

# Evaluation of the Grade of Hatching Eggs of Sensi-1 Agrinak and KUB Crossbred Chicken on Hatching and Production Performances

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**Abstract.** The potential of Sensi-1 Agrinak and KUB crossbred so-called SENKUB chicken as dual-purpose chicken can be increased by selecting hatching egg weights to get DOC with good quality. The study was conducted to evaluate the grades of hatching eggs of SENKUB chicken on hatching and production performances. The complete randomized design was applied in this experiment with 3 treatments. The treatments are the grades of hatching egg (small 36-40 g, medium 41-45 g, and large 46-50 g). The hatching process used two stages hatching machine. All DOCs were selected according to the Indonesia National Standard (SNI). The selected DOCs were raised in different pens to evaluate the production performances. The hatching showed that the large eggs have significantly the highest fertility, hatchability, hatching weight, and salable chick but the lowest weight loss. Embryo mortality was the same between different hatching egg grades. The best-weight DOC was obtained from medium and large hatching eggs. The hatching egg grades do not significantly affect the production performances of the hatched chicken. However, the chickens with small and large hatching eggs resulted in better production performance.

**Keywords:** Hatching egg weight, hatching performance, production performance, Sensi-1 Agrinak and KUB crossbred chicken

**Abstrak.** Potensi ayam persilangan Sensi-1 Agrinak dan KUB atau disebut SENKUB sebagai ayam dwiguna dapat ditingkatkan dengan memilih bobot telur tetas untuk mendapatkan DOC yang berkualitas baik. Penelitian ini dilakukan untuk mengevaluasi grade telur tetas ayam persilangan ini terhadap performa penetasan dan produksi. Rancangan acak lengkap diterapkan dalam percobaan ini dengan 3 perlakuan. Perlakuan yang diberikan adalah grade bobot telur tetas (kecil 36-40 g, sedang 41-45 g, dan besar 46-50 g). Proses penetasan menggunakan mesin tetas dua tahap. Semua DOC dipilih sesuai dengan Standar Nasional Indonesia (SNI). DOC yang dipilih dipelihara di kandang yang berbeda untuk mengevaluasi performa produksi. Hasil penetasan menunjukkan bahwa telur bobot besar secara nyata memiliki fertilitas, daya tetas, bobot tetas, dan salable chick paling tinggi tetapi susut bobotnya paling rendah. Mortalitas embrio tetap sama antara bobot telur tetas. Bobot DOC terbaik diperoleh dari telur tetas sedang dan besar. Grade telur tetas tidak berpengaruh secara nyata terhadap performa produksi hasil tetas ayamnya. Namun, ayam dari bobot telur tetas kecil dan besar menghasilkan performa produksi yang lebih baik.

**Kata kunci:** Ayam persilangan Sensi-1 Agrinak dan KUB, bobot telur tetas, performa penetasan, performa produksi

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## Introduction

KUB (*Kampung Unggul Balitbangtan*) and Sensi-1 Agrinak chickens were derived from the research of *Balai Penelitian Ternak (Balitnak)* Ciawi. KUB chicken is a layer-type and has been certified by a Decree of the Minister of Agriculture No. 698/Lpts/PD. 410/2/2013. KUB chickens have a high egg production with peak production of 65%-70% at the age of 30-35 weeks (Puslitbangnak, 2017). Besides KUB, *Balai Penelitian Ternak (Balitnak)* Ciawi produces

Sensi-1 Agrinak which is a meat-type chickens. Crossing KUB chicken as the female line and Sensi-1 Agrinak as the male line results in the so-called Senkub chicken (Puslitbangnak, 2017). (Subiharta and Prabowo, 2020) reported that the harvest age of Senkub at 56 days with suitable feed resulted in a body weight of  $834.35 \pm 45.63$  g, which is generally higher than other local chickens. Senkub chicken is developed to become a dual-purpose local chicken.

