Increasing Productivity of Egg Production through Individual Selection on Tegal Ducks (*Anas javanicus*)

(Peningkatkan Produktivitas Telur Itik Tegal melalui Seleksi Individu)

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Abstract. The purpose of this research was to study the effect of egg production selection characteristic on productivity of Tegal duck. Materials used were 112 of six month old Tegal ducks consisted of 16 males and 96 females. Selection for females was applied on 12 duck groups based on egg production phenotipic: parent stock duck (G1) which was offspring of their ancestor (G0) having egg production above average production (not less than 78 eggs in 120 days); while the males were selected based on egg production of their mother, and 4 groups were use as control. Production and reproduction data were analysed descriptively compared to initial population using T test. Egg production was analysed based on Nested Classification to estimate haritability value (h^2). The results indicated that egg production increased from 78.00±19.00 (G0) to 88.12±11.57 (G1). Heritability estimation on egg production and genetic progress were 0.35 and 5.95 respectively. On the male, the selection increased body weight and semen quality. It was concluded that selection of egg production characteristics increased productivity of Tegal duck.

Key Words : selection, heritability, body statistic, egg production, Tegal duck

Introduction

Tegal duck (*Anas javanicus*) is one of Indonesian native ducks which should be preserved and improved its genetic quality. The duck has a specific characteristic : (1) dominant feather color is *branjangan* brownish color at all body with clear dark brown spots on breast, back, and wings; (2) the other color are *lemahan* (light brown on neck , tight with brown spots on breast, back, and wings, *jarakan* (grey feather on neck , black spots on breast, back, leg, and wings), *blorong, putihan, irengan,* and *jambulan;* (3) black beak and leg (Sopiyana *et al*., 2006). The duck originated from Tegal and Brebes Regencies, and distributed at north plain area of Central and West Java, Sulawesi, Lampung, Aceh, and Papua. Li *et al.* (2006) stated that ducks produce meat, egg, and feather, and they could be reared with locally available feedstuffs. Their breeding performance depends on their reproduction performance. Adaptable local ducks have strategic position as source of germ plasm as well as source as a research material.

Breed quality is one of the most important factors for sucsesfull duck rearing, particulary that for egg production. On the other hand, good breed of duck is rarely available in Indonesia. Breeding approach seems to be an alternative to improve genetic quality of laying ducks as the approach will have relatively permanent impact. Nowadays, existing breeding system is done traditionally without control, therefore an effort should be conducted to implement breeding system especially in duck rearing centers. Genetic quality improvement through selection and mating system are the common methods applied (Al-Nasser *et al.,* 2007). To protect germ plasm, selection within breed should prevent characteristics of the breed, while conservation should not reduce its genetic variation in small population. Selection could be done to increase homozygocity of the desired characteristics. Combination both conservation and selection, based on production characteristics of certain duck breeds, would produce excellent native duck breeds, and improve their economic values (Li *et al.,* 2006).

Tegal duck has high potency as a laying duck therefore its selection on egg production is necessary to be done. Egg production is important to increase, because egg consumption will develop in a country (Windhorst, 2008). This research aimed to study the effect of individual selection on egg production characteristic on reproduction performance.

Research Methods

Animals Management

Materials used were 112 heads of six month old Tegal duck, consisting of 16 males and 96 females. The duck were fed using mask duck starting, growing, and laying rations (Table 1). The rations were mixed with water 1:1. Nutrition content was accordance to Scott and Dean (1992). During the research, the duck were kept in individual battery with 50 cm length, 50 cm width, and 50 cm height.

Data Collection

Ducks, collected from farmers in Tegal area and were relatively uniform in phenotype, were kept individually. Each male was used to mate six females through artificial insemination method.

Each duck was fed 160 grams per day with *ad libitum* drinking water. Individual egg produced was recorded daily for 120 days of production, and semen quality was observed three times (Etches, 1996). Semen quality observation comprised its volume, concentration, motility and viability which was done in the afternoon weekly.

Hatching eggs were collected after 50 percent of egg production. After seven days of collection, the eggs were hatched according to each mating group. During this research, hatching was done four times. The ducklings produced (F_1) were used as parents to produce the first generation (G_1).

From the initial population (G_0), there were 148 females and 112 males which were then selected as the first generation (G_1). Selection was conducted on 12 groups based on egg production characteristic. Ancestor duck of the first generation (G_1) was offspring of G_0 with egg production above 78, whereas the males were selected based on egg production of their mother. The selection resulted 76 females and 16 males, with 34 heads as control group. The selected and control ducks were used as population of the first generation (G_1).

