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Comparison Production and Reproduction Performance of Muscovy Duck from Different Regions

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ABSTRACT

Productivity includes the performance production and reproduction of female muscovy duck (duck), normally influenced by genetic and environmental factors. The research objective was to study the production, reproduction performance, and the adaptibility of female Muscovy duck based on the region of origin. The research method used an experimental method with a completely randomized design pattern of 4 treatment areas of origin of the duck, namely K1 (Cirebon), K2 (Indramayu), K3 (Majalengka), and K4 (Kuningan) with the treatment being repeated 5 times. Observations were made on 120 females who were mated to 20 males with a sex ratio of 1: 6. Data analysis was performed using ANOVA method with Duncan's advanced test. The results showed that the production, reproduction performance, the adaptibility of the duck were varied (the adaptability of duck highly affected production and reproduction performance). The duck from Kuningan has the best production and reproductive performance at sexual maturity with the criteria of age 167.4 days, body weight 1.718.6 g, first egg weight 61.0 g, food (ransum) consumption of 136 grams, and number of eggs 127. 0 items.

Keywords: Production and reproduction, performance, muscovy duck, regions of origin

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INTRODUCTION

The role of poultry in producing meat has received high attention, especially muscovy duck livestock in recent years. Muscovy duck (duck) is a waterfowl as a meat producer that has long been maintained in Indonesia, especially in rural areas. The easy maintenance of duck is very attractive for the community to raise livestock with the aim of food security and additional income for the family [1]. The potential of the duck is very strategic as a meat producer and as an economic support for local communities [2].

The productivity of muscovy duck in the Ciayumajakuning area (Cirebon, Indramayu, Majalengka, and Kuningan) has not been maximal [3]. Efforts to increase the productivity of the muscovy duck can be done through the provision of superior seeds which are supported by feeding and good management [4]. The formation of superior seeds can be through selection of production and reproduction performance [5]. The muscovy duck from Cirebon, Indramayu, Majalengka, and Kuningan are local which are thought to have superior production and reproduction performance in West Java. Production performance includes food (ransum) consumption, body weight, egg production, and food conversion [6]. Reproductive performance of the muscovy duck on sexual maturity includes age, body weight, first egg weight, shape index, fertility, hatchability, embryo mortality, hatching weight, and quality of Days Old Duck (DOD) [7].

Regional differences can cause differences in the productivity of the muscovy duck. Different seasons, temperature, humidity, and environmental pressure can also give rise to diversity of biological characteristics [8]. This diversity will result in a variety of qualitative and quantitative characteristics of the muscovy duck [9]. The diversity of quantitative properties is manifested in the diversity of the productivity of the the muscovy duck. Thus, the diversity of productivity can be used as a guide in the muscovy duck selection [10]. Muscovy duck selection is very important in the development of the muscovy duck productivity in the future [11].

Development of the muscovy duck as germplasm for various purposes, including conservation and production [12]. It is necessary to start by collecting baseline data on biological characteristics, such as qualitative traits (coat color, shank, and beak) and quantitative traits (body size) [13]. Biological diversity in populations is the product of interactions among evolutionary forces, such as selection, migration, mutation, maintenance management, and environmental stresses that the muscovy ducks have experienced over the years [14] [15]. Such population diversity can be used as a guide in selecting the muscovy duck for various purposes [16].

Research on the evaluation of production and reproduction performance of the muscovy duck is very important to determine the best quality for further seedlings [17]. Previously, performance comparisons of male muscovy duck have been carried out [6], [18]. However, there are not many studies on the comparison of production and reproduction performance of female muscovy ducks [19]. As a case study, this study aims to compare the productivity of the muscovy duck originating from Cirebon, Indramayu, Majalengka, and Kuningan.

MATERIALS AND METHODS

Materials

The muscovy ducks of 120 and 20 adult females and males, respectively, came from Cirebon, Indramayu, Majalengka, and Kuningan as many as 30 females and 5 males respectively with a sex ratio of 1: 6. The research enclosur was 20 units cages with a size of 4 x 1 meter. Each cage was equipped with a nest, a place to eat and drink. The feed given contains 18-20% crude protein and 2800 kcal / kg metabolic energy. The muscovy duck eggs are hatched using an electric hatching machine. Additional equipment used was a digital scale and calipers.

