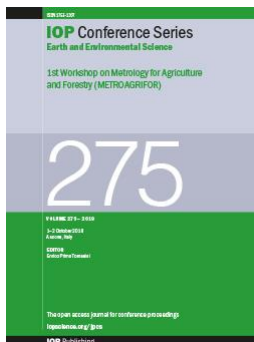


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## The effect of additional turmeric flour in rations on the performance and egg quality of laying chicken isa brown strain age 70<sup>th</sup> weeks

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# The effect of additional turmeric flour in rations on the performance and egg quality of laying chicken isa brown strain age 70<sup>th</sup> weeks

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**Abstract.** This research aims to study and analyze the effect of adding turmeric flour (*Curcuma domestica* Val) in the rations on the performance of 70 weeks old Isa Brown strain of laying hens. The research method used in this study was an experimental method with a completely randomized design (CRD) step with five treatments and four replications. The number of chickens used was as many as 40 laying hens. The treatments given to the sample were P0 = feed without giving turmeric flour (control), P1 = feed with 0.3% turmeric flour, P2 = feed with 0.5% turmeric flour, P3 = feed with 0.7% turmeric flour and treatment P4 = feed by giving turmeric flour 0,9%. The results showed that giving turmeric flour in the rations of the Isa Brown strain of laying hens affected chicken performance and egg quality. This research concludes that giving turmeric flour a percentage of 0.7% in Isa Brown's 70-week old laying hens is the best for ration consumption, Hen Day Production, egg weight, feed conversion, and egg quality: Haught Unit, yolk egg color, yolk egg index, grading egg and egg mass. Based on the haugh unit value, all eggs produced are still in the AA grade category

**Keywords:** Turmeric, ISA brown, performance, egg quality

## 1. Introduction

Laying hens are still the main commodity in the world of animal husbandry. This is supported by the results of laying hens as one of the producers of animal protein affordable by all levels of society in Indonesia. Laying hens in Indonesia are still dominated by brown laying hens, which are medium type laying hens. According [1] One type of brown laying hen is Isa Brown, who has the advantages of high uniformity, even sex maturity, increased production, high immunity, and good climate resistance.

The superiority of laying hens' productivity certainly supports meeting the increasing demand for chicken eggs as animal protein. Increasing the need for egg protein is a challenge at the same time for laying hens to increase the productivity of laying hens. One of the factors that can affect the productivity of laying hens is the provision of quality rations. Quality rations must be composed of a good composition according to the needs of livestock. The ration in poultry farming has a leading role that needs attention in addition to seeds and management. The ration is a mixture of various kinds of organic and inorganic materials given to livestock to meet the needs of nutrients needed for growth,



development, and reproduction. For maximum growth and production, the number of nutrients required by livestock must be adequate. Consumption of rations is very influential on the performance of laying hens to be achieved. If the appetite is low, it causes the growth rate to be inhibited, and egg production decreases. One of the factors that can cause a decrease in appetite and feed consumption is stressed chickens due to extreme weather conditions. Stressed chicken conditions can be handled by providing feed with natural additives. The natural additive ingredient used in the ration is turmeric flour (*Curcuma domestica* Val). Turmeric is a type of herbal plant originating from Southeast Asia. This plant is easy to find in Indonesia because it can grow in various environments, from the lowlands to the highlands. Turmeric is used in chicken feed because it can improve the digestive organs' work and stimulate the release of pancreatic juice, which contains the enzymes amylase, lipase, and protease [28]. The active substances in turmeric are curcumin and essential oils that function as kalagoga (a substance that destroys gallstones and can increase bile secretion). Essential oils contain chemical compounds sesquiterpene alcohol, turmerone, and zingiberene. The essential oil gives the tuber a fragrant aroma and distinctive taste. In addition to essential oils, other content contained increases appetite, which increases the live weight of chickens. Meanwhile, curcuminoids contain curcumin compounds and their yellow-colored derivatives which include desmethoxycurcumin.

Turmeric in the form of flour can be used to optimize the work of the digestive organs because turmeric belongs to the Zingiberaceae family plant, which people often use to increase appetite and treat organ disorders, especially digestion [2]. According [3] [4], giving 0.5% turmeric flour significantly reduced the FCR value, increased body weight, increased egg production, egg weight, and egg mass in laying hens. Based on the ability of turmeric flour to improve the performance of laying hens, it is necessary to research the addition of turmeric flour in the feed on the performance of laying hens strain Isa Brown.

