PROCEEDING

4th INTERNATIONAL SEMINAR OF ANIMAL NUTRITION & FEED SCIENCE (ISAINI 2015)

Theme:
Recent Advance in Animal Nutrition and Feed Technology of Support Sustainable Livestock Production System

SEPTEMBER 8TH-9TH, 2015 - SINTESA PENINSULA HOTEL MANADO, NORTH SULAWESI - INDONESIA
Editors:

Dr. Ir. Osfar Sjofjan, MSc
Dr. Anuraga Djayanegara, SPt., MSc
Wahyu Darsono, SPt., MSi
Ir. Jola JMR Londok, MSi
Ir. Youdhie HS Kowel, MSi
Mursye N Regar, SPt., MSi

Faculty of Animal Husbandry Sam Ratulangi University
Manado, Sulawesi Utara, Indonesia
PROCEEDING

4th International Seminar of AINI (ISAINI) 2015
“Recent Advance in Animal Nutrition and Feed Technology to Support Sustainable Livestock Production System”.

ISBN: 978-602-17454-5-8

@2015 Faculty of Animal Husbandry Sam Ratulangi University
This work is copyright, no part may be reproduced by any process without prior written permission from the editors. Requests and inquiries concerning reproduction and rights should be addresses to Wahyu Darsono (executive secretary of AINI) and Jola Londok (Faculty of Animal Husbandry Sam Ratulangi University) or email to ainiunsrat1415@yahoo.co.id

The intellectual property of each paper included in these proceedings remains vested in the Authors as listed on the papers.

Published by:

Faculty of Animal Husbandry, Sam Ratulangi University
Jl. Kampus Unsrat Baha Manado, Sulawesi Utara
INDONESIA 95115
Telp: (0431)863186
Fax : (0431)863186
Website: www.unsrat.ac.id

In Collaboration with:
Indonesian Association of Nutritionist & Feed Scientist (AINI)
THE COMMITTEE

PATRON

: Prof. Dr. Ir. Charles L. Kaunang, MS

STEERING COMMITTEE

: Prof. Dr. Ir. Ellen Joan Kumaat, MSc, DEA
    Prof. Dr. Ir. David A. Kaligis, DEA
    Dr. Ir. Jet S. Mandey, MS
    Prof. dr. Jimmy Posangi, MSc, SPFK, PhD
    Dr. Flora P. Kalalo, SH, MH
    Prof. Dr. Ir. H. Kiroh, MSi
    Prof. Dr. Ir. Sangkertadi, DEA
    Prof. Dr. Ir. Marie Najoan, MS
    Prof. Dr. Ali Agus, DAA, DEA
    Prof. Dr. Ir. NahrowiRamli, MSc
    Prof. Dr. Ir. Toto Toharmat, MSc
    Prof. Dr. Ir. Lies Mira Yusiat, MSc
    Prof. Dr. Ir. Erica B. Lanconi, MS
    Prof. Dr. Ir. Budi Tangendjaja
    Dr. Ir. Iman Hernawan, MSi

ORGANIZING COMMITTEE

CHAIRMAN

: Prof. Dr. Ir. Bernat Tulung, DEA

VICE CHAIRMAN

: Ir. Jola J. M. R. Londok, MSi

SECRETARY

: Ir. Kartini Maaruf, SU, MSc

VICE SECRETARY

: Dr. Ir. Umar Paputungan, MSc

TREASURER

: Dr. Ir. Florencia N. Sompie, MP

VICE TREASURER

: Dr. Ir. Jolanda K. J. Kalangi, MSi

SECRETARIAT OFFICERS

: Dr. Ir. Yohanis L. R. Tulung, MSi
    Mursye N. Regar, SPt, MSi
    Ir. Youdhie H. S. Kowel, MSi
    Ir. Evacure S. Tangkere,PgDip
    Wahyu Darsono, SPt
# CONTENTS

<table>
<thead>
<tr>
<th>The Committee</th>
<th>i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcoming Speech President of AINI</td>
<td>iii</td>
</tr>
<tr>
<td>Welcoming Speech Organizing Committee</td>
<td>v</td>
</tr>
<tr>
<td>KEYNOTE SPEAKERS</td>
<td>vi</td>
</tr>
</tbody>
</table>