Method

The experimental research method used a completely randomized design with 4 treatments to the area of origin of muscovy duck, namely K1 (Cirebon), K2 (Indramayu), K3 (Majalengka), and K4 (Kuningan) with 5 repetitions. The variables for determining the quality of production were body weight, food consumption, and egg production, while the variables for reproductive quality consisted of age, egg weight, and body weight of the Muscovy ducks when they first laid eggs (Figure 1).

The research process of the Muscovy duck was carried out in the following steps: (i) Weighing, numbering, coding, and classifying 120 females and 20 males into 20 cages (Figure 2a); (ii) Adaptation to new environmental conditions; (iii) Natural marriage at the age of 7 months with a sex ratio of 1: 6 (Figure 2b); (iv) Collect eggs, clean, weigh, code and number eggs according to treatment (Figure 2c); (v) Hatching eggs for 35 days using 4 units of hatching machines with a capacity of 100 eggs (Figure 2d). Hatching procedure: the hatching machine is cleaned then fumigated using KMnO4 and formalin, let stand for 24 hours, the hatching machine is turned on the temperature is 38-39oC with 70% relative humidity for 32 days and 40-41oC for 3 days, after the temperature is stable the eggs are put in, egg turning is done 3 times a day (24.00, 08.00 and 16.00) from day 4 to day 30. Candling was carried out 3 times, namely on the 7th, 14th and 24th days. Muscovy duck eggs hatched on the 33-35 days; (vi) Handling of the duckling is done by weighing, counting the number of those to obtain hatchability and mortality, and scoring their body and health to obtain sellable duck.

Research Process presented in Figure 1.

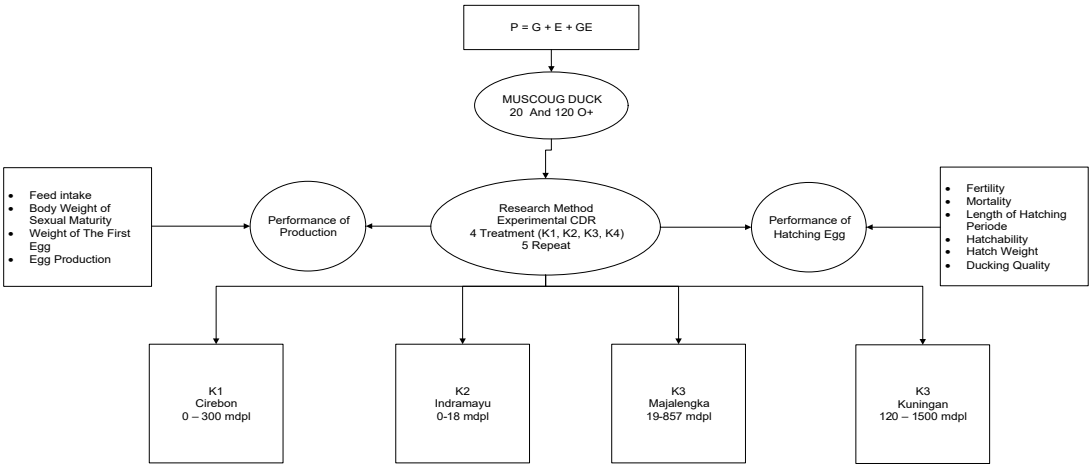

Figure 1. Research Process

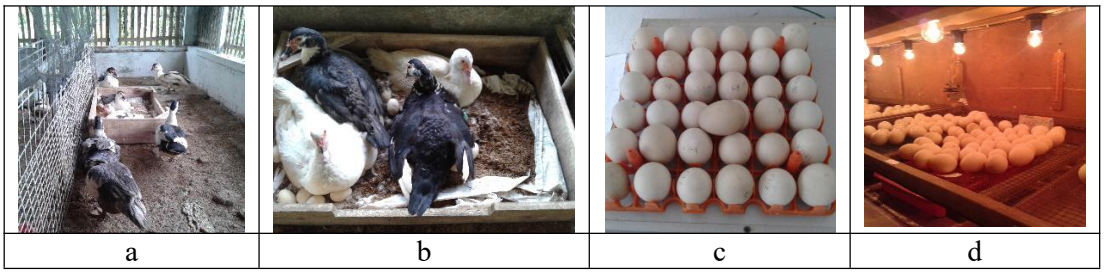

Figure 2. Muscovy duck research process.

