

Growing and laying performances of two varieties of Noi chickens raised in an intensive farming system

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Abstract:

This study was conducted to compare the black and dark brown varieties of Noi purebred chickens raised in an intensive farming system. A total of 600 black and 600 dark brown Noi chickens were observed starting from 1 day after hatching. At 20 weeks of age, 30 black Noi cocks and 300 black Noi hens, as well as 30 dark brown Noi cocks and 300 dark brown Noi hens, were studied until the beginning of reproduction. All roosters and hens were kept in individual cages and mating was accomplished artificially. At 24 weeks of age, the black and dark brown Noi cocks had average weights of 2555 and 2600 g, respectively, and 1796 and 1830 g for hens, respectively. There was no difference in body weight between the two varieties. The first egg-laying ages of both varieties were relatively late. From the age of 25 weeks up to 50 weeks, the egg yields of the black and dark brown Noi hens were 74.33 and 77.98 eggs/hen, respectively, with average egg weights of 48.3 and 49.7 g, respectively. Embryonic egg rates were low at 80.3 and 81.9% for the black and dark brown varieties, respectively, and the rate of chick/incubated eggs was 73.4 and 77.0%, respectively. The Noi chickens, especially the dark brown variety, reached a relatively high egg yield in an intensive farming system, which creates great potential for the exploitation and development of this genetic source.

Keywords: growth performance, laying performance, native hen, Noi chicken.

Classification number: 3.1

1. Introduction

Vietnam is a diverse country in terms of chicken genetic resources with 37 native chicken breeds listed. Noi chickens are also known as fighting cocks [1]. These native chickens have been recognised in Vietnam for a long time and are raised in many areas. Its main uses are for fighting games, a hobby of the local people, and for food as their firm and crispy skin are a specialty that Vietnamese people love. In recent years, there have been a few studies on the biological characteristics and genetic diversity of the Noi chicken in the southern provinces of Vietnam [2, 3]. In order to satisfy the Vietnamese preference for chicken meat, several studies on the hybridization between the Noi cock and some coloured-feather breeds have been conducted in recent years [4]. Indeed, hybrid Noi chicken farming has brought about high and sustainable incomes for households in many

regions of Vietnam. Therefore, purebred cocks are now a demand of many breeders. However, the ability to propagate and develop pure Noi chickens has been very limited. The reason for this is the vast majority of Noi chickens raised in backyards only begin to lay eggs at 1 year of age with only 5-8 eggs per clutch and 4-5 clutches per year [5].

Surveys in the Binh Dinh province of the south-central region - one of the largest Noi chicken breeding areas in Vietnam showed that, based on feather colour, two Noi chicken varieties can be distinguished, namely, the black Noi and dark brown Noi chickens. Within the framework of the Dabaco research program, which is a large group in the field of feed and livestock that aims to develop genetic resources of Vietnam's indigenous chickens, two varieties of Noi were collected, purebred, and raised in an intensive farming system at Dabaco

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Breeding Chicken Company, Vietnam, in 2019 and 2020. This study was conducted to evaluate growth and egg-laying performances, and to show the potential for the exploitation and development of native chicken genetic sources.

2. Materials and methods

A total of 600 black and 600 dark brown Noi experimental chickens were included in this study at 1 day old. The number of chickens selected to enter the laying stage at 20 weeks of age included 30 black cocks, 300 black hens, 30 dark brown cocks, and 300 dark brown hens, and they were kept until 50 weeks of age. All chickens were raised in an intensive farming system in a closed house. From 1 day old until 10 weeks of age, the chickens were kept on the floor with rice husks. From 11 to 50 weeks of age, the chickens were kept individually in cages with a length $\times$ width $\times$ height of 39 $\times$ 28 $\times$ 36 cm.

The lighting regime was as follows: for chickens under 4 weeks of age, 23 hours per day at 40-60 lux, then at 20-30 lux; for chickens 4-20 weeks old, 18 hours per day at 10 lux; for laying hens, 12-16 hours per day at 40-60 lux.

Table 1. Chemical composition of complete feed and diets.