## 2. Materials and methods

### 2.1. Materials

Turmeric flour and commercial feed for laying hens mixed with turmeric flour and made in crumbles produced by PT. Sinar Indochem with a composition according to the everyday needs of laying hens, 40 Isa Brown laying hens aged 70 weeks. Twenty battery cages and each unit has a capacity of two chickens Nutrient Content of ration: Crude Protein 17,8%, Crude Fat 3,4%, Crude Fiber 8,2%, Calcium 3,9%, Phosphorus 0,4%.

### 2.2. Place and time

The research was carried out at PT Nusa Indah Farm, located at Jalan A Yani RT 3, Bati-Bati District, Tanah Laut Regency. The time of the study is November-December 2020.

### 2.3. Methods

The method used in this study is an experimental method using a completely randomized design (CRD) with five treatments and four replications. The treatments carried out are: Without the addition of turmeric flour (P0), Addition of 0.3% turmeric powder (3 g.kg<sup>-1</sup> feed) (P1), 0.5% turmeric powder (5 g.kg<sup>-1</sup> feed) (P2), 0.7% turmeric flour (7 g.kg<sup>-1</sup> feed) (P3), 0.9% turmeric powder (9 g.kg<sup>-1</sup> feed) (P4).

### 2.4. Variable analysis

In this study, we will examine the level of use of turmeric flour in the feed of laying hens strain Isa Brown which is 70 weeks old with production parameters that include feed consumption, feed conversion, production, and egg weight. In addition, we tested the interior quality which included egg index, shell thickness, albumen pH, egg yolk and egg white height, yolk color, Haugh unit, and egg grade. Haugh Unit (HU) =  $100 \log (h + 7,57 - 1,7 W^{0,37})$  [5].

### 2.5. Research preparation

The preparations made during the study included the preparation of the equipment and materials used. Turmeric obtained from the market is washed first, scraped off the outer skin that still leaves roots and soil, and then cut to dry. After drying, the turmeric will be mashed using a blender and stored in a container to treat laying hens according to the prescribed dose.

### 2.6. Data analysis

The data obtained according to the experimental parameters were tested for homogeneity. Homogeneous data will be continued with Fisher's test (F). The Duncan/DMRT Multiple Range Tests are carried out to show a significant difference [6].

## 3. Results and discussions

All research data are presented in table 1. This table presents data on feed consumption, feed conversion, egg production, egg exterior quality and egg interior quality.

**Table 1.** Egg quality of laying hens strains ISA Brown during the study.

Variable	Treatments				
	P0	P1	P2	P3	P4
Feed consumption (g)	235.44c	229.28b	224.10b	215.33a	237.67c
Hen day production (%)	88.48b	80.78ab	76.61a	90.69b	88.65b
Feed conversion	2.04ab	2.30c	2.26bc	1.96a	2.10bc
Egg weight (g)	65.43	62.03	64.87	66.22	64.41
Egg shape index	74.66a	75.14a	75.31a	75.18a	76.12b
Egg-yolk diameter (mm)	4.28a	4.48a	4.37a	4.54b	4.63b
Egg-yolk percentage (%)	37.18a	36.28b	36.32b	37.24b	37.47b
pH albumin	8.2	8.5	8.4	8.7	8.5
Egg-shell thickness (mm)	0,358a	0,352a	0,347a	0,348a	3,580a
Egg-shell weight percentage (%)	10.16b	9.21a	9.68a	10.13b	9.24a
Depth aircell (mm)	2.90b	2.58b	2.72b	2.33a	2.72b
Albumin height (mm)	0,49	0,39	0.50	0.39	0.46
Egg-yolk height (mm)	1.71a	1.65a	1.69a	1.85b	1.81b
Egg-yolk color	4a	4a	5ab	5ab	6b
Haugh unit	85.26a	84.68a	85.32a	89.27b	88.41b
Grade egg	AA	AA	AA	AA	AA

Note: Numbers that have different superscript letters show a very significant difference in the DMRT test

