

Doi: 10.21059/buletinpeternak.v46i3.74401

## Reproduction and Growth Performance of Kampung Unggul Balitbangtan (KUB) Chicken Cross

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### ABSTRACT

In Indonesia, one of the sources of regional livestock genetic diversity is the kampung chicken. This study aimed to assess the development and reproductive potential of F1 Kampung Unggul Balitbangtan (KUB) crosses (KUB roosters with different types of combs crossed to layer chickens). This research was conducted at a private chicken company in Gunungkidul regency using 40 KUB roosters and 320 layer chicks. The KUB roosters were separated into four groups based on their comb types: single, walnut, and double. Each set of ten males was housed in a single cage, with a male-to-female ratio of one to eight (male and female). Observed reproductive variables included egg weight (EW), hatch weight (HW), fertility, hatchability, number of eggs, number of day-old chicks (DOCs), and number of saleable chicks. The body weight (BW) of the offspring at ages ranging from DOC, 4, 8, to 12 weeks of age is one measure of their growth characteristics. The analysis of variance using a one-way design and the DMRT test were performed to describe the difference in growth and reproductive performance across groups. As a result, each comb type revealed a significant difference in EW, HW, fertility, hatchability, egg and chick production, DOC, and saleable chick production ( $P < 0.05$ ). Compared to other combs, the single comb performed the best in terms of EW, HW, fertility, number of eggs, and number of DOC. The most hatchable and sellable chicks were from walnut comb. Therefore, comb size has a positive correlation with chicken reproduction and productivity. Comb type groups have no effect on BW at 12 weeks ( $P > 0.05$ ), while they significantly affect BW for DOC at 4 and 8 weeks ( $P < 0.05$ ). The rose comb shows BW at its maximum point. In conclusion, the rose comb has the biggest body weight and the single comb has the best reproductive performance in comparison to other comb types.

Key words: Comb shapes, Growth, KUB chicken cross, Reproduction

#### Article history

Submitted: 27 April 2022

Accepted: 8 August 2022

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### Introduction

The majority of rural Indonesians keep kampung chickens, which are an important source of meat and eggs. The phenotypes of kampung chickens reveal numerous genetic characteristics, such as feathers, skin, beak color, body shape, comb, cover feathers, and an external indicator of production, growth, and reproduction (Sidadolog, 2011). Stansfield (1991) states that non-epistatic gene interactions caused the comb type. Sulandari *et al.* (2006) explain that there are four different comb types for chickens: single, pea, rose, and walnut. As a sign of health, sexual maturity, and social position, the chicken comb is a significant secondary sexual trait. Schantz *et al.* (1995) found a link between the size of a chicken's comb and its ability to reproduce and lay eggs (Mukhtar and Khan, 2012).

Due to their poor productivity, kampung chickens are unable to provide for daily consumption (Diwyanto *et al.*, 1996). Kampung chickens raised on extensive farming reach sexual maturity at 6 to 7 months. They lay 40 to 45 eggs a year, each of which weighs 40g and has a 75% carcass percentage, a 31% day-old chick (DOC) mortality rate, an 86.65% hatchability rate, and a 21-day incubation period (Biyatmoko, 2003). Even after going through tight selection, the carefully kept kampung hens' egg output only rises to 151 eggs per year; instead, it rises to 170 to 230 eggs per year (Syamsari, 1997). Kampung chickens produce fewer eggs than layer hens do. Local chickens are slow-growing and have poor layers of small-sized eggs, but they make wonderful mothers, fine sitters, and foragers (Tadelle, 2003), are hardy (Darwish *et al.*, 1990), and have built-in immunity to common diseases (Dessie *et al.*, 2011). The capacity of kampung chickens to withstand harsh climatic circumstances and

inadequate husbandry practices (environment, handling, hydration, and feeding) without incurring major output losses is one of their most advantageous traits/production characteristics (Dessie *et al.*, 2011). However, due to genetic selection, better feeding, and regular veterinary care, layer hens display exceptional egg production performance. The ability of layer hens to produce eggs ranges from 250 to 280 eggs each year, with egg weights between 50 and 60 g. (Sudarmono, 2003). Compared to kampung chicken, this egg production is higher.

A new strain of native chicken was genetically selected by researchers from Balai Penelitian dan Pengembangan Pertanian (Balitbangtan) Indonesia. KUB chickens are chosen as laying hens and as a breeder that generates a large number of native DOCs. The KUB has two advantages over kampung chickens: a higher egg production rate and a shorter incubation period that allows for quicker egg production.