Chemical composition	Growing periods (age of week)			Laying period
	0-4	5-10	11-20	
<i>Nutrient value of feed</i>				
Metabolic energy (Kcal/kg)	2800	2700	2600	2650
Crude protein (%)	19.0	17.0	14.5	16.0
Crude fibre (%)	6.0	6.0	6.0	6.0
Calcium (%)	0.5-1.5	0.5-1.5	0.5-1.5	1.5-5.0
Total phosphorus (%)	0.2-1.0	0.2-1.0	0.2-1.0	0.2-1.0
Lysine (%)	1.00	0.90	0.65	0.73
Met. + Cys. (%)	0.75	0.68	0.55	0.62
<i>Diets</i>				
Male	Ad libitum	40-74*	80-115*	119-127*
Female	Ad libitum	38-69*	75-98*	97-124*

*: g/head/day

The chemical composition of complete feed and diet for different life stages are shown in Table 1.

Some major vaccines included those for Marek, infectious bronchitis, Gumboro, Newcastle, and CRD. Common veterinary drugs were also used according to the company's technical regulations.

Chickens were numbered at 1 day old. Every week, 30 males and 30 females were randomly sampled and weighed. During the laying stage, the eggs were collected daily and recorded for each hen, and then they were weighed weekly. Artificial insemination was used with a 1:10 ratio of male-to-female and mated every 3-4 days per one. Incubation eggs were collected from 34 weeks of age and incubated in an automatic industrial system with trays to monitor the chicks of each mother hen.

Data were collected and analysed using Excel 2010 and Minitab 16 software. Statistical comparisons were made using the T-test and Chi-squared test.

3. Results

The two varieties of black and dark brown Noi chickens could be easily distinguished through a number of key features of their appearances (see Table 2 and Fig. 1).

Table 2. Physical appearance characteristics of two Noi chicken varieties.

Physical appearance	Black Noi		Dark brown Noi	
	Male	Female	Male	Female
Body shape	Small front, gradually bigger back	Big front, gradually smaller back	Small front, gradually bigger back	
Feather colour	All black		Red neck, brown and black body	Dark brown with yellow lines body
Skin	Yellow, pink, and red colours			
Beak	Black and yellow colours			
Leg	Black and yellow colours			
Comb	Red colour, pea and strawberry shape			
Wattles	Red colours			
Toe	Smooth scale and stand in line			



Fig. 1. Black Noi chickens (left) and dark brown Noi chickens (right).

Table 3. Body weight at different periods of two Noi chicken varieties (g).

Age	Black Noi (Mean±SE)		Dark brown Noi (Mean±SE)	
Weeks	Male (n=30)	Female (n=30)	Male (n=30)	Female (n=30)
1	65.0±0.6	66.1±0.7	74.2±1.9	78.1±2.1
4	220.2±2.0	221.3±2.1	222.4±2.3	227.1±2.4
10	930.3 ^a ±6.8	863.2 ^b ±4.5	933.3 ^a ±6.7	805.4 ^b ±4.3
20	2150.4 ^a ±25.5	1575.3 ^b ±20.8	2170.4 ^a ±24.9	1590.2 ^b ±20.6
24	2555.4 ^a ±22.6	1796.3 ^b ±7.9	2600.2 ^a ±23.1	1830.1 ^b ±8.2

^{a, b}: means in the same row and same varieties without common letter are different at $p < 0.05$

In general, there was no difference in body weight between the black and dark brown varieties. At 10 weeks of age, there was a marked difference in body weight between males and females for both black and dark brown varieties. At 20 and 24 weeks of age, this difference was 35 and 42%, respectively (Table 3 and Fig. 2).

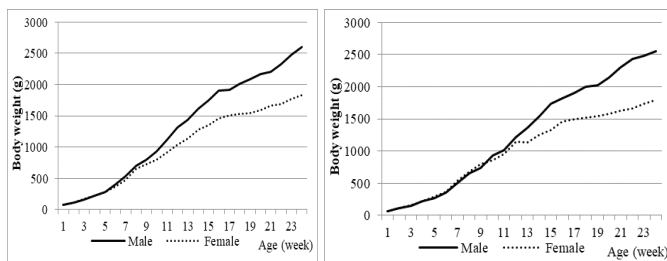


Fig. 2. Body weight at different ages for the black Noi chicken (left) and for the dark brown Noi chicken (right).

Table 4. Hen egg production and cumulated eggs curve for two Noi chicken varieties.