Data Analysis

Furthermore, the recorded data were analyzed using ANOVA and testing the differences between treatments using Duncan's multiple range test.

RESULT

Production Performance

The productive performance of female the Muscovy duck es is presented in Table 1. Muscovy duck originating from Kuningan and Majalengka show a significant difference (P <0.05) in achieving sexual maturity faster than those from Cirebon and Indramayu. The average achieved sexual maturity of the Muscovy duck from Kuningan and Majalengka were 167.4 days (5.58 months) and 169.6 days (5.65 months) while those from Cirebon and Indramayu were 194.6 days (6.49 months) and 206.4 days (6.88 months). The difference was presumably because the types of of the Muscovy duck from Kuningan and Majalengka quickly adapt more to environmental conditions, while those from Indramayu and Cirebon require different adaptation times to previous environmental conditions.

The body weight of the Muscovy duck when the condition reached sexual maturity did not show any significant difference (P> 0.05). This can be caused by the consumption of food that is not significantly different, the feed given has the same quality and quantity so that the body weight when it reaches sexual maturity is almost the same and the application of maintenance management is also the same. The results showed that the body weight of the Muscovy duck at sexual maturity was around 1,683-1,719 grams. The average body weight of the Muscovy duck starting from the highest to the lowest for the respective regions of origin of Indramayu,

Kuningan, Majalengka, and Cirebon is 1,756 grams, 1,716 grams, 1,678 grams, and 1,674 grams, respectively.

Table 1. Production and Reproduction Performance of the Muscovy duck Female

Characteristics	Muscovy duck			
	K1	K2	K3	K4
a. Production Performance at sexual maturity				
Feed consumption (grams)	137[a]	138,33[a]	138[a]	136[a]
Eggs number (egg)	130,4[a]	79,2[a]	126,0[a]	127,0[a]
Age (days)	194,6[b]	206,4[b]	169,6[a]	167,4[a]
Body weight (grams)	1.683,8[a]	1.719,0[a]	1.686,6[a]	1.718,6[a]
First egg weight (g)	73,0[b]	62,0[a]	60,0[a]	61,0[a]
b. b. Reproductive Performance				
Shape index	76,57[a]	75,82[a]	75,48[a]	75,67[a]
Egg weight (g)	77,8[a]	70,9[a]	71,5[a]	76,5[a]
Fertility (%)	94,8[b]	93,5[b]	94,8[b]	82,0[a]
Mortality (%)	24,4[b]	21,7[b]	13,9[a]	21,7[b]
- Early mortality (%)	11,3[a]	10,2[a]	7,8[b]	10,6[a]
- Late mortality (%)	13,1[a]	11,5[a]	6,1[b]	11,1[a]
Length of hatching (days)	33,0[a]	33,6[a]	34,4[b]	32,8[a]
Hatchability (%)	72,9[a]	78,2[a]	81,6[a]	76,0[a]
Hatch weight (g)	42,9[a]	40,9[a]	41,8[a]	44,2[a]
Duckling Quality / Sellable duck	97,2[a]	96,0[a]	97,2[a]	96,0[a]

Means in the same row with different superscript differ significantly (P<0.05)
Note: K1 (Cirebon), K2 (Indramayu), K3 (Majalengka), and K4 (Kuningan)

The first egg weight of the Muscovy duck from Cirebon showed a significant difference (P <0.05), which was higher than the average weight of Indramayu, Majalengka, and Kuningan. This difference is thought to be due to a genetic influence from the parents passed on to the offspring. The Muscovy duck from Cirebon has a fairly high body weight so it also affects egg weight. This difference is thought to be due to differences in the adaptability of the Muscovy duck to environmental conditions. Adaptation from a hot to a cooler environment requires sufficient time and energy for primary living and egg production.