In recent years, the costumers need naturally produced, high nutritive, no contaminants with chemical and good meat quality. Because native chickens are often raised without the use of antibiotics or pesticides, they are safe and have no detrimental effects on human health (Funaro *et al.*, 2014). Although kampung chickens are only sold in a tiny market, consumers have a strong demand for them since they add value to other poultry products. Numerous researchers performed experiments on Kampung chickens to enhance growth performance and select for body weight in order to address this issue. To meet the growing consumer demand for kampung chicken products, some local breeders have recently begun to apply breeding and selection programs using kampung chickens (Ulfah *et al.*, 2015). Usually, crossbreeding layer chickens with Indonesian kampung chickens is done to increase egg production or the hens' market value (Abubakar *et al.*, 2014). Selection criteria for male Kampung chickens based on the shape of the comb had never been done. Therefore, the purpose of this study is to determine the reproductive efficiency of layer hens bred with KUB roosters. The results of the study are expected to give information and tips for choosing KUB roosters with different types of combs.

## Materials and Methods

This research was conducted at private chicken company in Semanu, Gunungkidul, Indonesia. This chicken is housed in a semi-closed facility that maintains the same temperature and humidity levels. The hens used in this study were a cross between ISA Brown commercial layer type females and kampung chicken males with diverse comb forms. Forty male kampung chickens and 320 layer hens were separated into four groups based on the comb types of the roosters: single, pea, rose, and walnut. Each group contains ten roosters, and

each cage contains one rooster and eight layers; the sex ratio is one to eight. In each day during six days, various kinds of hatching eggs (HE) were collected; each egg was weighed and stored in a holding chamber (18°C; 80% to 85%Rh) for a maximum of six days. The HE was co-hatched with a modern hatching machine for 21 days, beginning on the seventh day of storage in the holding area. Fertility was assessed based on the number of eggs laid, whereas egg hatchability and body weight at the hatch on the day of hatching were considered (were calculated based on total fertile eggs set). Fertility and hatchability were estimated with the following formulas:

$$\text{Fertility (\%)} = \frac{\text{Total number of fertile eggs}}{\text{Total number of egg set}} \times 100\%$$

$$\text{Hatchability (\%)} = \frac{\text{Total number of chicks hatched out}}{\text{Total number of fertile eggs}} \times 100\%$$

**Statistical analysis.** The analysis of variance (Anova) with one-way design was performed using SPSS version 23 for Windows to describe the difference of growth and reproductive performance among groups. A DMRT test was undertaken if a discernible difference existed.

## Results and Discussion

Table 1 shows the egg weight, fertility, hatchability, hatch weight, number of eggs, number of day-old chicks, and number of saleable chicks for laying hens crossed with kampung chickens with different types of combs (Figure 1). Compared to other combs, the single comb had the best egg weight, hatch weight, fertility, number of eggs, and number of DOC. The chick with the walnut comb has the highest hatchability and saleability. Mukhtar and Khan (2012) confirmed these results when they found a link between the size of a chicken's comb and its ability to reproduce and make eggs.

### Egg weight

Tabulated in Table 1 are the Egg Weight Characteristics for the Various Comb Types. KUB roosters with a single comb produce the heaviest eggs (62.94±4.68 g), while those with a pea comb yield the lightest (62.60±4.82 g). Egg weight had a significant ( $P < 0.05$ ) effect on all various types of combs (single, pea, rose and walnut). Scanes *et al.* (2004) state that chickens with large combs and wattles will have greater reproductive and production performance than those with small combs. According to Kirby *et al.* (1994), there is a relationship between comb size and egg production. The greater the size of the comb, the greater the egg production capacity. According to Muharlieni and Rachmawati (2011), kampung chicken eggs weigh 35 to 40 g per egg, layer eggs weigh 55 to 60 g per egg, duck eggs weigh 60 to 65 g per egg, and quail eggs weigh 10 to 12 g per egg. Noor (2004) states that crossing can

increase the proportion of heterozygous gene pairs, making the offspring's appearance superior to the average appearance of the parents for specific traits. Breed differences in the effect of comb phenotype on egg production (Wan *et al.*, 2018).

### Fertility

Crossbreeding KUB roosters with a single comb have the highest fertility (96.30±3.65%), while those with a pea comb have the lowest fertility (91.20±5.85%). The fertility rate significantly affected all types of combs ( $P<0.05$ ). Numerous studies have documented a correlation between the Rose-comb allele and decreased male fertility (Crawford and Smyth, 1964). Heterozygous Rose-comb roosters exhibit normal fertility and transmit an equal number of Rose-comb and wild-type alleles to their offspring. Her genotype at the R locus has been shown to have no effect on the hen's fertility (Crawford and Merritt, 1963). The multiple range test revealed that males carrying the rose comb gene homozygously (RRpp, RRPP) had a significantly ( $P<0.05$ ) shorter duration of fertility than those carrying the pea comb gene homozygously (Buckland, 1965).