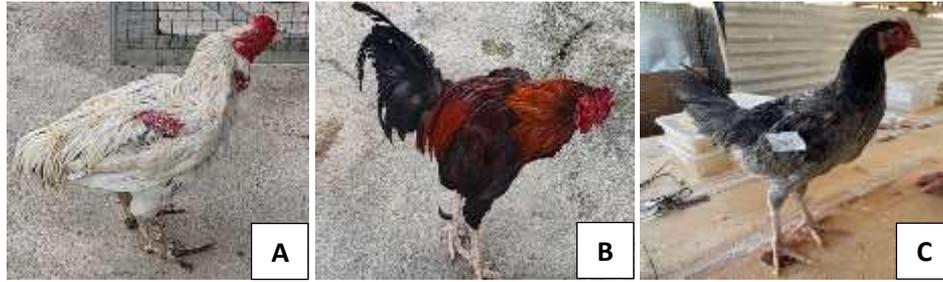


Figure 1. Sensi-1 Agrinak (A), KUB (B), and Senkub (C) chicken

The good quality of DOC is a key factor in the success and improvement of local chickens. Appropriate hatching management is the requirement for the developing process of the embryo to become chicks of good quality. Before the incubating process, the hatching eggs are selected according to their weight to get uniform DOC. Generally, the farmers put only hatching eggs into incubators without selecting the egg weight. It is presumably causing deterioration in hatching results because egg weight influences hatchability (Bassareh and Rezaeipour, 2021). Medium-weight eggs in the range of 45 to 56 g resulted in higher hatchability compared to smaller or larger eggs (Iqbal et al., 2016). Egg weight affects the proportion of egg contents, whereas small and medium eggs have a larger yolk ratio than larger eggs. Yolks provide nutrition for embryo development (Ulmer-Franco et al., 2010). Egg weight correlates positively with hatchling weight. (Setianto et al., 2015) reported that larger eggs provide more sufficient nutrients for embryo development during incubation. Therefore, it was resulting in heavier DOC. The weight of DOC ranges from 66% to 68% of egg weight (Cobb, 2015). Based on these facts, this research is done to evaluate the influence of the grade of hatching egg weight of Sensi-1 Agrinak and KUB crossbred on the hatching performance and to observe the production performance during raising these chickens in the stable.

## Materials and Methods

This study was carried out from January to April 2022 and took place at Usaha Kampung Asli

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### Hatching Trial

A total of 245 hatching eggs of SENKUB chicken were used and consisted of 40 small eggs weight, 125 medium eggs weight, and 80 large eggs weight. The hatching eggs were weight sorted from 36-50 g (Puslitbangnak, 2017). The hatching egg weights were grouped into 3 grades, namely small 36-40 g, medium 41-45 g, and large 46-50 g. Egg collection was carried out for 5 days according to the result of the previous author's research regarding the effect of egg time storage on SENKUB chickens. The hatching eggs were put into the setter machine for 18 days. The process of egg candling and transferring to the hatcher machine was carried out on day 18. The eggs were then placed into the hatcher machine for 3 days. DOC harvesting (pull chick) was carried out on day 21.

Weight loss (Susanti et al., 2015), percentage of fertility (Fitrah and Sudrajat, 2018), percentage of hatchability (Fitrah and Sudrajat, 2018), percentage of embryo mortality (Ardian et al., 2016), hatch weight (Burhanudin et al., 2019), and percentage of salable chick (Burhanudin et al., 2019) was observed during the hatching trial.

### Chicken Rearing

In the first 3 weeks, all chicks were kept in a cage with a brooder to warm the chickens. After 3 weeks of age, chickens were kept in slat cages.

Chickens were placed into 3 treatments according to grade category in hatching trials. Each treatment consisted of 3 replications with 10 chickens each. The cage was equipped with a drinker and feeder. A thermometer and hygrometer were set up to measure the microclimatic condition. Chicken fed commercial feed for starter age (1-3 weeks old) and grower-finisher phase (4-9 weeks of age). Water was freely available. Chickens were slaughtered on day 63. Slaughtering followed the standard regulation.

Production performances such as initial body weight, feed intake, slaughter weight, and carcass weight (Nurmi et al., 2018) were measured. Body weight gain and feed conversion were then calculated (Qurniawan, 2016) as well as the mortality (Nurmi et al., 2018). Microclimatic condition (temperature and relative humidity) was measured 4 times daily: morning (at 07.00 WITA), noon (at 20.00 WITA), afternoon (at 17.00 WITA), and evening (at 22.00 WITA). THI (temperature humidity index) in °C was calculated based on the formula of Tao and Xin (2003).