Hatching was conducted to calculate egg fertility (percentage of fertile eggs compared to total eggs), hatchability (percentage of hatching eggs compared to fertile eggs), and embryonic mortality (percentage of dead embryo compared to fertile eggs) (Ensminger, 1992).

Parameters Observed

Production performance : egg production, and phenotype of mother body, consisted of body weight (g), breast circle (cm), belly circle (cm), and pubic width, egg weight (g), day old duck (g), and weekly body weight (g).

Reproduction performance : semen quality, comprised volume (ml), concentration (billion/ml), motility (%), and viability up to 10%, fertility (%), and hatchability (%).

Table 1. Rations used during the research

Feedstuffs	Starter	Grower	Layer
Rice bran (%)	-	45,000	40,000
Corn (%)	-	35,000	35,000
Concentrate (%)	-	20,000	25,000
BR-I (commercial feed)(%)	100,000	-	-
Nutrient content			
Crude protein (%)	21,000	16,080	17,400
Energy (kcal/kg)	3000,000	2900,000	2800,000
Calcium (%)	1,000	2,438	3,035
Phosphate (%)	0,500	1,480	1,604

Data analysis

Data on production and reproduction were analised descriptively compared to initial population using T test. Data on egg production was analised using nested classification to estimate heritability value of egg production.

Results and Discussion

Female Tegal Duck

Morphological measurements were conducted on initial population and the first generation, both ducks in control and selected populations. Selection, individual or mass, is a selection done based on certain phenotype of characteristics, both single or multiple characteristics to improve the characteristics (Warwick *et al.,* 1995). Selection was done to 12 groups of initial population, ducks with egg production below the average production (less than 78 eggs) were not used in this expreriment. Control population was four groups of initial population from which all its offspring was used. Results of morphological measurements are presented in Table 2, that shows that body statistics and egg weight of first generation had higher variation. This was most probably due to the selection thats was done based on egg production of initial population. Offspring used as the first generation were from initial population which had egg production above the average egg rpoduction i.e. 78 eggs in 120 days. The first generation population produced more eggs and had lower variation (10.19%) compared to the control. Subiharta *et al.* (2001) reported that selection on Tegal duck improved uniformity of egg production chracteristics of the first generation and better uniformity at the second generation particularly for the characteristics of sexual maturity, body weight at sexual maturity and 9.79% egg production, and higher initial egg weight of 2.11 g. Sumeidiana *et al*. (2005) reported that selection on quail egg weight increased egg number and weight. T test conducted indicated that performance of initial population and first generation population were difference, except on pubic width. Ducks in initial population population had higher variation of body statistics, egg production and weight compared to those in the first generation.

Body statistics sligtly increased in G_1 as shown in Table 3. Egg production increased by 12.7%, from 78 to be 88.12 eggs in 120 days on average. This was due to selection was done on 12 groups of initial population which had egg production of more than 78. The other four groups were not selected as they were used as control population.

Genetic progress was found by multiplying heritability score of observed characteristics to selection differencial which is superiority number of selected population compared to average value of the population (Warwick *et al.,* 1995). Calculation on heritability of egg production characteristics resulted h^2 value of 0.35 and selection differencial of 17, therefore the selection progress was 5.95. It means that first generation resulted higher egg production of 5.95 or 6 eggs.

Table 2. Average of body statistics and egg production of the first generation (G_1)

No.	Body statistics	All population	Control population	Selected population
1.	Body weight (g)	1554.65±109.79	1536.21±99.18	1564.45±114.57
2.	Breast circle (cm)	29.60± 1.58	29.52± 1.50	29.58± 1.63
3.	Belly circle (cm)	29.94± 1.78	29.19± 1.37	30.33± 1.86
4.	Pubic width (cm)	5.58± 0.82	5.29± 0.77	5.74± 0.81
5.	Egg production	88.12± 11.57	80.65± 11.70	92.09± 9.39
6.	Egg weight (g)	64.78± 2.57	64.43± 2.44	64.97± 2.63

Control population : flock with no selection; Selected population: flock of selected ancestor

Table 3. Differences of production performance between G_0 and G_1

No.	Body statistics	G_0	G_1
1.	Body weight (g) **	$1550.18^a \pm 133.87$	$1554.65^b \pm 109.79$
2.	Breast circle (cm) **	$28.65^a \pm 1.35$	$29.6^b \pm 1.58$
3.	Belly circle (cm) **	$29.62^a \pm 2.13$	$29.94^b \pm 1.78$
4.	Pubic width (cm) **	$6.14^a \pm 1.21$	$5.58^a \pm 0.82$
5.	Egg production **	$78.00^a \pm 19.00$	$88.12^b \pm 11.57$
6.	Egg weght (g) **	$66.60^b \pm 5.05$	$64.78^a \pm 2.57$