Hen egg production	Black Noi (n=296)	Dark brown Noi (n=500)
Age to first egg (week)	23	24
Age to 5% hen-day production (week)	25	26
Age to 30% hen-day production (week)	28	28
Age to 50% hen-day production (week)	30	30
Age at peak hen-day production (week)	35	35
Egg production at peak (%)	58.78	65.83
Cumulated eggs per hen up to 50 age of week	74.33 ^a ±1.73	77.98 ^a ±1.13
Average egg weight (g)	48.34±0.57	49.65±0.62

^{a, b}: means in the same row without common letter are different at $p < 0.05$.

The egg production, yield, and egg weight of the two types are shown in Table 4 and Fig. 3. There was not much difference in the evolution of the egg production as well as the egg weight between the two Noi chicken varieties. However, the dark brown hens had higher laying rates at the peak given that the cumulated egg per hen up to 50 weeks of age was significantly higher than that of the black Noi.

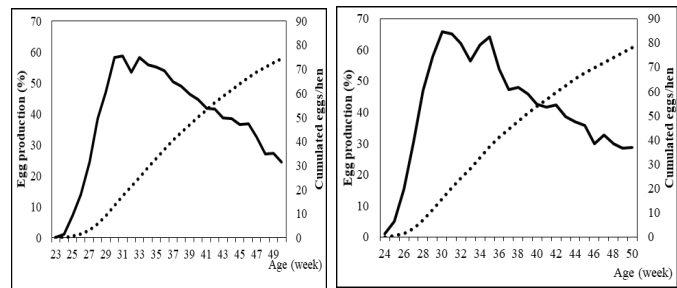


Fig. 3. Curves of egg production (lines) and cumulated eggs (points) for black Noi chicken (left) and for dark brown Noi chicken (right).

Table 5. Egg incubation results for the two Noi chicken varieties.

Egg incubation	Black Noi	Dark brown Noi	p
Number of incubated eggs	3488	8435	
Rate of embryonated egg (%)	80.3	81.9	0.038
Rate of chick/embryonated egg (%)	91.4	94.0	0.001
Rate of chick/incubated egg (%)	73.4	77.0	0.001

There was a clear difference between the black and dark brown varieties in terms of the embryonated egg proportion and hatching rates (Table 5).

4. Discussion

Recently, the exploitation and development of livestock gene resources have become important research directions for developing countries-especially Vietnam-as it is a country with many local chicken breeds. However, low growth and egg laying performances are the main challenges to farming these chicken breeds. Research results and production practices in many countries like Vietnam have indicated that crossing local chickens with exotic, high-yielding breeds may be an effective solution. Therefore, the use of an intensive farming system in a closed house with a complete feed, suitable lighting regime, and veterinary care in the present experiment could be an effective solution to improve local chicken farming performance. In agreement with our hypothesis, research already done on native chickens in Bangladesh showed that changes in traditional management practices could improve the performance of native chicken farming and thus contribute to household incomes per year [6]. Indeed, the low production performance of native breeds of chickens can be improved through enhancements to husbandry practices, better health care, and supplementary feeds during the lean season [7].

The appearance characteristics of 815 Noi chickens raised in the households of six Mekong delta provinces were evaluated, and the results showed that Noi chickens with brown feathers accounted for 38.9%, while those with black feathers accounted for 11.7%, and the remainder were other colours [3]. This study focused on the black and dark brown Noi chicken varieties. The differences in colour can

be clearly seen in Fig. 1, and the most obvious difference between these two varieties is their feather colour as shown in Table 1.

There was no difference in the observed body weights between the black and dark brown Noi chicken varieties at all ages, and they are some of the largest statured native chicken breeds in Vietnam alongside Dong Tao, Ho, and Mia chickens. The body weight of the cock at first laying weeks (24 weeks of age) was equivalent to that of Dong Tao and Ho chickens but greater than that of Mia chickens. Dong Tao chickens raised in a semi-intensive system at 24 weeks of age had a weight of 2585 g for cocks and 2189 g for hens [8]. In intensive farming, at 20 weeks of age, Ho chickens had a weight of 2147 g for cocks and 1886 g for hens, while Mia chickens were 1843 g for cocks and 1647 g for hens [9].