### Hatchability

The KUB rooster with a walnut comb has the highest hatchability (91.37±6.84%), whereas those with a pea comb have the lowest (83.80±5.90%). The hatchability percentage had a significant ( $P<0.05$ ) effect on all types of combs. Kampung chicken eggs have a natural hatchability of 72.02% (Iriyanti *et al.*, 2007). Numerous variables have a significant impact on the hatchability of chicken eggs. Many of these are crucial prior to placing the eggs in the incubator. Many of these are crucial. For example, breeder

flock health, nutrition, breed, the age of breeders, and breeder flock management can have a significant impact (Mauldin, 2002). Despite their generally lower fertility, the high hatchability associated with other males carrying the R allele (RRpp, Rrpp, RrPp) was not significantly ( $P>0.05$ ) different from singles for this trait (Buckland, 1965). Numerous factors, including lethal genes, insufficient nutrients in the egg, and exposure to conditions that do not meet the needs of the developing embryo, contribute to the failure of a fertile egg to hatch. A breeder's strain, health, nutrition, flock age, egg size, weight, and quality, as well as how long and how the eggs are stored, all affect how likely it is that the eggs will hatch (King'ori, 2011).

### Hatch weight

Because egg weight varies, hatch weight had a significant ( $P<0.05$ ) impact on all types of combs (single, pea, rose, and walnut). Tullet and Burton (2008) explain that the fresh weight of the egg, the weight lost from the egg during the incubation period, and the weight of the shell and residues at hatch account for the variation in chick weight at hatch. According to Traldi *et al.* (2011), hatchling weight is only affected by egg weight, independent of yolk weight and breeder age. In both experiments, the composition of eggs produced by young and mature breeders was distinct, but hatchling weight relative to egg weight was comparable, varying between 67% and 70%, which is consistent with the 62% to 76% range reported in the literature (Wilson, 1991). Consequently, egg composition does not appear to impact hatchling weight. Traddi *et al.* (2011) say that the differences in protein, lipid, vitamin, mineral, and water content, as well as the differences in albumen and yolk proportions in the eggs laid by breeders of different ages, may

Table 1. Reproductive performance of KUB chicken cross in different comb types

Variable	Comb type			
	Single	Pea	Rose	Walnut
Egg weight (g)	62.94±4.68 <sup>b</sup>	62.60±4.84 <sup>b</sup>	62.64±4.75 <sup>b</sup>	61.92±4.96 <sup>a</sup>
Fertility (%)	96.30±3.65 <sup>b</sup>	91.20±5.24 <sup>a</sup>	95.40±4.16 <sup>ab</sup>	92.10±5.34 <sup>ab</sup>
Hatchability (%)	84.14±8.09 <sup>a</sup>	83.80±5.47 <sup>a</sup>	89.30±5.55 <sup>ab</sup>	91.37±6.84 <sup>b</sup>
Hatch weight (g)	42.86±3.33 <sup>b</sup>	42.45±3.22 <sup>b</sup>	42.28±3.38 <sup>b</sup>	41.32±3.25 <sup>a</sup>
Number of egg	42.10±2.76 <sup>b</sup>	39.80±2.20 <sup>ab</sup>	39.00±2.30 <sup>a</sup>	39.00±2.87 <sup>a</sup>
Number of DOC	30.40±2.87 <sup>b</sup>	28.60±3.50 <sup>ab</sup>	26.60±4.40 <sup>a</sup>	29.90±3.10 <sup>ab</sup>
Saleable chick (%)	98.60±2.27 <sup>ab</sup>	95.80±4.13 <sup>a</sup>	96.90±3.41 <sup>ab</sup>	99.00±1.49 <sup>b</sup>

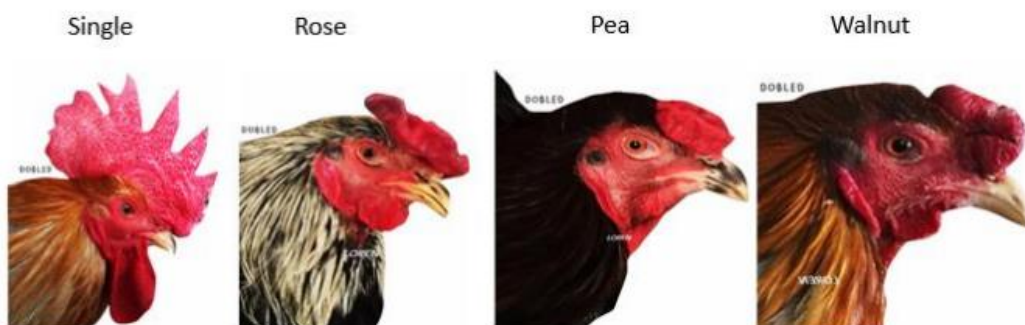


Figure 1. Four comb types of kampung chicken.