### Statistical Analysis

The hatching trial was subjected to a completely randomized design (Matjjik and Sumertajaya, 2006) with 3 treatments i.e. small egg (36-40 g), medium egg (41-45 g), and large egg (46-50 g), and it was replicated 5 times. The rearing trial was set up with a completely randomized design with 3 treatments and replicated 3 times. Data were subjected to variance analysis and tested by Tukey.

Microclimatic data were descriptively analyzed (Lambey et al., 2013).

## Results and Discussion

### Hatching Performance

The hatching performance is shown in Table 1. The egg grade of SENKUB chicken affected significantly ( $P < 0.01$ ) the hatching performance on egg weight loss, hatch weight, and salable chick. Meanwhile, fertility, hatchability, and embryo mortality did not differ.

Small eggs have a larger egg surface area compared to larger eggs. Eggs with a larger surface area evaporate water faster (Şekeroğlu et al., 2016). Ulmer-Franco et al. (2010) reported that weight loss affects egg weight. Large eggs have a higher percentage of albumen and water content than smaller eggs. Large eggs, therefore, increase weight loss.

Hatch weight was influenced by egg weight. The greater the egg weight, the higher the hatching weight. The smaller the egg weight loss correspondent with lower hatch weight. (Bassareh and Rezaeipour, 2021) found that hatch weight had a significant effect on egg weight. The greater weight of the hatched eggs, the greater the hatching weight. Setianto et al. (2015) mentioned that hatch weight showed a high correlation with egg weight as food reserves for embryo development were available more in large eggs.

Salable chicks in this study were selected according to SNI (Indonesia National Standard) by examining the qualitative criteria (physical condition of chicks) and quantitative criteria (chick weight).

Table 1. Hatching performance of Senkub chicken from different egg grades (means  $\pm$  sd)

| Traits               | Egg Grade                      |                                |                                |
|----------------------|--------------------------------|--------------------------------|--------------------------------|
|                      | Small (36-40 g)                | Medium (41-45 g)               | Large (46-50 g)                |
| Weight loss (%)      | 14.21 $\pm$ 0.90 <sup>A</sup>  | 13.48 $\pm$ 0.55 <sup>A</sup>  | 11.70 $\pm$ 0.23 <sup>B</sup>  |
| Fertility (%)        | 77.50 $\pm$ 14.58              | 87.20 $\pm$ 2.99               | 87.50 $\pm$ 3.95               |
| Hatchability (%)     | 75.98 $\pm$ 10.82              | 82.83 $\pm$ 8.25               | 82.73 $\pm$ 17.29              |
| Hatch weight (g)     | 24.56 $\pm$ 0.59 <sup>C</sup>  | 27.06 $\pm$ 0.51 <sup>B</sup>  | 30.21 $\pm$ 0.21 <sup>A</sup>  |
| Salable chick (%)    | 12.86 $\pm$ 19.38 <sup>C</sup> | 77.50 $\pm$ 11.93 <sup>B</sup> | 100.00 $\pm$ 0.00 <sup>A</sup> |
| Embryo mortality (%) | 34.52 $\pm$ 20.45              | 21.97 $\pm$ 12.57              | 28.40 $\pm$ 36.41              |

<sup>A, B, C</sup> Different superscripts in the same line shows a highly significant effect ( $P < 0.01$ ); sd = standard deviation

Table 2. Production performance of Senkub chicken from different egg grades during starter and finisher periods (mean  $\pm$  sd)

| Parameter             | Egg grade                      |                                 |                                |
|-----------------------|--------------------------------|---------------------------------|--------------------------------|
|                       | Small<br>(36-40 g)             | Medium<br>(41-45 g)             | Large<br>(46-50 g)             |
| Feed intake (g)       |                                |                                 |                                |
| Starter               | 282.24 $\pm$ 2.36 <sup>a</sup> | 286.37 $\pm$ 0.42 <sup>b</sup>  | 286.43 $\pm$ 0.21 <sup>b</sup> |
| Grower-Finisher       | 2363.10 $\pm$ 2.37             | 2362.47 $\pm$ 8.38              | 2367.43 $\pm$ 0.21             |
| Body weight gain (g)  |                                |                                 |                                |
| Starter               | 264.19 $\pm$ 9.41              | 270.47 $\pm$ 4.02               | 275.23 $\pm$ 6.27              |
| Grower-Finisher       | 798.52 $\pm$ 33.63             | 764.17 $\pm$ 24.90              | 798.77 $\pm$ 46.57             |
| FCR                   |                                |                                 |                                |
| Starter               | 1.07 $\pm$ 0.03                | 1.06 $\pm$ 0.01                 | 1.04 $\pm$ 0.02                |
| Grower-Finisher       | 2.96 $\pm$ 0.13                | 3.09 $\pm$ 0.10                 | 2.97 $\pm$ 0.17                |
| Final body weight (g) |                                |                                 |                                |
| Starter               | 174.24 $\pm$ 4.27 <sup>a</sup> | 181.17 $\pm$ 3.07 <sup>ab</sup> | 185.50 $\pm$ 2.28 <sup>b</sup> |
| Grower-Finisher       | 822.67 $\pm$ 34.03             | 792.17 $\pm$ 24.91              | 828.53 $\pm$ 46.25             |
| Carcass (%)           | 64.21 $\pm$ 1.00               | 63.38 $\pm$ 3.60                | 65.95 $\pm$ 0.39               |