### 3.1. Feed consumption

The analysis of diversity showed that the treatment which was declared had a very significant effect ( $P < 0.01$ ) on ration consumption. The addition of turmeric flour to feed with a percentage of 0.3%, 0.5%, and 0.7% was significantly different from the portion of turmeric flour 0.9% and the control (0% turmeric flour). This is presumably due to the influence of the aroma and taste of turmeric; [7], turmeric has a very intense aroma and is slightly bitter. This aroma is produced due to the presence of essential oils, so it is suspected that the condition of the contents resulted in the influence of giving turmeric flour and without giving it. [8] also stated that turmeric contains essential oils with a distinctive odor and bitter taste, thereby reducing appetite.

The percentage of turmeric flour 0.3% is not different from the percentage of 0.5% but is different from the percentage of turmeric flour, which is 0.7% and 0.9%. It is presumed that the turmeric flour with the percentage of 0.3% and 0.5% contained curcumin and essential oils with the same levels so that they did not show a different effect on the consumption of rations. The percentages of using turmeric

flour 0.3%, 0.5%, 0.7% and 0.9% showed significantly different results. The provision of 0.7% turmeric flour resulted in the lowest feed consumption, while the provision of 0.9% turmeric flour resulted in the highest feed consumption.

Giving turmeric flour percentages of 0.3%, 0.5% and 0.7% showed a decrease in ration consumption. However, at the percentage of 0.9%, there was a very significant increase in ration consumption. It is suspected that the level of essential oil content in the provision of 0.3%-0.7% turmeric flour reduces palatability [7], that turmeric has a quite pungent aroma and bitter taste, thus allowing the effect of decreasing palatability. Then [8] also stated that turmeric contains essential oils with a distinctive odor and bitter taste, thereby reducing appetite. Meanwhile, when giving turmeric flour with a percentage of 0.9%, there was an increase in ration consumption, presumably because of the volatile oil content, originally palatability-lowering (at 0.3%-0.7% turmeric flour). Changed the effect to increase appetite [9] [29], that the mechanism of curcumin and essential oils can increase the appetite of livestock by accelerating the process of emptying stomach contents.

### 3.2. Feed conversion

Based on the analysis of variance, it is known that the addition of turmeric flour in laying hens had a very significant effect on the conversion of laying hens rations ( $P < 0.01$ ). The percentage of giving turmeric flour 0.7% was not different from the control (without giving turmeric flour) and the control treatment and the portions of 0.3%, 0.5%, and 0.9% were also not different. But the percentage of 0.7% turmeric flour was significantly different with the portions of 0.3%, 0.5%, and 0.9%. This is presumably due to the provision of turmeric flour at a percentage of 0.7%, curcumin, and essential oils. It provides an effective impact as an antibacterial in the digestive tract of laying hens to increase feed efficiency and maximize egg production. The curcuminoid compounds could cause an increase in feed efficiency in turmeric, which has antibacterial activity [10].

The presence of curcumin in turmeric provides a fairly strong antibacterial inhibition and stimulates growth, and increases feed efficiency by reducing disturbing microorganisms and increasing beneficial microorganisms [27]. While [11], stated that the essential oil contained in turmeric could help digestion by stimulating the nervous system secretions, causing gastric juice-containing enzymes that are secreted into the stomach and intestines to increase the metabolism of food substances. Using turmeric flour with a percentage of 0.7% is very good because it can produce 1.8 ration conversions and is the lowest among other portions. This indicates that the provision of rations is more efficient than the absence of turmeric flour in the feed. These results also showed that the conversion rate of 1.8 was below the standard feed conversion of laying hens strain Isa Brown aged 70-75 weeks, which was 2.17-2.28 [12]. According to [1], if the feed conversion value is getting smaller, the feed conversion is getting better, which means the chickens can use feed well and produce eggs well.

