefits of the productivity gains made possible through alternative practices. Government and land grant university research policies could be modified to emphasize the development of sustainable alternatives. Marketing orders and cosmetic standards could be amended to encourage reduced pesticide use. Coalitions must be created to address these policy concerns at the local, regional, and national level. In addition to strategies for preserving natural resources and changing production practices, sustainable agriculture requires a commitment to changing public policies, economic institutions, and social values. Strategies for change must take into account the complex, reciprocal and ever-changing relationship between agricultural production and the broader society.

Critical discussion of the sustainable agriculture concept will and should continue. Understanding will deepen; answers will continue to come. On-going dialog is important for another reason: with more parties, each with its own agenda, jumping into the sustainable agriculture "tent," only a continued focus on the real issues and goals will keep sustainable agriculture from becoming so all-encompassing as to become meaningless.

Finally, it is important to point out that reaching toward the goal of sustainable agriculture is the responsibility of all participants in the system, including farmers, laborers, policymakers, researchers, retailers, and consumers. Each group has its own part to play, its own unique contribution to make to strengthen the sustainable agriculture community.

**Dr. Mithat DIREK**

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# EFFECT OF SUBSTITUTION NONI LEAF MEAL (MORINDA CITRIFOLIA) IN THE RATION ON PRODUCTIVITY AND QUALITY QUAIL EGGS

**Tuty Maria Wardiny** and **Tengku Eduard Azwar Sinar**[22]

## ABSTRACT

Quail egg is one source of animal protein in Indonesia that is cheap and easily obtained by the public, but it has a complete nutritional contents. Therefore, farmers need to improve the productivity and quality of quail eggs by utilizing an alternative feed source. One of the alternatives is noni leaf, which has advantages in nutrient content and active substances. This study aimed to evaluate the level of noni leaf meal (NLM) in the ration that can impact on productivity and quality of quail eggs. Completely Randomized Design (CRD) is used to analyze the data obtained from this study. Seventy-two female quails aged four weeks were divided into four treatments and three replications. Each replication was consisted of six quails. Four treatments applied were: control without any NLM in the ration (R0), 9% of NLM in the ration (R1), 10% of NLM in the ration (R2), and 11% of NLM in the ration (R3). Parameters measured were feed consumption, egg production, feed conversion, egg weight, yolk weight, the weight of the egg white, eggshell weight, eggshell thickness, egg yolk scores and Haugh unit. The results showed that the feed consumption, scores yolk and Haugh Unit ($P < 0.05$) affected by the treatment. However treatments did not significantly have effects on feed conversion, egg weight, yolk weight, the weight of the egg white, eggshell weight and eggshell thickness. The level of 11% noni leaf meal in the ration can improve the quality of quail eggs.

**Keywords :** egg quality, noni leaf meal, quail eggs

## INTRODUCTION

Coturnix coturnix japonica or quail is already known as a producer of eggs in Indonesia. Quail eggs are one of source of animal protein to meet the nutritional demands of society, especially for the middle to lower income families. The nutritional value of quail eggs is not inferior compared with other poultry, so it can be used as a source of animal protein provider. Quail eggs are the best sources of protein, one hundred grams of quail egg contains 13.05 grams of protein, slightly higher than chicken eggs or duck eggs (USDA, 2007).

Enormous demand on quail eggs are causing farmers must keep their quails intensively with high feed costs to get an optimal production. So, it is necessary to find an alternative feed ingredient that are easy to find, inexpensive, not compete with human needs and the availability can be assured continuously. Noni is one of the medicinal plants a lot of interest both from the agribusiness entrepreneurs, businessmen traditional medicine industry and among scientists. This is due to that in all parts of the noni plant contained a variety of chemical compounds that can be utilized. According Wardiny, T.M. (2006), noni leaf meal contains 161 mg of beta carotene and crude protein, calcium, Fe and Zn that was better than its fruit. In addition, noni leaf has a high active substance in the form of steroids. The beta carotene form noni leaf is expected to make noni leaf meal as a source of carotene to increase egg yolk color score.

From previous research, Wardiny, T.M. (2006) proved that noni leaf meal can improve chicken egg productivity, yolk color score, vitamin A and lower egg yolk cholesterol. Therefore, this research needs to be done to evaluate the level of use noni leaf meal (NLM) in the ration of the quality of quail eggs. Noni leaf meal is expected to improve the quality of quail eggs. Besides quality of eggs, NLM can be a source of antibiotics so it does not need to use chemical antibiotics, so quail eggs consumer do not need to worry carcinogenic effect of antibiotics.