<sup>a, b, c</sup> Different superscripts in the same line shows a significant effect ( $P < 0.05$ ); FCR = feed conversion ratio; sd = standard deviation

Regarding the amount of food reserve in the egg, larger eggs consequently had larger hatch weights than the small egg. Therefore, large and medium eggs resulted in higher salable chicks. The large egg remained the highest percentage of salable chicks. Melese et al. (2017) reported that chicks with a wet navel, red feet, or other abnormalities were culled because they do not meet the commercial hatchery standards for sale. These poor chick qualities may be caused by incorrect temperature and humidity during settings in the incubator. Higher or lower temperatures than standard during the end of the incubation period can cause a wet navel. Poor sanitation in the hatchery possibly increases the infection of embryos and triggers omphalitis (navel inflammation). In conclusion, eggs for hatching purposes in the range of 41-50 g produced maximum hatching performance.

### Production Performance

Senkub chickens were raised for 9 weeks and fed the same starter diet (0-3 weeks of age) and grower-finisher diet (4-9 weeks of age). Starter ration contents of 24% protein and 3150 kcal energy. Meanwhile, finisher ration contents of 21% protein and 3100 kcal. These nutritional contents are following SNI (Indonesia National

Standard) for ration. The production performance of Senkub chicken during the starter and finisher periods is shown in Table 2.

Senkub chicken from different egg grades differed significantly ( $P < 0.05$ ) in feed intake and final body weight at the starter period, but they did not differ significantly in all production performances at the end of the experiment. The small egg grade significantly produced the lightest hatch weight and the lowest feed intake at the starter period. During the grower-finisher period, the chicks compensated for their growth by increasing feed intake and eventuated the heaviest by the end of the experiment. Statistically, however, it had no significant impact on the FCR and carcass percentage.

Senkub chicken from small eggs was the lightest compared to others (Table 1). This has impacts on traits in the starter period. During the starter period, chicken originating from medium and large eggs consumed more feed than chicken from small eggs. Regardless of the statistics, the chicken from small egg grade and large egg tended to show better growth and covert feed more efficiently compared to chicken from medium grade. Chicken from large eggs weighed most at the end of the starter period. Entering the finisher, the chicken from

small eggs grew more than the chicken from medium and gain as fast as the chicken from large eggs by the end of the rearing period. By the end of the experiment in week 9, the final body weight of the chicken from the small egg was greater than chickens from medium egg grade and even almost the same weight as the chicken from a large egg. This indicated that chicken from small eggs responds better and can compensate for the performance. It seems that chickens with small eggs tend to respond better to high protein feed and use it to compensate for the growth to be alike chickens with large eggs in the grower-finisher period. Iqbal et al. (2017) mentioned that the growth of chicks in the first 3 weeks is influenced by egg weight but after entering the fourth week until harvest, the relationship between egg weight and chicken body weight decreases with the increasing age of chickens. This case is in line with the finding of this trial. The same pattern was observed in the feed conversion ratio.

The body weight of the chickens in the case was higher when compared to the parental lines, Puslitbangnak (2017) that the average body weight of Sensi-1 Agrinak chickens at the age of 10 weeks (70 days) can reach 905.5 g, while the average body weight of KUB chickens at the age of 9 weeks (63 days) reaches 776 g.

However, regardless of the statistical analysis, the chicken from small eggs and large eggs are beneficial to raise because they convert feed more efficiently, grow better, and result in the same end body weight as chickens from medium eggs.