### 3.3. Hen day production

The analysis of diversity showed that the treatment had a significant effect on the hen day production of laying hens ( $P < 0.05$ ). Giving turmeric flour at a percentage of 0.3% was not different from turmeric flour with a percentage of 0.5%, 0.7% 0.9%, and without giving turmeric flour. But the use of 0.5% turmeric flour was different from the use of 0.7%, 0.9% turmeric flour, and control on hen day production. This is because the hen day production on giving turmeric a percentage of 0.5% is different from the percentages of 0.3%, 0.7%, and 0.95 due to the influence of chicken age. The percentage of each giving turmeric showed the same results to HDP and only the percentage of 0.5% was different. So it is suspected that the age of the chicken is the cause of the difference. Because the chickens used in the study was 70 weeks old and approaching rejection. The percentage of turmeric flour in feed with a percentage of 0.7% gave the best results for laying hens HDP although the results of the analysis stated that the percentage of 0.7% was not significantly different from the control, the percentage of turmeric flour was 0.3% and 0.9%. It is suspected that the content of curcumin in turmeric flour on the portion of treatment has not been able to give a significant effect on increasing egg production. The age factor of laying hens used in the study is also suspected to be a factor that causes no increase in HDP. [13], stated

that chicken egg production is also influenced by genetics, age, use of drugs, and food substances in feed. The laying hens used in this study were 70 weeks old and nearing the end of the period. According [14], chickens aged 82 weeks must be rejected because egg production is below 50%. The laying hens of the Isa Brown strain have an egg-laying period of 18-80 weeks, 93.2% liveability, 95% peak production at 25-26 weeks of age. The average egg weight of laying hens strain Isabrown is 58.8-59.6 g [12]. The research data showed that giving turmeric flour with a percentage of 0.7% gave the best HDP results reaching 90.69%. This result exceeded the HDP standard of laying hens Isa Brown which was only 81% at 70 weeks of age and decreased to 77% at 75 weeks [12].

### 3.4. Egg exterior quality

*3.4.1. Egg weight.* The use of turmeric flour in the feed of laying hens strain Isa Brown did not significantly affect the weight of chicken eggs ( $P>0.05$ ). The average egg weight above does not show any difference. This is presumably because, at the age of 70 weeks, the chicken has reached the maximum egg weight, [15], the chicken will gain the maximum egg weight after 50 weeks of age. The standard egg weight of laying hens Isa Brown aged 70-75 weeks ranged from 64.4-64.5 [12]. Egg weight is influenced by the age of chickens, environmental temperature, strain or breed, nutritional content in the ration, bodyweight of chickens, and the time of egg production [13]. The average weight of broiler eggs is 57.9 grams [15]. Egg weight is grouped into three: small (less than 50 grams), medium 50-60 g, largely more than 60 g. The standard classification of egg weight is jumbo ( $> 76$  g), extra-large (70-77 g), large (64-70 g), medium (58-64 g), medium-small (52-58 g), small ( $< 52$  g).). Small eggs have a higher filling quality than large ones. The standard size in egg marketing is 56.7 grams per egg [16].

*3.4.2. Egg shell thickness.* Based on the results of the analysis of variance, the results of the treatment shell thickness ranged from 0.358 to 0.580 mm. but did not show any difference in treatment of this thickness of eggshells. The thickness of the eggshells of broilers ranges from 0.330-0.350 mm. The thickness of the eggshell is influenced by several factors, namely: age, type of chicken, nutrients, physiological events from body organs, stress, and components of the shell layer. Thin shells are relatively more porous and large, thus accelerating the decline in egg quality due to evaporation and faster decay [17]. There are pores in the eggshell. The number of pores per egg of broilers ranges from 7,000 to 17,000 which is used for gas exchange. The pores are 0.01 – 0.07 m in size and are spread over the entire surface of the egg. The eggshell on the blunt side has more pores per unit area compared to other chart pores [18].

*3.4.3. Egg shape index.* Judging from the results of the analysis of variance, it is known that the shape index ranges from 74.66 to 76.12. The highest shape index was obtained in treatment P4. However, between the control treatment and the use of turmeric flour up to 0.7% did not show any difference. This means that from P0 to P4 it shows the oval shape of the egg. The shape of the egg is influenced by the shape of the oviduct in each hen, so the shape of the eggs produced will be different. The shape of the egg is usually expressed by a shape index measure, namely the ratio (in percent) between the width and length of the egg [19]. A good egg is oval and ideally has a "shape index" (SI) between 72-76 and egg oval  $SI > 76$  [16]. The factor of uniformity of egg shape is something that needs to be considered, irregular egg shape is possible due to diseases such as Infectious Bronchitis and others.