Note : very significant difference of T test (P≤0.01)

Stevens (1991) stated that h^2 was grouped into 3 categories : (1) high (h^2 = more than 0.5); (2) moderate (h^2 = 0.2 - 0.5); and (3) low (h^2 = less than 0.5). This finding confirmed that Tegal duck had moderate heritability. Pingel (1990) indicated that heritability of egg production of Pekin duck was 0.2, while Cheng (1995) reported that the value of Brown Tsaiya duck was 0.118. The differences were due to different breed as reported by Stevens (1991) that heritability value of poultry could be different due to breed, group, or selection effect.

Male Tegal Duck and Hatching

Results on body weight measurement and semen quality of initial population and first generation ducks were presented in Table 4. Body weight and semen quality variations decreased at first generation, but not for semen volume. Male of the first generation had higher productivity than initial population. Body weight increased by 9% with less variation (5.3%). The low variation was happened due to selection done on male ducklings (F_1) at eight weeks of age. Twenty male ducklings were taken from each group, and were selected at 24 weeks of age to be male ancestor based on semen quality.

Improvement of semen quality of first generation partly becaused of improvement of body weight. Bearden and Fuquay (2000) found that there was realtionship between body wieght and testical size, and the size had positive correlation with sperm production. According to Etches (1996) sperm was produced by Sertoli cells and the number of the cells affected the testis to produce sperm. He also indicated that the number of Sertoli cells correlated to testical size. It means that daily semen production is dependant to testical size. Semen quality and quantity was strongly affected by feed, breed, age, body weight, ambient temperature, and container used in semen collection. It seems that improvement semen quality at first generation mainly due to selection done. Male duck of initial population had lower semen quality because no selection done on farm level, or it could be due to different environmental condition as first generation were kept intensively while initial population, during growing period, were in semi-intensive system. But it is believed that different genetic was the main factor affecting semen quality in which first generation was better than initial population.

The first generation had fertility and hatchability higher than initial population, although embryonic mortality was high. Higher quality of hatching result was probably due to improvement of ancestor genetic as indicated by improvement of semen quality. High mortality was a result of unsucssesfull pipping at the end period of hatching.

Table 4. Body weight and semen quality of G_0 and G_1 ducks

No.	Parameters	Average and standard deviation	Average and standard deviation
1.	Body weight (g)	$1409.75^a \pm 105.33$	$1537.25^b \pm 81.48$
2.	Semen volume (ml)	$0.58^a \pm 0.09$	$0.714^b \pm 0.129$
3.	Semen concentration (bill/ml)	$2.34^a \pm 0.54$	$2.447^b \pm 0.487$
4.	Motility (%)	$66.88^a \pm 13.40$	$72.812^b \pm 8.938$
5.	Viability up to 10% (min.)	$259.81^a \pm 54.42$	$263.75^b \pm 39.644$

Note : very significant difference of T test (P≤0.01)

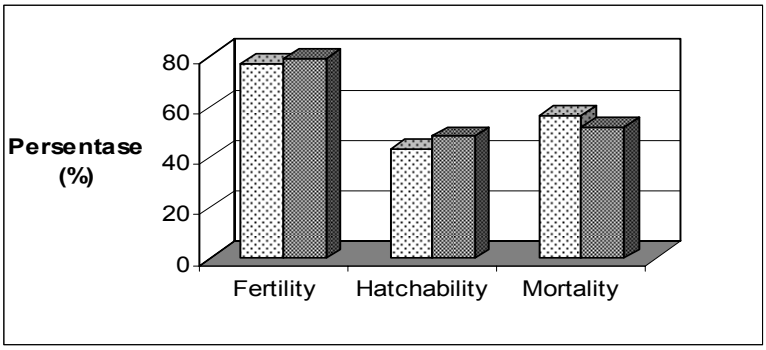

Figure 1. Graph shows hatching quality of G_0 and G_1

Fertility was 2% high at first generation compared that at initial population as a consequence of improved semen quality. Hatching quality of initial population and first generation is presented in Figure 1.

Conclusions

Selection on egg production characteristic improved female Tegal ducks' body performances i.e. body weight, circles of breast and belly, and increased egg production. While for the male, selection improved body weight and semen quality.

Acknowledgement

This work suported by The 13th Hibah Bersaing Research Project.

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