## MATERIALS AND METHODS

Location and Time

The study was conducted in the village of Jabon Mekar, Parung, Bogor and Faculty of Animal Husbandry, Bogor Agricultural University.

Noni Leaf Meal Making

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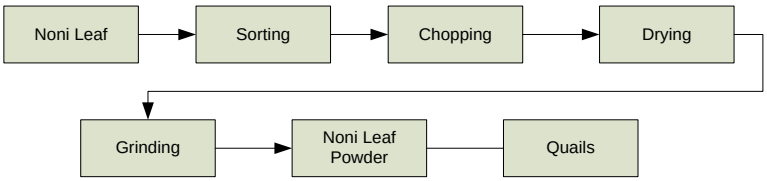


Figure 1. Process Noni Leaf Meal

Birds, diets and management

This study used 72 quails aged 6 weeks that divided into 4 treatments and 3 replications. Each replication was consisted of six quails. 12 colony cages were used, with dimensions of 182 cm x 100 cm x 60 cm. Each cage was filled with 6 quails. In each cage was equipped with a feed and drinking water.

Feed research used in this study is a commercial feed from Sinta Prima Feedmill. The nutrient content contained in Table 1.

**Table 1. Nutrient Feed Quail Layer**

| **Type** | **Feed Code** | **Nutrient (%)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Protein | Fat | Crude Fiber | Ash | Water | Ca | P |
| **Meal** | SP -2 | 20 - 22 | 4 - 7 | Max 6 | Max 14 | Max 12 | 3.5 - 4.0 | 0.6 - 0.8 |

The research feed content has met Indonesian National Standard (2006) on laying quail feed.

Experimental design

The experimental design used in this research was completely randomized design (CRD) with four treatments and three replications. There was 6 (six) quails for each repetition. The treatment in this study were four types of rations. Four types of treatments were : R0 (control diet, without addition noni leaf meal), R1 (9% of noni leaf meal), R2 (10% of noni leaf meal) and R3 (11% of noni leaf meal).

Data were analyzed statistically using analysis of variance (ANOVA) and if it shows a marked influence continued with Duncan test (Steel and Torrie, 1993).

Observed Variables

The parameters in this study is productivity and quality of eggs which includes hen day (%), feed consumption, feed conversion, egg weight, the weight of the egg white, egg yolk weight, egg shell weight, shell thickness, yolk color and Haugh Unit.

Hen day (%) was number of egg produced during research divided by number of quails during the research and multiply by 100%.

$$Hen\,day\,(\%) = \frac{No.of\ egg\,s\ during\ research}{No.of\ quail\,x\,No.of\ days\,during\ research}\ x100\%$$

Feed consumption (g) was obtained from the amount of rations given during a week minus the ration were not eaten at the end of the week.

Feed conversion is obtained by dividing the amount of feed consumed by the production of eggs (total weight of eggs) during the study. Egg weight (g) was obtained by weighing each egg that was grouped by each treatment of each replicate.

Yolk weights (g) was obtained by weighing the egg yolk separated from egg white. The percentage of egg yolk weight was calculated using the formula weight divided by the weight of the egg yolk multiplied by 100%.

The weight of egg white (g) was obtained from the difference between the sum of the weights of eggs with yolk weight (g) and shell weight (g). The percentage weight of the egg white was calculated by using the formula weight divided by the weight of the egg white egg multiplied by 100%.

Eggshell weights (g) was obtained by weighing the eggshell after being separated from the egg contents. Percentage weight of egg shell was calculated using the formula weight divided by the weight of egg shell eggs

multiplied by 100%.

Eggshell thickness (mm) was obtained by measuring the shell thickness was measured using a micrometer and at the blunt end, middle, and end of the taper eggs then averaged.

Score yolk color was observed by comparing the color of egg yolks with the Roche Yolk Color Fan on a scale of 1-15.

Haugh Unit (HU) was used to determine the freshness of white eggs on the relationship high logarithm egg whites (mm) with egg weight (g). High egg whites were measured using a micrometer tripoid then use the formula:

$$HU = 100 \log (H + 7.57 - 1.7 W^{0.37})$$

Where: W = weight of eggs (g) and H = height egg whites (mm)

## RESULTS AND DISCUSSION

Productivity of quails

Effect of Noni Leaf Meal on productivity of quails can be seen in Table 2.