### Microclimatic Condition

The microclimatic conditions in stable comprise of temperature, humidity, and THI (temperature humidity index) is shown in Figure 2.

The temperature has a direct impact on the comfort and productivity of chickens. The average daily temperature of pens during this study ranged from 28.33-30.57 °C. The temperature inside the pens was higher than the ambient temperature because the heat inside the pens accumulates from the radiation of sunlight and metabolic production. Syahrudin et al. (2013) that the chicks require high temperatures in the starter phase since they do not have sweat glands and incomplete feather covers. Rahmawati et al. (2017) mentioned that the optimum environmental temperature in the tropic for local chicken ranges from 18-28 °C which relates directly to humidity. The higher the temperature, the lower the humidity. The average daily humidity of the pens during this study ranged from 60.67%-76.60%. Gouda et al. (2020) reported that 68.5%-76.5% relative humidity is comfortable for chickens.

The temperature and humidity during rearing in this experiment are above the comfort zone. The high temperature and humidity of the stable can be a major cause of stress for chickens and lower production performance. Elevate environmental temperature and extreme fluctuations of environmental temperature affect the physiology of the chickens (Syaefullah et al., 2021).

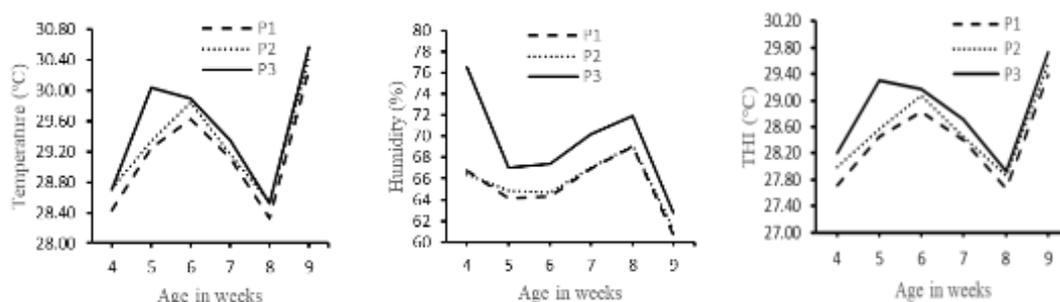


Figure 2. Microclimatic in pen 1 (small egg), pen 2 (medium egg), pen 3 (large egg)

High temperatures cause stress to the chickens and high humidity leads to disruption of the chicken's respiratory system (Fahrina et al., 2021). THI values during rearing in this study ranged from 27.66 to 29.73 °C categorized as moderate to high which is not comfortable for chickens.

Rahmawati et al. (2017) and Qurniawan (2016) mentioned that the microclimatic above a comfortable zone can reduce feed intake and decrease body weight. The fluctuating microclimatic during the study indicated that the chickens experience uncomfortable conditions.

Microclimatic stress has a relation with high FCR. When chicken experience stress, their body responds by mobilizing glucose to be converted into energy to cope with stress, and less energy is converted into body weight (Tagueha et al., 2018). Stress exposure to chickens from medium eggs is observed from high pecking incidents among the chickens that result in discomfort thus lowering feed intake and body weight gain. The percentage of the carcass weight in this study was the same but it was better compared to other local chickens in general. Antara et al. (2017) that the percentage of carcass weight of native chickens aged 10 weeks with the provision of commercial ration of 55.81%. The body weight and carcass percentage of Senkub chickens are better than the parental lines. Hanafi et al. (2022) reported that the average percentage of Sensi-1 Agrinak chicken carcasses reared for 10 weeks yielded a value of 61.35%, and Ayu et al. (2016) that the average percentage of KUB chicken carcasses reared for 16 weeks was 59%. The heterosis effect may exist from the cross of different breeds, demonstrating an increase in body weight and carcass weight percentage in the Senkub chickens. Darwati et al. (2017) that the heterosis effect can be obtained by crossing different chicken breeds. The crossing in breeding program is defined as the increased hybrid productivity compared to the parental breeds (Sumantri et al., 2020).

## Conclusions

Large egg (46-50 g) shows the lowest weight loss, highest hatched weight and highest salable chick. Different egg weight grades have the same fertility, hatchability, and embryo mortality. Chickens from small and large eggs perform better production performance.

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