Selection responses for egg production of Fayoumi and Rhode Island Red breeds

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Abstract

This experiment estimated the selection responses for egg production of Fayoumi (Fay) and Rhode Island Red (RIR) breeds. A total of 3000; belonging Fay 2000 & RIR 1000 day old chicks were collected from Egypt and Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka respectively, considered as foundation stock. The chicks were brooded for 5 weeks and reared up to 14 weeks of age providing standard feeding and management. After brooding, 640 Fay and 504 RIR pullets were reared in 40 and 36 individual pens respectively, considering as a family. Finally, 30 and 24 best families of Fay and RIR respectively were selected with 420 Fay and 288 RIR pullets at 15 weeks of age, on the basis of age at 1st egg lay, egg production and fertility. Salmonella and mycoplasma free eggs were collected on the basis of blood test (agglutinate test) from the selected families of both the breeds and hatched out for next generation. The experiment was continued up to 40 weeks of age for each generation. The study revealed that hen day egg production of Fay and RIR was higher in Foundation stock (64.39% in Fay and 68.54% in RIR) than that of F_1 generation (58.6% in Fay and 46.8% in RIR) but no significant difference ($P > 0.05$) was observed for livability between Foundation stock and F_1 generation. Reasons for lower productivity in F_1 generation may be the poor management practices during growing period. In F_2 generation, egg production was higher in both the breeds (64.09% in Fay and 62.05% in RIR) than in F_1 generation. Egg production of RIR was not recorded for F_3 generation, as their ability to adopt under farmers condition was very poor. However, in F_3 generation, egg production of Fay was higher (65.82%) than in F_2 generation. Genetic gain in Fay was 0.06%, 0.11% and 0.12% for F_1, F_2 and F_3 generation, respectively. In case of RIR genetic gain was 0.07% in F_1 and 0.18% in F_2 generation. Due to selection slight genetic gain for egg production was obtained in Fay and RIR but further research with larger stock is needed for better understanding of selection responses of these breeds.

Key words: Selection, genetic gain, egg production, Fay and RIR

Introduction

Native chickens, scavenge on cereal by-products and wastes and pieces of biota of rural areas (Rao, 1990) are still playing a significant role on quantitative production of chicken eggs and meat in the developing countries. Increasing consumer demands for organic produces, higher market prices are reflecting their economic importance to farmers. About 98 per cent of farm households keep a few pullets, as a means to earn additional cash and to meet emergency family needs (Huque, *et al*. 1990). Non-descript native colored chickens, as an important source of meat and eggs are more acceptable to all classes of people (Barua and Howlider, 1990). They produce about 75 per cent of total eggs and 78 per cent of meat consumed domestically (Huque, 1993). Native chickens are early maturing with higher egg fertility than that of exotic breeds (Islam, *et al*. 1981). Their eggs are tinted having higher threonine and valine content than those of exotic breeds (Khan, 1983). Horst and Mathur (1989) opined that the native fowl still has a position in genetic improvement of tropically orientated stock.

The exotic breeds so far introduced in Bangladesh were not well adapted to scavenging system because of chickens are slow growing and lower egg producers (Barua and Howlider, 1990). They produce only 35

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-45 eggs per year per hen (Bulbul, 1983; Ahmed and Islam, 1985; Sazzad, 1896 and Huque, et al. 1990). Their mature body weight was 1.0-1.2kg (Panda, 1989; Okada, et al. 1989 and Barua and Howlider, 1990), which, do not encourage rural farmers to extend their poultry operations at commercial level. In that circumstance, crossing of local stock with exotic breeds may yield crossbred that might increase egg production, egg size and body weight.

Among exotic breeds/strains of chicken, farmers are interested to rear Fay and RIR under semi scavenging system of rearing for enhancing rural poultry production. Fay is extensively used in rural areas and well adapted under farm condition in Bangladesh (Anisuzzaman, 1988). This breed is originated from Egypt and possesses the characteristics of early sexual maturity, more egg production and low mortality (Barua, et al. 1998). Some research reports supported that crossing of Fay with exotic breed increased egg production, egg size and body weight. Ali (1989) also found that crossing of Fay with other standard exotic breed improved egg size, growth rate and adaptability of crossbreds under farm condition of Bangladesh.