The basic population consumption of the Muscovy duck food ingredients showed no significant difference (P> 0.05). The average food ingredients consumption ranges from 151.1 - 153.7 grams. The order of the average consumption of food ingredients (grams / head / day) of the Muscovy duck from the lowest to the highest from Kuningan, Cirebon, Majalengka, and Indramayu were 151.1; 152.2; 153.3; and 153.7 respectively. This is presumably because the food given during the study had the same quality and quantity. The consumption of food will be the same in each mixture that has the same metabolic energy and protein content. Food consumption can also be affected by palatability, physical properties, and chemical properties of ingredients. Palatability includes aroma, texture and blend color. The physical properties of the concoction include forms including mash, crumble, and pellets. The chemical properties of the ingredients include nutritional content, including crude protein, crude fat, minerals, vitamins, and metabolic energy.

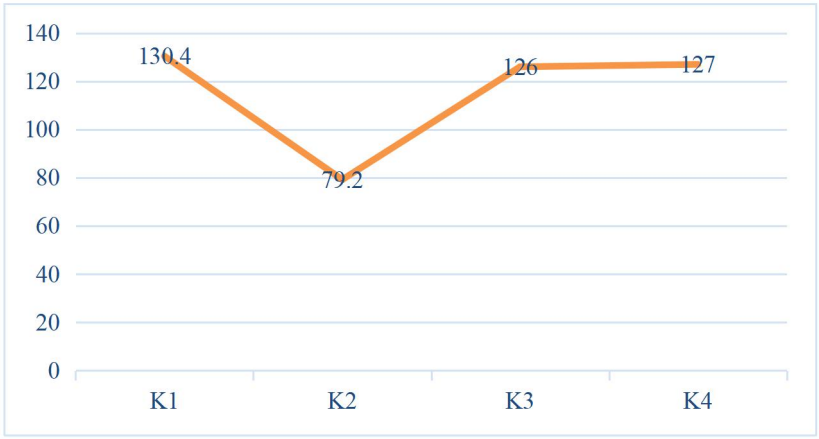

Figure 3. Eggs Number of Muscovy duck.

The number of eggs of the Muscovy duck did not show a significant difference (P> 0.05), both from Cirebon of 130.4, Indramayu of 79.0, Majalengka of 126.0, and Kuningan of 127.0 eggs (Figure 3). Those were due to the

variation in the age at which the Muscovy duck first laid eggs. The age at first laying of eggs indicates that the Muscovy duck was sexual maturity, although ovulation may have occurred. The number of eggs was also influenced by maintenance management such as the way of feeding, as well as the treatment of breeders before the ducks were lifted into intensive cages which their ages were also different. When it is related between the average egg production obtained with the nutritional quality of the feed used in the three study sites, there was a positive relationship.

Reproductive Performance

The embryo mortality of the Muscovy duck originating from Majalengka showed a significant difference (P <0.05) lower than that from Cirebon, Indramayu, and Kuningan. The composition of the average embryo mortality from the lowest to the highest were Majalengka around 6.95%, Kuningan around 10.85%, Indramayu around 10.85%, and Cirebon around 12.2%. This difference occurs because the size of the Muscovy duck eggs from Majalengka was smaller and uniform than the others so that the heat reception in the eggs was more evenly so that the embryo can develop properly and the mortality was lower.

The egg fertility of the Muscovy duck from Cirebon, Indramayu, Majalengka showed a significant difference (P <0.05) higher than that of eggs originating from Kuningan. The composition of the highest to the lowest fertility rates in each region were Cirebon 94.8%, Majalengka 94.8%, Indramayu 93.5%, and 82.0%. This difference was thought to have occurred due to the low consumption of ingredients which resulted in low quality eggs.