**Table 2 Productivity of quails during the research**

| Treatments | Feed Consumption (g/quail) | Hen Day (%) | Feed Conversion (%) |
|---|---|---|---|
| R0 | 142,69 ± 7,04 [b] | 78,45 ± 15,65[b] | 2,33 ± 0,07 |
| R1 | 146,90 ± 7,30 [b] | 75,61 ± 5,05 [b] | 2,29 ± 0,14 |
| R2 | 123,34 ± 11,36 [a] | 47,62 ± 10,76[a] | 1,98 ± 0,23 |
| R3 | 141,36 ± 7,60 [b] | 76,27 ± 9,49 [b] | 2,27 ± 0,27 |

Note:

- Superscripts within a column indicate significant differences (P <0.05)
- Description: R0 = control diet; R1 = 9% of NLM; R2 = 10% of NLM; R3 = 11% of NLM

The average feed consumption on this research for all treatments were ranged from 123.34 to 146.90 g/quail/week. Results of analysis of variance showed that the level of NLM in ration had significantly effect on feed consumption. From Table 2, it showed that the smallest average of feed consumption was at of 10% NLM in ration. This was not in line with previous research by Wardiny, T.M. (2006) in which layer feed intake was decreased along with the increasing level NLM in the ration. According Wardiny, T.M. (2006), this was due to NLM contained coarse fibers in high level around 11.75% (Wardiny, T.M., 2006) so that the layer felt full faster. With the increasing level of NLM, the color of rations were greener and this color was less favored by quail that prefer yellow and red ration.

Feed consumption on 10% of NLM (R2) ration was decreased. This was due to Infection Coryza disease, which caused decreased appetite and drink and have swollen quail eyes.

Based on phytochemical analysis, noni leaf meal contains saponins, which is at a certain dose saponins can cause a bitter taste in the ration so that less favored by quail. High tannin content can interfere with the digestive process so that the protein cannot be digested feed perfectly. This is in accordance with the opinion of Butler and Rogler, 1992 which stated that the consumption of feed containing a high tannin can reduce body weight, and looks very apparent digestibility and feed efficiency.

Egg production was ranged from 47.62 to 78.45%. Based on analysis of variance, it showed that the treatments in ration had significantly effect on quail egg production. Quail egg production with 10% of NLM (R2) was lower compared to control (R0) and other treatments (R1 and R3). This was along with feed consumption. Lower egg production in R2 was due to lower consumption of protein. For details can be seen in Table 2. However, quail with R1 and R3 had same feed consumption with control diet (R0) and higher than R2. The same patterns happened in egg production as well. This was due to a complete and healthy diet will force quail to produce a high egg production.

The average feed conversion in all treatments during the study ranged from 1.98 to 2.33. Results of analysis of variance showed that there were no differences between treatments. Quails treated noni leaf meal had better feed conversion than control. The best feed conversion of 2.27 produced by R3 where feed intake is consumed to produce higher egg production when compared to R2 which had the smallest the conversion. Smallest feed conversion of R2 was not followed by a high egg production but the lowest egg production. So the quail with R2 was not the best productivity.

Quail Egg Quality

The quality of ration can be judged from the quality of eggs produced. This analysis needs to be done to evaluate how far the level of provision of noni leaf meal gives the best results on the quality of the eggs. Results of analysis of the quality of the eggs in this study can be seen in Table 3.

Stadelman and Cotteril (1995) stated that classification and measurement of egg quality is divided into two parts, namely exterior and interior quality. Exterior quality can be seen physically with direct eye such as cleanliness eggshell, eggshell color, thick eggshell and egg weight. While interior quality can be measured after the egg is cracked, such as egg white index, egg yolk index, Haugh Unit and yolk color. Statistical analysis showed that the use of noni leaf meal had significant effect ($P < 0.05$) on egg yolk color and Haugh Units, but not had significant ($P > 0.05$) on egg weight, yolk weight, egg white weight, egg shell weight and thick eggshell.