The Department of Livestock Services (DLS) of Bangladesh has introduced *Sonali* crossbred chicken (by crossing RIR males with Fay females) in the rural area to improve rural poultry production. The appearances of *Sonali* chicken are very close to the non-descript native colored chicken. They are very much suited to the semi intensive rearing system in rural areas. They have better production records (50-60% hen day egg production with feed conversion ratio of 4.33 and lower age of first egg production with 50% egg production at 179 days) and higher disease resistance (Huque, et al. 1999 and Miah, et al. 2002). The Sonali have the highest egg production, lowest mortality and highest profit per hen among eight crossbred chickens tested under rural condition of Bangladesh (Rahman, et al. 1997). The parents' genetic merits along with proper environment and genotype environment interaction determine production potential and survivability of crossbred pullets. Therefore, increasing productivity of parents through selective breeding might increase productivity of their crossbreds. Considering the above facts, the present experiment aimed to evaluate the possibility of increasing egg production performances of Fay and RIR through selective breeding.

Materials and Methods

Location and Management

The study was conducted at Govt. Poultry Farm, Savar, Dhaka, to estimate the selection response of Fayoumi and RIR for egg production performances. A total of 3000; 2000 day old chicks of purebreed Fay from Egypt and 1000 RIR from Bangladesh Livestock Research Institute (BLRI) were collected and reared as foundation stock to produce chicks for next generations. The chicks were brooded (5 weeks) and subsequently reared up to 14 weeks of age providing standard feeding and management. A depth of 15 cm rice husk was used as litter materials. The photoperiod for brooding period started at 24 hours/day and reduced @ 1 hour/week. Initially, 640 Fay pullets were transferred to 40 pens having 16 pullets in each pen (family) and 504 RIR to 36 pens having 14 pullets in each pen at the age of 15 weeks. Finally, 14 and 12 pullets of Fay and RIR from each pen respectively were selected. Male and female ratio was maintained as 1:14 and 1: 12 for Fay and RIR, respectively. There were 30 best families of Fay with 420 pullets and 24 best families RIR with 288 pullets were selected on the basis of age at 1st egg laid, higher egg production and fertility. In each generation, 65.62% and 57.14% pullets of Fay and RIR were selected, respectively. The experiment was continued for successive 3 generations for Fay and 2 generations for RIR. The egg production performance was studied for all families (40 for Fay and 36 for RIR) but eggs of the selected families (30 for Fay and 24 for RIR) were collected and hatched for next generation. As per blood test (agglutination test) of the selected families salmonella and mycoplasma free eggs were collected and hatched out. The birds were fed with a ready-made pellet diet containing required amount of CP (%), ME (Kcal/Kg) and other nutrients. Vaccination (except salmonella), deworming and debeaking schedule was maintained during investigation. Blood test was performed at Poultry Diagnosis Laboratory of Poultry Production Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka. Egg production (up to 40 weeks of age), fertility and livability of Fay and RIR were recorded. Fay, considered to be the best female line, was selected on the basis of age at 1st egg and egg production performance and RIR considered as male line was selected considering the rate of fertility. Eggs from individual pen (family) of foundation stock were collected and hatched for next generation. In case of Fay, hen day egg production (up to 40 weeks of age), fertility, hatchability and livability were recorded up to F_3 generation and in case of RIR data were recorded up to F_2 generation. Data of RIR were not recorded up to F_3 generation, as the performance of RIR pullets was not satisfactory due to inability of RIR breed to adopt in farm conditions. Eggs were collected at 16:00 hours, daily and numbered.

The hen day egg production as the indicator of egg production of birds was measured using the following formula (Sing and Kumar, 1994):

$$\text{Hen day production (\%)} = \frac{\text{No. of eggs laid up to 40 weeks of age}}{\text{No. of days in lay}} \times 100$$

Genetic gain estimation

Genetic gain in Fay and RIR for hen day egg production (HDEP) was estimated for each generation using the following equation (Lush, 1945):

$$G_f = i \times h^2 \times \sigma_p \frac{1+(n-1)r}{\sqrt{n\{1+(n-1)t\}}}$$

Where, G_f = genetic gain or responses of selection; h^2 = heritability of HDEP (h^2 for egg production was 0.25 as per R. A. Singh, 1981); n = number of pullets in the family; t = intra class correlation of phenotypic values of members of the family; r = half/ full-sib relationship among individuals; σ_p = phenotypic standard deviation in HDEP

The genetic gain found in F_1, F_2 and F_3 generations were regressed to find out rate of progress in selection programme. The selection differential, selection intensity and phenotypic standard deviation for hen day egg production used in the estimation of genetic gain are given in Table 1. The values of selection intensity were taken from Lush (1945) against per cent of pullets selected for the next generation.