The duration of hatching of the Muscovy duck from Cirebon, Indramayu, and Kuningan showed a significant difference (P <0.05) faster than those from Majalengka. The composition of the hatching average length from the fastest to the late one for each region were Cirebon 32.0 days, Indramayu 32.6 days, Kuningan 32.8 days, and Majalengka 34.4 days. This difference was thought to be due to differences in heat acceptance of eggs and egg size where the sizes from Majalengka were smaller than eggs from Cirebon, Indramayu, and Kuningan.

The hatchability of the Muscovy duck from Majalengka showed a significant difference (P <0.05) higher than that of Cirebon, Indramayu, and Kuningan. The composition of the average hatchability from the highest to the lowest in each region were Majalengka 81.6%, Indramayu 78.2%, Kuningan 76.0%, and Cirebon 72.9%. This difference was thought to be due to the medium size of the eggs from Majalengka so that the heat reaching the surface of the eggs was more evenly distributed and was very good for embryo development.

Hatching weight of the Muscovy duck showed no significant difference (P> 0.05). The composition of the average hatch weight from the highest to the lowest in each region were Kuningan 44.2 grams, Cirebon 42.9 grams, Majalengka 41.8 grams, and Indramayu 40.9 grams. The hatching weight of the Muscovy duck from Kuningan was higher because it has a higher egg weight than those from Cirebon, Majalengka, and Indramayu.

The duckling quality of sellable duck did not show any significant difference (P> 0.05). The composition of the sellable duck from the highest to the lowest were Majalengka 97.2%, Cirebon 97.2%, Indramayu 96.0%, and Kuningan 96.0%. This was thought to be due to good temperature and hatch management as well as good egg quality.

DISCUSSION

Sexual maturity can be influenced by the environment, quality and quantity of feed [20]. The quality and quantity of feed given in this study were the same. The results of this study agree with [11] who obtained the age of sexual maturity ranging from 5-6 months, faster than the results of the study [21] who obtained the age of sexual maturity at the age of 189.13 - 214.86 days. Reseacrh results from [22] [23] stated that the Muscovy duck's female sexual maturity was achieved after 26-28 weeks, and [17] who reported that the female Muscovy duck reached sexual maturity at 28-29 weeks of age.

The lower ingredients consumption, the lower of growth rate is achieved [24]. Weight gain represents general growth [25]. Growth can be stimulated by administering ingredients containing the required amino acids in addition to maintaining a balance of metabolic energy and protein content [26].

Egg weight in this study is close to the results of previous studies [27] which obtained egg weight at 38 weeks of 63.80 grams. According to [4] the weight of the first egg ranges from 42-48 g. After that the average egg weight increased to 58.5 g and then increased to 71.1 g at the age of 40-43 weeks with a range of 69.6-74.1 g.

The ingredient consumption of the Muscovy duck ranged from 128.54 to 131.14 grams / head / day [4] [28] which obtained an average, but was higher than the results of the study by [29] who obtained an average ration consumption of 40.81 grams / day. tails / day. This difference was thought to be due to the physical properties of the different ingredients, this study used a flour-based ingredient whereas the previous study [29] used pelleted ingredients. Pelleted ingredients are preferred and make it easier for the Muscovy duck to consume. This is in line with the opinion [24] which states that the ingredients consumption can also be influenced by the physical properties of the feed ingredients.

Low nutritional quality of feed will result in low egg production achieved [30]. This is in line with the opinion [4] which states that inadequate amount and nutrient content of feed can affect the egg formation process so that production decreases. The number of eggs is the number of eggs produced in a population divided by the number of parents in the population [31]. The average number of eggs from the results of this study was higher than the results of research [16] which obtained 40-60 eggs per year. The results of this study concur with [4] who reported that the Muscovy duck can lay between 60-80 eggs per year in an extensive rearing system and about 100-125 eggs per year in an intensive care system.