### 3.5. Egg interior quality

*3.5.1. Depth aircell.* Based on the results of the analysis, the results showed that the use of turmeric flour ranged from 2.90 mm to 2.33 mm. This shows that there is an effect of using turmeric flour on the depth of the air cavity. However, the P3 treatment showed the lowest air void value. As they age, eggs will lose fluid and their contents will shrink, thereby enlarging the air cavity. Fresh eggs have an average depth of 0.9 mm below the air cavity and are classified as quality 1 eggs [20]. This shows that the results



of the research on all treatments are still classified as egg quality criteria 1. The size of the air cavity indicates the length of time the egg is stored, the longer the storage time the larger the size of the air cavity [21]. The increase in the size of the air cavity caused by shrinkage of egg weight due to evaporation of water and gas release that occurs during storage [20]. With age, eggs will lose fluid and their contents will shrink, increasing the air cavity. The average depth of the air cavity of fresh eggs was 2.19 mm, in the first week it became 5.69 mm and increased in size in the third week to 8.52 mm [25]. Fresh eggs have less air space than old eggs. Abroad, egg quality can be grouped based on the size of the depth of the air space. The following is the division of egg quality based on the size of the depth of the air space. (1). AA quality has an air chamber depth of 0.3 cm. (2). Quality A has an air chamber depth of 0.5 cm. (3). Quality B has a depth of air space of more than 0.5 cm [21].

*3.5.2. pH albumin.* Based on the results of the analysis of variance, the results showed that the addition of turmeric flour did not affect the pH of egg albumin. Albumin pH usually indicates egg damage that occurs due to the release of carbon dioxide gas from the egg, thus increasing the acidity of the product [22]. The characteristics of the part of the egg that experienced a decrease in quality include the air space being wider, the volume of the yolk reduced, the pH increasing, the phosphorus level is reduced, the ammonia level is increased, the yolk position shifting, the water content of the egg white decreasing, the skin condition is reduced. Eggs are usually mottled, and their color tends to change [21].

*3.5.3. Egg yolk and albumin height (mm).* The increasing age of eggs affects the physical properties of eggs, namely the albumen viscosity decreases. The decreased albumen viscosity was due to the reduced amount of lysozyme complex with ovomucin from normal conditions due to CO<sub>2</sub> evaporation from the egg contents. Ovomucin and lysozyme are two compounds that play a role in albumen viscosity [5]. The basic principle of decreasing egg quality is due to evaporation of water, the release of CO<sub>2</sub>, and damage by microbes [18]. Based on the results of the analysis, it was found that the use of turmeric flour did not affect the high albumin thickness but did affect the yolk height. The highest yolk height was obtained in treatment P3 with a height of 1.85, but this was not different from treatment P4. Decreased albumen height due to migration of water from albumen to yolk results in interactions between lysozyme and ovomucin which reduces the solubility of ovomucin and damages albumen viscosity [23].

*3.5.4. Egg yolk color.* Egg yolk color is a consumer favorite. Based on the results of the analysis of variance, the use of turmeric flour affects the color of the egg yolk. In this study, the yolk color for P0 and P1 showed a value of 4, while treatment P2 and P3 showed a value of 5 and P4 showed a value of 5. This indicates that the higher the use of turmeric flour has an impact on the quality of the egg yolk which gives a very yellow color. The color of the yolk is very closely related to the high content of vitamin A contained in the egg. Generally, the egg yolks that consumers prefer are golden yellow to orange and these colors are in the range of 8-14 on the Roche yolk color fan. Egg yolk color is not affected by storage time and shell color [24]. In addition, egg yolk color is more influenced by the content of carotene which is widely contained in pigments and feed. The color of egg yolks that consumers prefer is influenced by xanthophyll dyes which are widely found in the hydroxy carotenoid group. These substances not only affect the color of the egg yolk but also the color of the skin. The cause of the diversity of egg yolk color is not only caused by the amount of xanthophyll content in feed ingredients but also due to differences in strains, individual diversity, cages, morbidity (morbidity), stress, fat in xanthophyll oxidation feed in certain feed ingredients. Based on measurements with this tool, the color of a good egg yolk is in the range of numbers 9-12 [21]. Egg yolks contain dyes (pigments) that are generally included in the carotenoid group, namely xanthine, lutein, and zeaxanthin, and a small amount of beta-carotene and cryptoxanthin. Changes in the yellow color of processed egg yolks to greenish-black color are caused by prolonged heating to form Fe and S [25].