## CONTENTS

| 01. | Global Climate Change: Nutritional Strategies for Sustainable Livestock Production (Prof. Alimon) | 1 |
| 02. | Stress, Nutrition and Immune Regulation in Pigs (Cheol-Heui YUN) | 3 |
| 03. | The Use of Feed Biotech Products as an Alternative to Support Improvement of Poultry Production (Osfar Sofian) | 4 |
| 05. | NutriOpt Split-feeding, Optimal Supply of Nutrients to Enhance the Persistency (J. de los Mozos, F. Sánchez Fernández, W. W. Wardani) | 6 |
| 06. | Influence of Shrimp Waste, Katuk Leaf (*Sauropus androgynus L.Merr.*), Bromelain and Garlic Powder addition on Performance and Egg Quality of Quail (A. Sudarma, N. M. Filina, Sumiati) | 8 |
| 07. | The Effect of Herb Medicine Supplementation on Blood Profiles of Laying Quail (Dwi Margi Suci, I.Purwanto, and Widya Hermana) | 15 |
| 08. | Supplementation of *Azolla Pinnata* To Sorghum Base Diet on Egg Quality of Japanese Quails (R. Mutia, Widya Hermana, and Febriinita Ulfah) | 21 |
| 09. | Performance and Selenium (Se) Content of Meat of Kampong Chicken Fed Se and Vitamin E Fortified Diet (Widya Hermana, Ali Nurhadi, and Sumiati) | 26 |
| 10. | The Effect of Feeding Zinc (Zn) and Vitamin E Fortified Diets on Duck Egg Quality Stored at Different Temperature During 21 Days (Sumiati, Widya Hermana, Arif Darmawan, and Neni Nurainen) | 30 |
| 11. | Carcass Characteristics and Intestinal Morphology of Male Laying Quails Affected by Administered Indigenous Probiotics Lactic Acid Bacteria (Sri Harimurti and Sapta Chandra Marmadi Hidayat) | 40 |
| 12. | Cholesterol, Glucose and Uric Acid In Broiler Chicken with Dietary Herbs As Feed Additive (Sri Suhermiyati dan Ning Iriyanti) | 44 |
| 13. | Optimization of Organic Herbs in Feed as an Effort to Increase Broiler Chickens Performance (Wahyu Widodo) | 50 |
| 14. | An Examination on Pesticide Residue in Rice Bran and Corn From Several Regions in East Java (Imbang Dwi Rahayu) | 55 |
| 15. | The Trend of Corn Availability as Poultry Feed in East Java (Adi Sutanto) | 61 |
| 16. | The Effect of Dietary Vitamin E And Zinc (Zn) Levels on Performance of Laying Ducks (Darmawan, A, Sumiati, Widya Hermana) | 67 |
| 17. | The Effects of Length of Feeding and Level of Crude Fiber on Carcass Quality and Serum Cholesterol of Broiler Chicken (Bernat Tulung, Jola J.M.R. Lombok, and Mursy N. Regar) | 72 |
| 18. | Cricket and Pupa Meal as Source of Protein in Pre and Post Weaning Lamb Diet to Evaluate Hematology and Blood Metabolic Profiles (Astuti DA, L. Khotidjah, lip Sukrillah, Aditya OR and JP Ardi) | 78 |
INFLUENCE OF SHRIMP WASTE, KATUK LEAF
(Sauropus androgynus L. Merr.), BROMELAIN AND GARLIC POWDER
ADDITION ON PERFORMANCE AND EGG QUALITY OF QUAIL

A. Sudarman*, N. M. Filina, Sumiati
Department of Animal Nutrition and Feed Technology of
Bogor Agricultural University
*Corresponding author: a_sudarman@yahoo.com