The body weights of the other native chicken breeds of Vietnam with medium or small statures were lower than that of the Noi chickens. For example, Ri chickens at 19 weeks of age were 1838 g for cocks and 1286 g for hens [10]. The H'Mong chickens at 38 weeks of age were 2.02 kg for cocks and 1.56 kg for hens [11]. Native breeds in some countries also had smaller body weights than Noi chickens like the Hon Chu chickens of the People's Democratic Republic of Lao raised in extensive farming at 20 weeks of age reached only 780 g for cocks and 670 g for hens [12]. However, in a semi-intensive system, they had weights at 24 weeks of age of 2174 g for cocks and 1858 g for hens [12]. The body weights of native chickens in Tanzania were 1948 g for males and 1348 g for females, respectively [13]. The native chickens in Jordan were mature at 22-30 weeks of age, and cock and hen body weights reached 1890 and 1240 g, respectively [14].

The age Noi chickens first began to lay eggs were 161-168 days old and the laying ages of 5% were 25-26 weeks (Table 4). This data was equivalent to the result of Southern Noi chickens over two selective generations [15]. When raised in the backyard, but some other native chicken breeds in Vietnam such as Ri chicken began to lay at 130 days old [16] or 144-151 days old for Tau Vang chicken [17]. Age of initiation egg laying of local chickens in Bangladesh was 152-159 days old [18], and in Ethiopia was 6.89-6.97 months [19]. This proved that late egg-laying was one main characteristic of both Noi chicken varieties.

The cumulated eggs up to 50 weeks of age of the black and dark brown Noi chickens reached 74 and 78 eggs per hen, respectively (Table 4). Meanwhile, the egg yield/hen/year over the two selective generations of Noi chickens in the Southern provinces were only 67.7 and 71.5 eggs, respectively [15], or 94.5 eggs [3]. Raised by backyard farming, the Noi's egg yield was only 48 eggs/hen/year [20]. Ho chickens in backyard farming laid 13 eggs per clutch,

5.2 clutches per year and the egg yield was 66 eggs/hens/year [21]. The egg number of hens per clutch in Ethiopia was 14.9-15.7, and the highest was 17.7 eggs [19].

Thus, an intensive farming system using the mixed feed, keeping chickens in individual cages, and under proper lighting were all important factors to achieve the relatively high egg yield in this experiment for both Noi chicken varieties. Similarly, Indonesian Kampung chickens raised in extensive, semi-intensive, and intensive farming conditions had 3, 6, and 7 clutches per year, respectively, and achieved egg yields of 47, 59, and 146 eggs/hen/year, respectively. Hence, the egg production in intensive systems tripled that of extensive systems [22].

The average egg weights observed from the first laying week until 50 weeks of age for both Noi chicken varieties were about 48-50 g (Table 4). The egg weight of the Noi chickens was 45.4 g [3], and at 38-40 weeks of age were 46.3-46.5 g [15]. The chickens with a larger stature had egg weights greater than that of chickens with smaller stature. For example, the egg weight of Ri chickens was only 38.8 g at 40 weeks of age and 45.2 g at 60 weeks of age [10]. However, the egg weight of Noi chickens were lower than that of Ho chickens [21]. Similarly, five local Indonesian breeds with small statures had small egg weights from 39.2 to 47.5 g [22].

Through the two selected generations, the rates of embryonated eggs of the Noi chickens ranged between 94.5-95.2%, and the rates of chick/incubated eggs were between 77.7-77.8% [15]. Meanwhile, the rate of embryonated Noi chicken eggs was 83.3%, and the hatching rate/embryonated egg rate was 85.3% [3]. These percentages of embryonated eggs were all higher than those obtained in Table 4. It could be possible that artificial insemination was the cause of this lower incidence. However, the percentage of embryonated eggs of Ho chickens raised by backyard farming were even lower with 82.83 [23] and 61.99% [24].

5. Conclusions

The two varieties of black and dark brown Noi chickens in this research had an easily distinguishable appearance through their feather colour.

There was no difference in body weight between these two varieties.

Both varieties of Noi chickens laid late. The black and dark brown Noi reached egg yields of 74 and 78 eggs/hen/26 laying weeks, respectively, and had average egg weights of 48.3 g and 49.7 g, respectively.

In an intensive farming system, Noi chickens, especially the dark brown variety, reached a relatively high egg yield, which has created great potential for the exploitation and development of this genetic source.

CRediT author statement

Vu Hoa Dang: Data analysis and Interpretation, Writing and Manuscript revising; Van Diep Duong, Thi Huong Nguyen, Ngoc Khanh Do, Thi Hue Le, Minh Hieu Nguyen, Thi Ut Tran, Hoang Nguyen Nguyen, Thuy Nhung Dang: Method, Data analysis and Writing.

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COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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