**Table 3. Quail Eggs Quality**

| Parameter | Treatment | | | |
|---|---|---|---|---|
| | R0 | R1 | R2 | R3 |
| Egg Weight (g) | 9.74 ± 0.18 | 10.44 ± 0.26 | 9.64 ± 1.10 | 10.19 ± 0.47 |
| Yolk weights | | | | |
| (g) | 3.51 ± 0.16 | 3.78 ± 0.15 | 3.69 ± 0.45 | 3.65 ± 0.22 |
| (%) | 36.04 ± 0.98 | 36.28 ± 2.17 | 38.91 ± 9.38 | 36.77 ± 4.35 |
| Egg White Weights | | | | |
| (g) | 5.08 ± 0.55 | 5.40 ± 0.30 | 5.08 ± 0.74 | 5.39 ± 0.31 |
| (%) | 52.15 ± 0.87 | 51.68 ± 1.55 | 52.63 ± 2.39 | 52.83 ± 1.21 |
| Eggshell weights | | | | |
| (g) | 1.15 ± 0.08 | 1.26 ± 0.12 | 1.19 ± 0.21 | 1.15 ± 0.12 |
| (%) | 11.81 ± 0.83 | 12.03 ± 1.01 | 12.34 ± 0.81 | 11.33 ± 0.43 |
| Eggshell thickness (mm) | 0.18 ± 0.01 | 0.18 ± 0.01 | 0.19 ± 0.02 | 0.20 ± 0.02 |
| Score yolk color | 5.77 ± 0.50[a] | 6.87 ± 0.67[b] | 7.13 ± 0.67[b] | 6.73 ± 0.25[ab] |
| Haugh Unit | 90.89 ± 0.23[b] | 88.23 ± 0.34[a] | 88.83 ± 0.76[a] | 90.37 ± 1.23[b] |

Note:

- Superscripts within a column indicate significant differences ($P < 0.05$)
- Description: R0 = control diet; R1 = 9% of NLM; R2 = 10% of NLM; R3 = 11% of NLP

Egg weights

The average weight of eggs during this study was 9.64 to 10.44 g of egg-1. This value was consistent with the results of research Song et al. (2000), who reported that the normal weight of quail eggs was ranged from 9.41 to 11.27 g of egg-1. However, it was slightly lower than the results Nastiti (2013) weighing 10.49 to 10.95 g of egg-1, which uses a combination of coarse wheat bran and noni leaf meal as a substitute for corn. This may be due to quails used were young quail as young as 42 days, so just entering the early period of egg production. Rasyaf (2002) states that the quail is ready to spawn when entering the age of 6 weeks. Quails in this study were still adapted to produce eggs so eggs produced still had low in weight. In line with increasing time the eggs produced weight will increase.

So substitution noni leaf meal in the ration provides quality protein and amino acids that are sufficient for quail to produce eggs with normal weight. This is in line with Kul and Seker (2004) that eggs weight was influenced by genetic structure, health condition, age of animal, feed components, differences in maintenance and livestock management.

Egg Yolk Weight

The average weight egg yolk in this study was 3.51 to 3.78 g egg yolk of egg-1. These results were higher than the results Song et al. (2000) of 2.85 to 3.25 g of egg-1, Nastiti (2013) of 3.21 to 3.36 g of egg-1 and were not different from the results of Kul and Seker (2004) of 2.75 - 4.40 g of egg-1. From the results it can be concluded that the increasing level of noni leaf meal in the ration will increase egg yolk weight. Egg yolk is a source of fat so that egg yolk weight is influenced in part by the fat content in the ration.

Percentage of yolk weight in this study was 36.04% - 38.91%, this result was above results by Kul and Seker (2004) amounted to 25.98% - 36.27% and Nastiti (2013) amounted to 29.99% - 30.89%. This suggests that the treatments in rations had a positive effect to egg yolk weight because noni leaf meal was not disturbing the absorption of nutrients by quails.

Weights White Eggs

The average egg white weight of this study was 5.08 to 5.40 g of egg-1. This was lower than the results Song et al. (2000) from 5.74 to 6.33 g of egg-1, Kul and Seker (2004) from 5.43 to 8.18 g of egg-1 and Nastiti (2013) from 5.82 to 6.13 g of egg-1. This might be caused by the egg yolk weight in this study was greater than their research.

Similarly, the percentage of egg white weight in this study was ranged from 51.68% - 52, 83%. This was lower than research by Song et al. (2000), Kul and Seker (2004) and Nastiti (2013).