Table 1. Data structure for estimation of genetic gain

Generation	Fayoumi			RIR		
	SD (%HDEP)	i	$б_p$ (%HDEP)	SD (%HDEP)	i	$б_p$ (%HDEP)
Foundation stock	1.08	0.5705	2.376	1.30	0.5411	2.419951
F_1 generation	1.88	0.5705	4.326	2.25	0.5411	5.366001
F_2 generation	1.50	0.5705	4.066	2.96	0.5411	6.099857
F_3 generation	1.69	0.5705	4.003	-	-	-

SD, Selection differential; I, selection intensity; $б_p$, Phenotypic standard deviation; HDEP, Hen day egg production

Data analysis

All data were analyzed in a Completely Randomized Design (CRD) with ANOVA (Steel and Torrie, 1980) for comparing hen day egg production, fertility, hatchability and livability of Fay and RIR breed among different generations (Foundation stock, F_1, F_2, and F_3). Data were entered in a spreadsheet (Excel 2000, Microsoft Corporation), transferred to STAT-7 (STAT Corporation) and analyzed using SPSS computer package.

Table 2. Mean (±SE) of egg production, fertility, hatchability and livability of Fay and RIR under farm condition: Foundation stock (F_0) F_1, F_2 and F_3 generation

Parameter	F_0	F_1	F_2	F_3
Fay				
Hen day egg production (%)*	$64.39^a \pm 0.38$	$58.60^b \pm 0.68$	$64.09^a \pm 0.99$	$65.82^a \pm 0.71$
Fertility (%)*	$94.00^a \pm 0.80$	$89.91^b \pm 1.28$	$94.65^a \pm 1.22$	$92.91^a \pm 0.60$
Hatchability on total egg (%)*	$73.48^a \pm 1.50$	$73.70^a \pm 1.31$	$82.96^b \pm 1.66$	$79.30^b \pm 0.98$
Livability during laying period (%)*	$91.6^b \pm 1.18$	$87.63^a \pm 1.65$	$93.80^b \pm 1.10$	$87.51^a \pm 2.54$
RIR				
Hen day egg production (%)*	$68.54^a \pm 0.40$	$46.80^b \pm 0.89$	$62.05^c \pm 1.02$	-
Fertility (%)*	$84.42^a \pm 1.75$	$74.39^b \pm 1.37$	$81.75^a \pm 1.92$	-
Hatchability on total egg (%)*	$63.25^a \pm 1.49$	$53.40^b \pm 0.52$	$62.61^a \pm 1.91$	-
Livability during laying period (%)*	$81.94^a \pm 0.78$	$79.53^a \pm 1.66$	$90.52^b \pm 1.37$	-

^{abc} values with different superscripts in a row indicate significant difference; * Significant at $P < 0.05$

Results and Discussion

Table 2 shows the average egg production, fertility, hatchability and livability of Fay (up to F_3 generation) and RIR (up to F_2 generation). It was observed that hen day egg production and fertility was higher (P <

0.01) in Foundation stock than that of F_1 generation but no significant difference ($P > 0.05$) was observed for livability and hatchability between Foundation stock and F_1 generation. Reasons for lower productivity in F_1 generation of Fay and RIR may be for poor management practices and the inability to adjust in tropical climate (in case of RIR).

In F_2 generation, egg production was higher in both the breeds (64.09% in Fay and 62.05% in RIR) than in F_1 generation. Egg production data of RIR was not recorded for F_3 generation, perhaps the performance occurred for RIR to thrive under semi intensive system was very poor. However, in F_3 generation, egg production of Fay was higher (65.82%) than in F_2 generation.