Table 2. Growth performance of F1 KUB chicken cross in different comb types

Age	Comb Type			
	Single	Rose	Pea	Walnut
DOC	42.93±2.1 <sup>c</sup>	42.10±3.94 <sup>b</sup>	42.44±3.23 <sup>bc</sup>	41.18±3.57 <sup>a</sup>
4 weeks	259.94±21.13 <sup>d</sup>	260.37±24.25 <sup>d</sup>	251.19±20.21 <sup>a</sup>	247.16±35.37 <sup>a</sup>
8 weeks	652.55±74.03 <sup>ab</sup>	675.15±79.48 <sup>c</sup>	660.75±67.55 <sup>b</sup>	647.88±46.95 <sup>a</sup>
12 weeks <sup>ns</sup>	957.20±38.69	961.05±16.39	963.36±24.89	964.03±24.19

<sup>a,b,c</sup> Means in the same row with different superscript letters are significantly different ( $P < 0.05$ ).

cause the chicks to have a different body composition and different tissue and organ development.

### Number of egg

Crossbred KUB roosters with a single comb produce the highest proportion of eggs (42.10±2.76). The number of eggs had a significant effect ( $P < 0.05$ ) on the single comb, rose comb, and walnut comb, but not on the pea comb, because its body weight varied. According to Resnawati and Ida (2006), there is a negative correlation between body mass and egg production. A large hen will lay fewer, but larger, eggs than a smaller hen. According to Suryana and Hasbianto (2008), the productivity of kampung chicken varies depending on the system of rearing and the variety of individuals. The adult body, age, body weight, plumage color, and level of adaptation constitute the kampung chicken's diversity. The topography of the area where kampung chickens are raised also affects their performance.

### Number of DOC

The crossbred KUB rooster with a single comb has the highest proportion of DOC (30.40±2.87). The number of DOCs had a significant effect ( $P < 0.05$ ) between single comb and rose comb, but not between pea and walnut comb; the number of DOCs can affect fertility and hatchability. Mauldin (2002) notes that a number of these are crucial well before the eggs are placed in the incubator. In terms of hatchability, factors such as breeder flock health, nutrition, breed, breeder age, and breeder flock management can have a significant impact. Several studies conducted in the second half of incubation on the effect of a high eggshell temperature (EST) on incubation parameters demonstrated that a high EST increased late embryonic mortality and decreased hatchability (Lourens *et al.*, 2007).

### Saleable chick

Crossbreeding KUB rooster with walnut comb produced the highest percentage of saleable chicks (99.00±4.68 g), while pea comb produced the lowest percentage (62.60±4.84 g), which was influenced by the incubation procedure. Egg storage length and conditions, breeder flock age and genotype, incubation conditions, incubation types, and post-hatch management are all environmental factors that affect chick quality. Chick quality is determined using both quantitative and qualitative measures. Morphological measurements such as chick weight, chick length,

leg length, chest circumference, and shank diameter are among the quantitative approaches used. The qualitative methods used to determine chick quality are visual assessment methods known as the Pasgar and Tona scores. In recent years, researchers have used the Tona and Pasgar methods a lot to figure out how different environmental practices affect the quality of chicks (Narinç and Aydemir, 2021).

### Growth performance

DOC comb type groups had a significant effect on DOC body weight at 4 and 8 weeks of age ( $P < 0.05$ ), but had no effect at 12 weeks of age ( $P > 0.05$ ). The maximum body weight is displayed in the rose comb type. In comparison to Creswell and Gunawan (1982) and Hidayat and Asmarasari (2015) in Kampung chicken (without crossing), the KUB chicken cross weighs more than Kampung chicken.

### Conclusions

Overall, the single comb type had the best reproductive performance when compared to other comb types, whereas the rose comb type had the largest body weight.

### Acknowledgement

The Indonesian Directorate General of Higher Education (DIKTI) PDUPT 2018 grant scheme and contract No. 105/UN1/DITLIT/DITLIT/LT/2018 sponsored this study. The officers at Adijaya Unindo Perkasa, Semanu, are also thanked for the help and cooperation they gave during the raising of the birds and collecting of data.

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