



Egg Production Performance of Crossbred Merawang X KUB Chicken

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Abstract. The aim of this study was to compare between the crossbred and local chicken population based on its egg production performance. The animals used was 104 crossbred hen (F1 offspring of Merawang rooster x KUB hen) and 57 KUB hen (D = 33 hen, E = 24 hen). The F1 crossbred differentiated into four types: BS1, BS2, BS3, and BS4. Egg production indicator such as egg number, production rate, and egg weight were observed for 12 weeks (20 - 32 weeks old). The hen kept in individual battery cage and given the similar environment. The data were then analyzed using one-way ANOVA. As a result, there were a different egg performance between the crossbred (BS1, BS2, BS3, and BS4) and purebred (KUB D and KUB E). The crossbred had lower egg number, production rate, and egg weight than the KUB's. The KUB E had the highest production rate (47,22 ± 2,59%) and egg number (39,67 ± 2,17 egg/hen). Meanwhile, the KUB D had the highest egg weight (48.69 ± 2.72 g). In the crossbred group, the BS4 had the lowest number of eggs (20.62 ± 4.25 egg/hen), production rate (24.54 ± 5.06%), and egg weight (41.33 ± 0.86 g). The egg weight of BS5 (43,96 ± 0,44 g) was higher than the KUB E (43,14 ± 0,44 g). Among the crossbred there were no significant different performance ($p < 0.05$). These findings can be used as a reference for the selection of crossbred chicken variants to be developed.

Keywords: Performance · Kampung Unggul Balitbangtan (KUB) · Crossbred · Egg production

1 Introduction

The Merawang chicken is an Indonesian local chicken breed, coming from the species *Gallus-gallus*, family *Phasianidae* [1]. This chicken was developed in Merawang village in Bangka-Belitung Province, and it has a dual purpose as a meat and egg producer. The Merawang hen could produce on average 160 eggs/hen/year, which is higher than other local chicken breeds [2].

The KUB chicken is a newly developed local chicken, created by the Badan Litbang Pertanian, Ministry of Agriculture, Republic of Indonesia. This chicken has advantages such as: higher egg production, higher growth rate, the savoury taste of its meat, and high

protein and fat content compared to other local chicken [3]. According to the ministry of agriculture of the republic.

of Indonesia at 2019 reported that the egg production of KUB chicken was 130–180 eggs/head/year. The advantage of this chicken is high egg production of 44–70% hen/day, peak production of 65–70%, and egg production/year of 180 eggs [4].

In order to improve the genetic quality of livestock and increase the variant of diversity, a cross breeding method was used to create new commercial breeds. By crossing two different superior breeds, hopefully the productivity will increase [5]. One of economical traits should be in consideration when crossing livestock is the egg production. Egg production performance can be caused by genetic and non-genetic factors [6]. Crossing could lead to heterosis effect and increase the performance. Hence, in this study we aim to compare the egg production of crossbred chicken (F1 offspring of Merawang x KUB) and purebred chicken (KUB).

2 Material and Methods

2.1 Management of Hens

All chicken reared in a battery cage in Semanu, Gunungkidul. During the data collection, the hens were given the same feed (100 g/hen/day), a commercial layer (PAR-L) from Japfa Comfeed, Tbk. The feed contains 12% moisture, 14% ash, 17% crude protein, 6% crude fiber, and 3% crude fat. Egg stimulant was also given to the hens occasionally in drinking water.

2.2 Data Collection

The data (egg number, production rate, egg weight) was collected for 12 weeks (from 20 to 32 weeks old). The crossbred and purebred chickens used in this study were 104 and 57 chickens, respectively. The crossbred chicken is produced using a mating scheme as shown in Fig. 1. The egg number is recorded per day by collecting the egg in an individual battery cage every afternoon. The production rate is calculated using the formula below:

$$\text{Production rate (\%)} = \frac{\sum \text{egg number}}{\sum \text{days}} \times 100\% \tag{1}$$

note:

- *The egg weight obtained from weighing the egg using digital scales.
- *Number of eggs over 12 weeks.
- *The number of days of observation is 84 days.

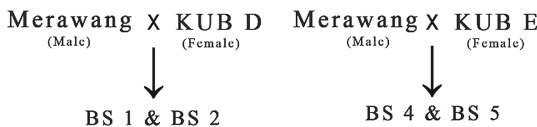


Fig. 1. Crossing pattern

2.3 Data Analysis

Data on the number of eggs, production rate, and egg weight were analyzed using one-way ANOVA in Statistical Program for Social Science version 20 (SPSS Inc., Chicago, IL, USA). The test was conducted to determine significant differences among the crossbred chickens (BS1, BS2, BS4, and BS5) with their maternal parents (purebred), KUB D and KUB E.

3 Result and Discussion

The age of sexual maturity (ASM), marked by the release of the first egg, in crossbred chicken (BS1-BS4) was lowest than the purebred (KUB D and KUB E). The KUB chicken achieved its sexual maturity at 20 weeks (4 months old), but the crossbred offspring matured at 23–25 weeks (5-month old). KUB-G6 had aged at the first egg about 22 - 23 weeks [7]. Differently, the ASM of KUB chicken was early at 20 - 22 weeks (140- 154 days) [8]. Hence, the findings of this research were still in normal range for both purebred and crossbred chicken.

The body weight at the first egg (BWFE) of the crossbred chicken ranged from 1403 to 2194 g, with average 1806.07 ± 198.27 g. For the purebred chicken, the BWFE ranged from 1398 to 2231 g, with average 1813.89 ± 201.92 g. The variations of BWFE in purebred chicken was higher than in the crossbred chicken. These findings were different from other research [8]. He reported that the BWFE of the female KUB chicken reared in breeder farms was $1.561,27 \pm 153,36$ g, much lower than the BWFE of KUB chicken in this research [8].