Table 3. Genetic gain in selection programme of Fayoumi and RIR population

Generation	Genetic gain (% HDEP/generation)	
	Fayoumi	RIR
F_1 generation	0.06	0.07
F_2 generation	0.11	0.18
F_3 generation	0.12	-

The genetic merits of Fay and RIR laying hens for hen day egg production (HDEP) were 0.06 and 0.07 in $F_{1,}$ 0.11 and 0.18 in F_2 and 0.12 in F_3 generations, respectively (Table 3). The declined % HDEP of Fay and RIR in F_1 generation besides their positive genetic merits for the trait may be for poorer adaptation under intensive system. Phenotypic performances of poultry may be lower than that of their genetic potential without support of proper environment and management care (Lasley, 1987).

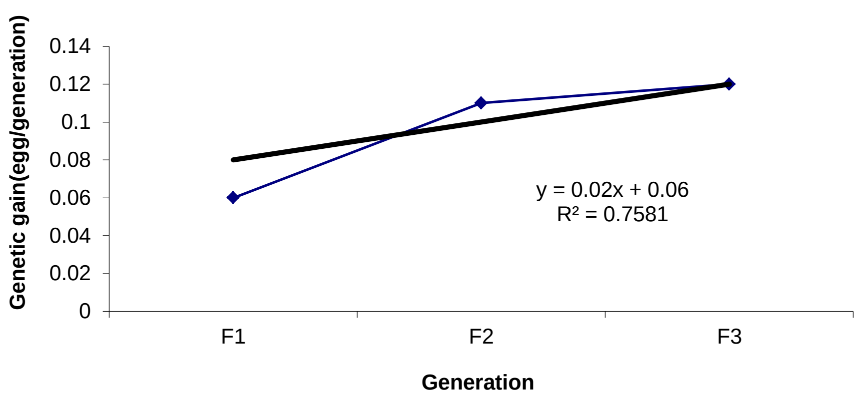

Fig 1: Genetic gain in percent HDEP of Fayoumi laying hens

The Figure 1 and 2 shows that per cent hen day egg production of Fay and RIR breed were increased over the generation. However, the rate of genetic gain was very low to get rapid improvement in laying performances of the breeds. The rate of genetic gain was 0.02 egg/ generation in Fay and 0.044 egg/ generation in RIR. This genetic gain does not correlate with phenotypic performances of Fay and RIR. However, in some circumstances genetic gain in production traits might be hindered by environmental influences (Pidduck, 1995). It is mentioned that lower productivity was found during experimental period as managemental practices (water, electricity etc.) were interrupted for shorter period.

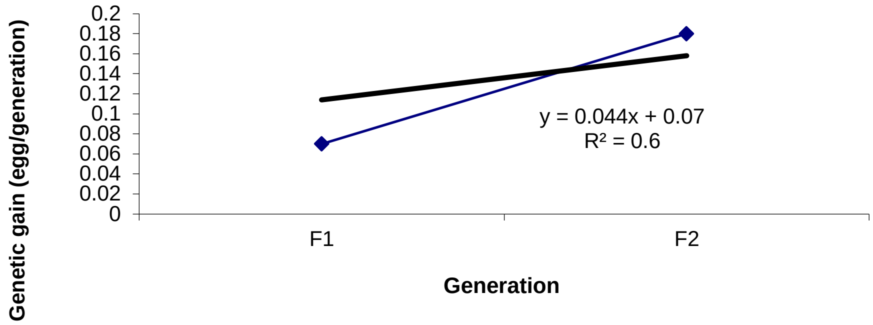

Fig 2: Genetic gain in percent HDEP of RIR laying hens

Conclusion

Hen day egg production of Fay and RIR was found to response suitably to selection with higher rate of lay. The rate of genetic gains so far achieved in the breeding stocks from selective breeding within a small population is required to be increased by many folds to get commercially viable high producing Fay and RIR hens. Selection with larger flock might give a better understanding of selection response.

Selection of Fay may be continued with improved bio-security system for several generations with a larger flock to provide continuous supply of Fay to support the rural poultry production.

Acknowledgements

The Danish International Development Agency (DANIDA) is acknowledged with many thanks for funding this research through Smallholder Livestock Development Project (SLDP) -2 of the Department of Livestock Services (DLS). Thanks are due to Mr. Md. Golam Mostafa, Project Director, SLDP- 2 for allowing to implement the research project.

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