ABSTRACT

This experiment aimed to study effect of addition of shrimp waste, katuk leaf, garlic powder, and bromelain on performance, egg weight quality, and physical composition of the egg. This experiment used 160 quail pullet reared 10 weeks and divided into five treatments and four replicates. The experimental diets were P0 (control), P1 = P0 + 31.1 ppm bromelain, P2 = P0 + 0.43% waste shrimp powder, P3 = P0 + 10% katuk leaf powder, and P4 = P0 + 1% garlic powder. This study used a completely randomized design. The results showed that egg weight and yolk color score were significantly different (P<0.05) among the treatments. Egg production, feed consumption, feed conversion, egg white percentage, egg yolk percentage, egg shell percentage, index of eggs and Haugh Unit were not significantly different. All eggs were classified into AA quality. All treatments produced higher (P<0.05) egg weight compared to control. Egg yolk color score of katuk leaf powder group was significantly higher (P<0.05) than other groups. It is concluded that the addition of bromelain, shrimp waste powder, katuk leaf powder, and garlic powder did not affect performance. But those had significant different effect on egg quality.

Keywords: Quail egg, Egg quality, Shrimp waste, Katuk leaf, Garlic, Bromelain

INTRODUCTION

Quail have a high potential to produce eggs. Quail egg farms are able to produce proteins that help meet the needs of the people of Indonesia. Quail small body size gives the advantage because the land requirement is not too wide for maintaining them in large numbers. Another advantage is their very fast grow and mature, ie at the age of 35-42 days have started laying eggs. Their eggs production capable of reaching 200-300 eggs/year with a weight of 10 grams/egg. Based on data from the Directorate General of Livestock (2012) quail egg production in Indonesia in 2011 reached 16.926 million tons.

The most important factor in the maintenance of quail is feed. Quail nutritional needs should be met within the feed. Needs amount of feed for quail is usually more than 10% of their body weight. Shrimp waste is a waste of frozen shrimp processing industry that have potential and relatively high nutritional value. Garlic has a wide range of active substances in it. Katuk leaves contain high nutrients and bromelain is one of the sulphydryl protease enzyme capable of hydrolyzing the bond polypeptides into amino acids.

Enzyme bromelain is a proteolytic enzyme such as renin (rennet), papain and fisin which has the properties of protein hydrolysis. Enzyme bromelain from pineapple weevil is one of the alternatives in order to utilize waste sehingga pineaple can provide added value for pineapple in addition to reducing the pollution problems of waste on the environment (Sebayang, 2006).
Shrimp heads flour can be used as animal feed ingredients. Advantage of shrimp heads flour is a waste product of fisheries that have a fairly continuous availability, the price is quite stable and nutritional able to compete with conventional feed ingredients (Wanasuria, 1990). Berda- sarkan Syukron research (2006) the best Taraf administration shrimp heads in the ration of broiler chickens is as much as 6%. According Mawaddah study (2011), granting 10% katuk leaf meal in the diet of quail produce quality meat and eggs are better than the product quail. The treated extract katuk leaf meal at the same level. Garlic is thought to be able to optimize the metabolic functions of food ingredients so as to improve the efficiency of feed utilization. Each 2 kg of fresh ingredients, garlic produces 600 g of dry matter (Wiryawan et al., 2005).

Katuk leaves, waste shrimp, garlic, and bromelain contains good nutrition and still rarely used as animal feed. In addition, the availability can be obtained throughout the year. Some feed materials can be added to the feed of quail to supplement the nutritional needs of quail. The content of nutrients in each feedstuff is expected to give a good effect on the performance and quality of quail eggs. Therefore, it is necessary to study the effect of addition, bromelain, flour shrimp waste, katuk leaf flour and garlic powder to the quality of quail eggs. This study aimed to evaluate the effect of adding shrimp waste flour, flour leaves katuk (Sauropus androgynus L. Merr.), Garlic powder, and bromelain on the performance and quality of eggs (egg shell weight percentage, the percentage weight of egg yolk, egg white weight percentage, thick egg shell and yolk color) quail.

**MATERIALS AND METHOD**

This study used 160 quails grower phase that are ready for production and placed in 20 pieces of battery cages. Each cage contains eight quails. Each cage is equipped with a place to eat and drink. Each plot enclosure is equipped with double rations and the drinking water. The quail is divided into five treatments and four replications and maintained for 10 weeks.