*3.5.5. Haugh unit.* Based on the results of the study, the HU values ranged from 84.68 - 89.27. The P3 treatment gave the highest HU value and the lowest was the P1 treatment. Treatment P0, P1, and P3 did

not show any difference, as well as between P3 and P4 showed no different results. This situation is following the results of the study where eggs that have a greater weight produce a large HU weight as well. Haugh unit values of more than 60-72 are categorized as quality A eggs, Haugh unit values of 31-60 as eggs of B quality, and Haugh unit values of less than 31 are categorized as C quality eggs. This is reinforced by [21] which states that the normal Haugh unit value is more than 72 which is classified as AA quality. The Haugh Unit (HU) value is an indicator of the freshness of eggs which consistently decreases with the increasing age of the hen [26]. HU values vary between 20-110 and good quality eggs have HU values between 50-100 [15]. The HU value is based on the correlation between egg weight and egg white height [22] [30]. The smaller the value of HU, the more dilute the egg white, so the quality of the egg white is lower. This is due to the dilution of egg whites caused by the evaporation of CO<sub>2</sub> gas so that the pH rises and accelerates the breakdown of ovomucin. This is following the opinion of [5], which stated that the dilution of the egg white was caused by the physicochemical damage of the ovomucin fibers. Evaporation of CO<sub>2</sub> is caused by the decomposition of NaHCO<sub>3</sub> compounds from chicken eggs into NaOH and CO<sub>2</sub>. The formed NaOH will be decomposed into Na<sup>+</sup> and OH<sup>-</sup> while the formed CO<sub>2</sub> will evaporate, so that the quality of egg whites decreases. Based on the Haugh unit value, which ranged from 84.68 to 89.27, all eggs produced showed that they were in the AA grade category.

#### 4. Conclusions and suggestions

The use of turmeric flour in feed affects increasing hen day production, egg weight, increasing feed consumption, egg index, egg yolk height, egg yolk color, and Haugh unit value and reducing feed conversion of laying hen strain Isa Brown age 70 weeks. The use of turmeric flour with a percentage of 0.7% in the feed of laying hens strain Isa Brown had the best effect on performance because it reduced ration consumption and ration conversion and increased hen day production, Haugh unit, egg weight, egg yolk color, and height of yolk. Based on the Haugh unit value, all eggs produced are still in the AA grade category.

#### Reference

- [1] Rasyaf M 2009 *Beternak Ayam Petelur* Penebar Swadaya Jakarta Abbas M H 1989 *Pengelolaan produksi unggas* Jilid ke 1 Universitas Andalas Padang
- [2] Sumiati S 2004 *Kunyit Si Kuning Yang Bermanfaat* Cakrawala
- [3] Sidik 2020 *Pengaruh Penggunaan Kunyit (Curcuma domestica Val) Pada Air Minum Terhadap Performan Ayam Broiler* Skripsi Universitas Garut
- [4] Jihadulhaq BM 2016 *pengaruh penggunaan tepung kunyit (curcuma domestica val) terhadap performa itik lokal (anas sp)*. Skripsi. Fakultas Peternakan. Universitas Hasanudin. Makassar
- [5] North M O 1978 *Commercial Chicken Production Manual* 2nd Edition, Publ. Co. Inc. Westport CT: 31-8-321
- [6] Gaspersz V 1994 *Metode perancangan percobaan untuk ilmu-ilmu pertanian, ilmu-ilmu teknik dan biologi* Armica Bandung
- [7] Pratikno H 2010 *Pengaruh ekstrak kunyit (curcuma domestica val) terhadap bobot badan ayam broiler (gallus sp)*. Universitas Diponegoro
- [8] Hartati S Y 2013 *khasiat kunyit sebagai obat tradisional dan manfaat lainnya* Warta Penelitian dan Pengembangan Tanaman Industri *Jur. Puslitbang Perkebunan* **19** 9-12
- [9] Purwanti 2008 *Kajian efektifitas pemberian kunyit, bawang putih dan mineral zink terhadap performa, kadar lemak, kolesterol dan status kesehatan broiler* Thesis Pascasarjana Institut Pertanian Bogor
- [10] Lawhavinit O, N Kongkathip and B Kongkathip 2010 *antimicrobial activity of curcuminoids from curcuma longa l on pathogenic bacteria of shrimp and chicken* *Kasetsart J. (Nat. Sci)* **44** 364-371
- [11] Abbas AK, Lichtman AH 2004 *Basic Immunology: Functions and disorders of the immune system* Ed. Ke-2 Philadelphia (US): Saunders
- [12] Hendrix Genetic Company, 2011. *Jurnal Ayam Petelur Isa Brown*. ISA Company Jakarta