Muscovy duck begins to lay eggs at the age of 6 - 7 months and is able to produce about 15 - 18 eggs in a period so that the production will be around 90-120 eggs / year [9]. According to research [10] [32] duck egg production which traditionally reared is capable of producing the number of eggs as much as 10.30 - 10.52 eggs / head / period. Ducks that are semi-intensively raised can produce eggs per period with an average of 10 eggs with a variation of 8-13 eggs and the spawning distance after hatching in the parent who is separated from the chicks is around 22.4 - 22.7 days while the parent who cares for the cubs is around 50, 8 - 51.8 days [33].

Receiving heat from the heat source to the surface of the eggs is very important in hatching [34]. Eggs that have less surface are able to absorb heat optimally than eggs which have a wider surface [35]. One of the high

rates of embryo mortality is egg hygiene [36]. Many embryos died on days 26-28 due to high temperature and low humidity during the hatcher period. On days 26-28 or the hatcher period is a critical period for embryo development. At that time (day 26-27) the embryo tries to crack the shell [30]. High temperature causes embryo death or embryo abnormality while humidity affects the normal growth of the embryo and keeps the fluid in the egg and brittle the eggshell [37].

Egg fertility is also influenced by the ratio of male to female, duck parent feed, male age, egg age and duck parent age [38]. Fertility can be affected by the parent's age, sex ratio, and food consumption [39]. In addition, there is a relationship between fertility and environmental temperature where the higher the atmospheric temperature, the lower the fertility, or vice versa. According to [40] fertility is greatly influenced by climate, breed or variety of chickens, and mating system. According to [41] feed is also very influential on egg fertility, health, duck parent age, egg management before entering the hatchery including size selection and storage of hatching eggs, and hatchery management [42]. Causes of failure of fertile eggs to hatch include nutrient deficiencies in the eggs [34]. Fertility can also be affected by the number of rotten and broken eggs in the hatching machine [43].

Hatching can be affected by hatch management and egg size [44]. The Muscovy duck is capable of hatching 20 eggs per incubation [33]. This is supported by [26] which stated that the Muscovy duck can incubate 20-30 duck eggs / head / incubation period. Hatching by natural means usually achieves a success rate of about 80–90% [7]. [33] stated that natural hatchery using the Muscovy duck as an incubator produced better results than artificial incubation. This is consistent with the natural conditions of the Muscovy duck as a good incubator, which can self-regulate its temperature, humidity, egg spinning, and so on through its behavior during incubation. However, the disadvantage is that the number of eggs that can be hatched is very limited and must coincide with the incubation time of the Muscovy duck [45]. Hatchability can be influenced by the selection process, size, and storage duration of the incubation eggs [8]. Besides that, hatchability can also be affected by the quality of the seeds and incubation management (temperature, humidity, air circulation and egg rotation). [34] [40].

Hatching weight is influenced by egg weight [46]. Eggs of average or medium weight will hatch better than eggs that are small or too large. Larger eggs tend to take longer to hatch than smaller eggs [47]. The relationship between egg weight and hatching weight is thought to be due to nutrient factors in the eggs. The greater the weight of the egg, the higher the nutrient content, so that the embryo has the opportunity to absorb more nutrients and consequently can grow and develop properly. This opinion is in line with research [20], which showed that the average hatch weights were 30.25g and 31.41g. The same thing is also expressed in [4] which states that eggs contain lots of nutrients such as vitamins, minerals, and water (needed for embryonic development during incubation and also used as food reserves).

DOD quality can be affected by temperature, egg screening, and good egg quality [44] [48]. Duckling quality refers to the assessment conducted by [49]. [46] conducted an assessment of days old chicken using a score called Tona's score. Tonas score includes exterior performance, hair, eyes, nepal, physical disability, and activity.

CONCLUSION

Based on the results and discussion, it can be concluded that the duck from the same area as the research location adapts more quickly. Duck from Kuningan has the better production and hatching egg performance, age of sexual maturity was 167.4 days, body weight at sexual maturity was 1.718.6 g, first egg weight is 61.0 g, feed consumption is 151.1 gram/head/day, total egg number was 127, fertility 82.0%, mortality 10.85%, hatching time 32.8%, hatchability 76.0%, hatching weight 44.2 g, and duckling quality 96.0%.

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