The egg production performance of the crossbred chicken and its maternal parents are shown in Table 1. The findings showed that there were significant differences between the crossbred and purebred chicken ($p < 0.05$) for egg number and production rate. In egg weight, the KUB D was higher (48.69 ± 2.72 g) than the other (ranging from 41 to 44 g). Compared to KUB D, the egg number and production rate of KUB E was higher. In contrast, the KUB E has a lower egg weight than the KUB D. The KUB chicken could produce 16–180 eggs/hen/year with a production rate 50% [9].

From the results of the analysis egg number BS1 (21.47 ± 1.80) and BS 2 (22.74 ± 2.28) when compared to its parent, KUB D (37.97 ± 1.71), there was a decrease in egg number from its parent. The similar result also showed in BS4 (20.62 ± 4.25) and BS 5 (23.04 ± 2.46) when compared to its parent KUB E (39.67 ± 2.17). The production rate in BS 1 (25.56 ± 2.14) and BS 2 (27.07 ± 2.72) is lower compared to the KUB D (45.20 ± 2.04). There was also a decrease for BS 4 (24.54 ± 5.06) and BS 5 (27.43 ± 2.93) when compared to its parent, KUB E (47.22 ± 0.44). In egg weight trait, the BS1 (44.26 ± 0.72) and BS 2 (43.51 ± 0.57) was lower than the KUB D (48.69 ± 2.72). In compare to KUB E (43.14 ± 0.44), the BS4 (41.33 ± 0.86) was lower. Differently, the BS5 was higher than the KUB E (43.96 ± 0.44).

Table 1. Results of Egg Production Performance Analysis from Crossbred Merawang X KUB Chicken

Variable	Crossbred Group				Parental Group (Female)	
	BS 1	BS2	BS4	BS5	KUB D	KUB E
	n = 30	n = 35	n = 13	n = 26	n = 33	n = 24
Egg number (N)	21,47 ± 1,80 ^a	22,74 ± 2,28 ^a	20,62 ± 4,25 ^a	23,04 ± 2,46 ^a	37,97 ± 1,71 ^b	39,67 ± 2,17 ^b
Production rate (%)	25,56 ± 2,14 ^a	27,07 ± 2,72 ^a	24,54 ± 5,06 ^a	27,43 ± 2,93 ^a	45,20 ± 2,04 ^b	47,22 ± 2,59 ^b
Average egg weight (gr)	44,26 ± 0,72 ^a	43,51 ± 0,57 ^a	41,33 ± 0,86 ^a	43,96 ± 0,44 ^a	48,69 ± 2,72 ^b	43,14 ± 0,44 ^a

Description:

- Different superscript symbols in each row indicate a significant difference in the data in each treatment based on the one-way ANOVA test with Duncan's test ($P < 0.05$)

In general, the findings of this study showed that the crossbred chicken has lower performance than the paternal chicken. The level of egg productivity of the chicken is influenced by several factors. Factors that affect egg productivity are genetic factors and environmental factors [10]. Genetic crossing is one of the essential breeding programs that plays a significant role in improvement of the chicken's performance. In order to create the commercial local chicken, the crossbreeding program is often used to exploit heterosis [11]. The level to which the performance of a crossbred in one or more qualities is superior to the average performance of the two parents is known as heterosis (hybrid vigour). Previously, some reports have demonstrated the efficiency of crossing for genetic enhancement of quantitative characteristics like chicken egg production. However, the hypothesis of heterosis effect was not proven in our population. Similar with this, the study in Alexandria male x Lohmann female cross (AL) showed that the age at sexual maturity was longer, the egg number and egg weight were lower than the purebred Lohmann [12]. However, when compared to the purebred Alexandria, the AL's performance was higher. Even though we did not calculate the heterosis value in this study, some researches showed that heterosis for the age of sexual maturity ranged from -25% to 11.5% after breeding local hens with Lohmann Brown and Leghorn [13]. According to other study, heterosis for characteristics related to egg production was significantly influenced by both epistasis and dominance [14]. Due to the type and extent of strain differences, the heterosis for egg production reported in the literature is quite variable, but it is frequently 10% or more [15].

The environmental factor such as feed preference also affects chicken egg production. For example, high protein consumption results in less efficient protein consumption and is considered less effective. This is because protein metabolism to produce energy also requires a lot of energy, so that a lot of energy is used to form energy, especially supported by a high enough temperature resulting in less efficient production [16]. Feeding is one of the environmental factors that affect egg production. Increasing productivity can be pursued by providing quality feed and additives [17]. Environmental factors such as housing are also one of the main aspects that need to be considered in intensive and

efficient chicken rearing [18]. One of the genetic factors can be caused by inbreeding. Chickens that have distant kinship relationships can have positive heterosis, so crossing with fellow local chickens' results in lower livestock productivity compared to their parents [19].

4 Conclusion

Based on the results of the study, it can be concluded that the number of eggs and production of BS1, BS2, BS4, and BS5 chickens are almost the same, but significantly different in KUB E and KUB D chickens. KUB D chickens have the highest egg weight, while the lowest egg weight is BS4 chickens. All BS chickens experienced a decrease in each variable compared to their parents, except for BS 5 chickens (43.96 ± 0.44 g) which experienced a slight increase in egg weight with KUB E chickens (43.14 ± 0.44 g).

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Authors' Contributions. D.M., H.S., and M.H.W. designed and convinced the research. A.P.Z.N.L.S. designed and convinced the analysis. Y.V.S. designed and convinced the analysis, supervised the work and collected the data. A.R.A. collected the data and wrote the paper.

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