Experimental diets consisted of basal ration supplemented with bromelain, shrimp waste meal, katuk leaf meal, and garlic powder in accordance with treatment. Drinking water was given every day during the study. Experimental diets were given after 2 weeks of maintenance. The composition of experimental diets is shown in Table 1. The nutrient content of the ration experiments are presented in Table 2.

The experimental design used in this research is completely randomized design (CRD) with 5 treatments and 4 replicates. The treatments provided are: P0: Rations control, P1: P0 + bromelain 0.625 mg/head /day, P2: P0 + 0.45% shrimp waste powder, P3: P0 + 10% katuk leaf meal, P4: P0 + garlic powder 1%.

Data were analyzed by analysis of variance (ANOVA). If significantly different between treatments was tested further by Duncan's multiple range test (Mettijk and Sumerjatajaya, 2006).

Parameters measured were as followed: production of eggs (%), feed conversion, feed intake, consumption of metabolizable energy (kcal/head/day), consumption of protein (g/head/day), egg weight (g/egg), proportion of yolk (%), egg white proportion (%) proportion eggshell (%), egg yolk color and Haugh Units (HU).
Table 1. Composition of experimental diets

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>P0</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Rice bran</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Fish meal</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>CPO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>DCP</td>
<td>0,8</td>
<td>0,8</td>
<td>0,8</td>
<td>0,8</td>
<td>0,8</td>
</tr>
<tr>
<td>NaCl</td>
<td>0,2</td>
<td>0,2</td>
<td>0,2</td>
<td>0,2</td>
<td>0,2</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Premix</td>
<td>0,4</td>
<td>0,4</td>
<td>0,4</td>
<td>0,4</td>
<td>0,4</td>
</tr>
<tr>
<td>DL-Methionine</td>
<td>0,6</td>
<td>0,6</td>
<td>0,6</td>
<td>0,6</td>
<td>0,6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Broermalin (mg/head/day)*
- P0: 0,625
- P1: -
- P2: -
- P3: -
- P4: -

*Waste shrimp meal (%)*
- P0: -
- P1: -
- P2: 0,45
- P3: -
- P4: -

*Katuk leaf meal (%)*
- P0: -
- P1: -
- P2: 10
- P3: -
- P4: -

*Garlic powder (%)*
- P0: -
- P1: -
- P2: -
- P3: 1
- P4: -

Table 2. Nutrients content of experimental diets based on calculation

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>P0</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME (kcal/kg)</td>
<td>2837,50</td>
<td>2825</td>
<td>2855,34</td>
<td>3017,5</td>
<td>2878,46</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>22,44</td>
<td>22,60</td>
<td>22,58</td>
<td>25,74</td>
<td>22,61</td>
</tr>
<tr>
<td>Ether extract (%)</td>
<td>5,49</td>
<td>5,01</td>
<td>5,53</td>
<td>6,49</td>
<td>5,50</td>
</tr>
<tr>
<td>Crude fibre (%)</td>
<td>3,12</td>
<td>4,00</td>
<td>3,22</td>
<td>3,12</td>
<td>3,14</td>
</tr>
<tr>
<td>Ca (%)</td>
<td>2,65</td>
<td>2,78</td>
<td>2,72</td>
<td>2,68</td>
<td>2,65</td>
</tr>
<tr>
<td>P (%)</td>
<td>0,46</td>
<td>0,48</td>
<td>0,47</td>
<td>0,49</td>
<td>0,47</td>
</tr>
</tbody>
</table>

**Prosedur**

Shrimp waste powder. Shrimp waste powder was obtained from the Institute of Fisheries and Freshwater Aquaculture, Bogor. Katuk leaves meal. Leaves and stems were first separated. Katuk leaves then dried in the sun. Dried katuk leaves was then processed into katuk leaves meal. Garlic powder. First, garlic was dried in the sun, then was ground into a powder.