- [13] Wahyu J 2004 *Ilmu Nutrisi Unggas*. Cetakan ke-5 Gadjah Mada Press Yogyakarta
- [14] Salang F L, Wahyudi, E Queljoe, D Y Katili 2015 Kapasitas Ovarium Ayam Petelur Aktif *J. MIPA Unsrat Online* **4** 99-102
- [15] Yuwanta T 2010 *Telur dan Kualitas Telur* UGM Press Yogyakarta
- [16] Sumarni dan N Djuarnani 1995 *Diktat Penanganan Pasca Panen Unggas. Departemen Pertanian*. Balai Latihan Pertanian dan Peternakan Ciawi Bogor
- [17] Steward G F and J C Abbott 1972 *Marketing Eggs and Poultry* Third Printing Food and Agricultural Organization (FAO) the United Nations Rome
- [18] Kurtini T, K Nova dan D Septinova 2011 *Produksi Ternak Unggas*. Universitas Lampung, Bandar Lampung
- [19] Djanah D 1990 *Beternak Ayam* CV Yasaguna Cetakan Kedua Surabaya
- [20] Jazil N, Hintono A dan Mulyani S 2013 *Penurunan kualitas telur ayam ras dengan intensitas warna coklat kerabang berbeda selama penyimpanan* *J. App Tek. Pangan* **2** 1
- [21] Sudaryani T 2003 *Kualitas Telur* PT Penebar Swadaya Jakarta
- [22] Sihombing R, Kurtini T, Nova K 2014 Pengaruh lama penyimpanan terhadap Kualitas Internal Telur Ayam Ras pada Fase Kedua *Jurnal Ilmiah Peternakan Terpadu* **2** 81-86
- [23] Abbas M H 1989 *Pengelolaan Produksi Unggas* Jilid ke 1 Univesitas Andalas Padang
- [24] Saputra D.R., T. Kurtini dan Erwanto. 2016. Pengaruh Penambahan Feed Aditif Dalam Ransum Dengan Dosis Yang Berbeda Terhadap Bobot Telur dan Nilai Haugh Unit (HU) Telur Ayam Ras *Jurnal Ilmiah Peternakan Terpadu*. **4** 230-236
- [25] Winarno F G dan Koswara S 2002 *Telur : Komposisi, Penanganan dan Pengolahan* Institut Pertanian Bogor
- [26] Chang-Ho K, Jong-Ho S, Jae-Cheong L Kyung-Woo L 2014 *Age-related changes in egg quality of Hy-line brown hens* *IJPS* **13** 510-514
- [27] Bintang I A K dan Natamijaya 2008 Pengaruh Penambahan Tepung Kunyit terhadap Performans Ayam Broiler. *Pros. Sem. Nas. Tek. Pet. dan Vet. Bogor* 12-13 September 2005 Puslitbang Peternakan Bogor p 773-777
- [28] Natarajan C P and Y S Lewis 1980 *Technology Of Ginger An Turmeric* *Proc.of The National Sem. on Ginger Turmeric* Central Plantation Corps Research Institute Krala India
- [29] Sudarsono 1996 *Tumbuhan Obat* Pusat Penelitian Obat Tradisional UGM p30-35 Yogyakarta
- [30] Hastuti D R, Prabowo dan SA Anwar 2018 *Tingkat hen day production dan break event point usaha ayam ras petelur (gallus sp)*. *J. AGRIFO*. **3** 76-84