Egg Shell

The mean of shell egg weight in this study was ranged from 1.15 to 1.26 g. This value was above the results of Song et al. (2000) ranged 0.75 to 0.76 g of egg-1 and Kul and Seker (2004) ranged 0.61 to 1.06 g of egg-1 and was not far from result by Nastiti (2013) from 1.27 to 1.33 g of egg-1. While the average percentage of quail egg shell weight is 11.33% - 12.34%. Stadellman and Cotteril (1995) stated that the basic components of the eggshell is 98.2% calcium, magnesium 0.9%, and 0.9% phosphorus.

Consumers want eggs with strong eggshell thickness so that the egg is not easily broken. Eggshell thickness averaging the results was 0.18 to 0.20 mm, not far from the results of Song et al. (2000) was 0.174 mm and Nastiti (2013) ranged 0.165 to 0.171 mm. This result showed that even noni leaf meal contains tannins but did not disturb the absorption of the minerals calcium and phosphorus. So the quail egg shell thickness increased with the increasing of level of noni leaf meal in the ration.

So the use of noni leaf meal in the ration showed a positive effect on quail egg shell thickness. One determinant of factor of egg quality is the thickness of the shell as it protects the quality of the inside of the egg.

Yolk Color

Esfahani et al. (2009) stated that the color of yolk was the main characteristic of egg quality because it affected the taste of eggs. Quail egg yolk color score was significantly ($P < 0.05$) influenced by the treatments in ration. The higher level of noni meal in the ration resulted in increasing yolk color score. Mean scores quail egg yolk color in this study was 5.77 to 7.13. More detail can be seen in Figure 2 below.

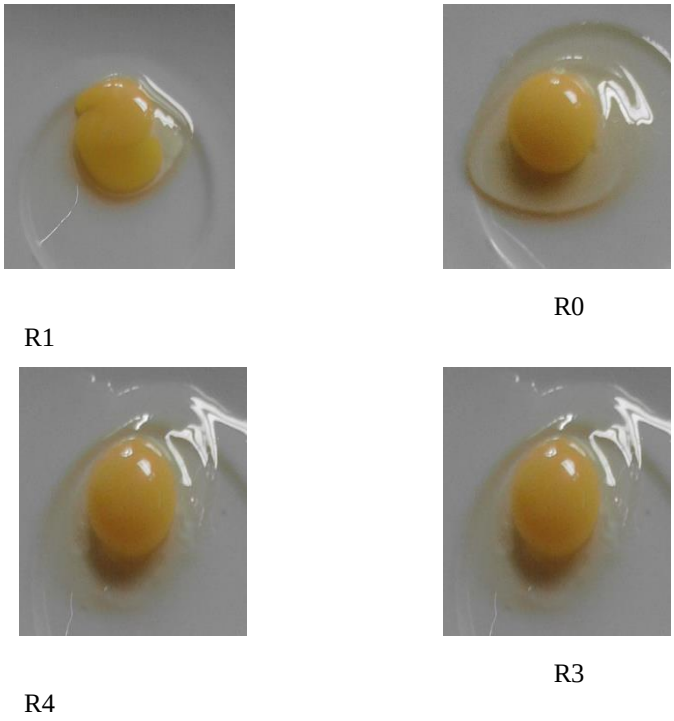


Figure 2. Yolk Color

Increased quail egg yolk color score occurred as a resulting from the use of noni leaf meal that had beta-carotene as much as 161 ppm. Carotene pigment deposition was suspected that influenced by noni leaf meal into the ration. According Wiradimadja (2007), the type and amount carotenoid consumed by laying birds is a major factor in egg yolk pigmentation. The type of carotenoid that plays an important role in coloring yolk is xanthofil, while the type of noni leaf carotenoid is beta-carotene. This carotene has the greatest provitamin A activity.

Haugh Unit (HU)

Haugh Unit is one of the parameters that can be usedto etermine the quality of the eggwhie. Haugh Unit is a ratio between the egg white height and egg weight that is affected by storage time and temperature. The mean of Haugh Unit in this study was ranged 88.23 to 90.89 and this was significantly effect ($P < 0.05$) by ration treatments. According to the USDA standard (2008), the quality of eggs of this research was in AA class, where the egg that has a value of more than 72 HU with characteristic skin clean, intact, and normal. The egg yolk was in the center and free patches, and the egg white was clear and thick. There was a decrease in value HU, since the measurement took place more than one day, so there was a dilution process of egg white and a high reduction of egg white height.

## CONCLUSION

The use of noni leaf meal in ration gives good results on the quality of quail eggs. 11% of noni leaf meal in ration has a good result in productivity and quality of eggs and can increase egg yolk score.

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