**Maintenance of Quail and Treatment Application**

Quail used in the study were randomly placed into battery cages by the treatment given. Treatments of diet were given at the second week of maintenance. In the beginning quail were fed the basal ration for 2 weeks. Maintenance of quail lasted for 10 weeks and the first 2 weeks serve as a control.

One hundred sixty quails were placed in a cage. Each treatment consisted of 4 replicates with 8 quails for each experimental unit.
RESULTS AND DISCUSSION

Feed Consumption, Eggs Production and Ration Conversion

Feed intake did not show significantly different results. The value of feed intake in the control treatment, administration of bromelain, shrimp waste powder, flour katuk leaves, and garlic powder are respectively 22.76 ± 2.12; 22.22 ± 1.59; 22.84 ± 1.89; 24 ± 3.22; and 23.16 ± 6.07 g / head / day. Factors affecting feed intake is the large body of livestock, livestock activity, ambient temperature, quality and quantity of ration (NRC, 1994).

The production value of eggs in each treatment showed significantly different results. Egg production in the control treatment, administration of bromelain, flour shrimp waste, katuk leaf, and garlic respectively in the amount of 32.25 ± 3.86%; 34.61 ± 6.88%; 36.16 ± 2.41%; 40.04 ± 8.91%; and 39.50 ± 5.90%. According Listyowati and Roospitasari (2004) Production of quail eggs is influenced by genetic and environmental factors such as diet, cage, temperature, environment, disease, and stress. Factors affecting feed intake is the large body of livestock, livestock activity, ambient temperature, quality and quantity of ration (NRC, 1994).

Feed conversion showed no significantly different results. Feed conversion in the control treatment, administration of bromelain, shrimp waste powder, flour katuk leaves, and garlic powder respectively is 9.13 ± 1.11; 7.43 ± 2.45; 7.57 ± 1.51; 7.37 ± 1.65; and 7.20 ± 3.30. This suggests that the efficiency of feed utilization on all treatments are the same (average 7.74). Widjastuti and Kartasudjana (2006) states that the balance between feed consumed by the production of eggs produced in each treatment causes no different feed conversion.

Egg Production, Energy Consumed, Protein Consumed, and Percentage Weight Components of Quail Eggs

The average weight of quail eggs in each treatment showed significantly different results. Giving bromelain produces the greatest egg weight from other treatments that is equal to 9.09 ± 0.31g. Bromelain has a high protein content. Quail egg weight is not only influenced by the quantity of feed consumed but also by the quality of feed, especially protein content (Mozin, 2006). Protein deficiency will result in a large decrease in the number of eggs and egg albumen (Amrullah, 2003).

Egg weight on the addition garlic powder and shrimp waste powder showed not significantly different results, and each has an eggs weight of 8.60 ± 0.37 g and 8.47 ± 0.53 g. On the addition of bromelain treatment showed a highest egg weight than the other treatment that was equal to 9.09 ± 0.31 g but the control treatment had the smallest egg weight of 7.84 ± 0.82 g. Results of the study had a lower weight value than that of Kul and Seker (2004) who obtained results of egg weight (g) of 11.28 ± 0.06g.

Consumption of protein and metabolizable energy used to meet the maintenance, growth and egg production (Widjastuti and Kartasudjana, 2006). The magnitude of the weight of the eggs produced by the addition of bromelain treatment can be caused due to consumption of protein and metabolizable energy used to meet maintenance and growth are fulfilled, so that the remainder is used to produce large eggs. Requirement for maintenance and growth in the control treatment that has not been fulfilled resulting in the consumption of protein and metabolizable energy is not widely used for the production of eggs, so the weight of eggs produced is low.

The percentage of egg whites on all treatments showed no significantly difference, i.e. ranging 54.06 – 55.59%. Hazim et al. (2011) measures the egg whites percentage of
“Recent Advance in Animal and Feed Technology to Support Sustainable Livestock Production System”

53.10%. Kul and Seker (2004) obtained the higher egg whites percentage of 59.83. Likewise, the percentage of egg yolk and eggshell were not significantly different. Kul and Seker (2004) reported that the percentage of yolk 32.71 ± 0.12% and the percentage of eggshell 7.47 ± 0.04%. According to Song et al (2000) quail egg yolk has a percentage of 29.42 to 33.38%, from 58.88 to 63.52% egg white, and eggshell 6.61 to 7.99%.

Table 3. Feed consumption, egg production, feed conversion, nutrient intake, egg weight and percentage weight components of quail eggs given experimental diets

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Feed intake (g/head/day)</td>
<td>22.76±2.12</td>
</tr>
<tr>
<td>Egg production (%)</td>
<td>32.25±3.86</td>
</tr>
<tr>
<td>Feed conversion energy intake (kcal/head/day)</td>
<td>9.13±1.11</td>
</tr>
<tr>
<td>Protein intake (g/head/day)</td>
<td>64.86±4.94</td>
</tr>
<tr>
<td>Egg weight (g)</td>
<td>5.13±0.37</td>
</tr>
<tr>
<td>Albumin (%)</td>
<td>7.84±0.82</td>
</tr>
<tr>
<td>Yolk (%)</td>
<td>54.06±0.44</td>
</tr>
<tr>
<td>Shell (%)</td>
<td>30.02±0.62</td>
</tr>
<tr>
<td>Shell (%)</td>
<td>9.79±0.10</td>
</tr>
</tbody>
</table>

Remark: different superscript within the same row indicate significantly different (P <0.05)

Table 4. Quail egg quality given experimental diets

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Egg index</td>
<td>78.81±4.36</td>
</tr>
<tr>
<td>Yolk colour score</td>
<td>4.13±0.91</td>
</tr>
<tr>
<td>Shell thickness (mm)</td>
<td>0.168±0.01</td>
</tr>
<tr>
<td>Hough Unit</td>
<td>92.64±1.01</td>
</tr>
</tbody>
</table>

Remark: different superscript within the same row indicate significantly different (P <0.05).

Egg Quality

The quality of the eggs is a collection of factors that affect the valuation and tastes of consumers on the quality of the eggs. Consumers are always looking for fresh eggs, with standard weight, good eggshell quality, yolk color attractive (yellow) and a relatively thick egg white (Yuwaanta, 2010). In this study, the egg index was not significantly different between treatments. This shows the shape of eggs in each treatment is more rounded than the results Kul and Seker (2004), i.e. with an index of 0.75 ± 0.22 eggs.

PROCEEDING 4th ISAINI 2015
ISBN: 12
Scores yolk color in this study was significantly different. In the treatment of leaf powder katuk have egg yolk color score highest than the others, namely $6.10 \pm 0.43$. In the administration of bromelain treatment, waste flour shrimp, garlic, and controls were not significantly different. Hulshoff et al. (1997) reported that among the vegetables and fruits were studied in Indonesia, the highest katuk leaf contains carotene. This shows that the carotene pigment found in leaves katuk have a role in improving the yolk color scores.

Eggshell thickness was significantly different in all treatments. Control treatment and administration of bromelain has the thickest shell, each of which is 0.168 mm and 0.167 mm. Treatment by administering powdered shrimp waste has the most thin shell that is $0.155 \pm 0.01$ mm. Eggshell thickness in treatment provision garlic powder and leaves katuk respectively 0.165 mm and 0.158 mm. Kul and Seker (2004) obtaining eggshell thickness values higher than this study is 0.231 mm.

Haugh unit in this study showed no significantly different results for all treatments and eggs belong to the quality of the AA indicated by HU value $>91.24$, i.e. above 72 (USDA, 2000). Haugh unit quail eggs on research Kul and Seker (2004) was $85.73 \pm 0.15$ was lower than HU in this study.

**CONCLUSION**

All treatments can provide a high quail egg weight compared with the control. The percentage weight of the composition of quail eggs are not affected by the provision of treatment. Giving katuk leaves can increase the value of yolk color scores and maintain a quail egg production. The addition of bromelain, flour shrimp waste, katuk leaf, and garlic does not affect performance and can maintain the quality of quail eggs.

**REFERENCES**


