Conservation of purelines of chicken and their performances under on-station condition

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Abstract

The study was conducted at Bangladesh Livestock Research Institute to evaluate the productive and reproductive performances of 4 pure lines (White Leghorn, L_1, White Rock, L_2, Barred Plymouth Rock, L_3 and Rhode Island Red, L_4) conserving for the production of next generation. A total of 2000 pedigree hatched day-old chicks were wing banded and reared up to 40 weeks of age. Data were kept on daily feed intake (g/bird/day), weekly body weight (g), age at sexual maturity (days), daily egg production (%) and egg weight (g). There were highly significant differences ($p<0.01$) in body weight at 38 weeks, age at sexual maturity, egg production up to 40 weeks and egg weight at 38 weeks of age among the treatment groups. There were no significant differences ($P>0.05$) in fertility, hatchability, dead in germ, sound chick and dead in shell percentage among the treatment except cull chicks where L1 showed the highest percent of cull chicks. Egg production at 23-28 and 35-40 weeks of age differ significantly ($p<0.01$) except at 29-34 weeks of age ($p>0.05$). Significant variations for FCR observed at 35-40 weeks of age while it was non-significant ($p>0.05$) at 23-28 and 29-34 weeks of age. It is revealed that line-2 is superior in terms of egg production, age at sexual maturity and egg mass where line-1 was better in terms of FCR value. Considering the results it may be concluded that there are significant variations exists regarding egg production performances among the experimental pure lines, thus could be utilized successfully for the production of high yielding strains through proper breeding programme.

(**Key words:** Conservation, performances, purelines, research farm)

Introduction

The production potentials of exotic chicken are much higher in comparison with indigenous chicken (Ahmed *et al.*, 2009). Several studies have been conducted regarding the introduction of high yielding exotic poultry breed or crossbred into the small holder family farming to increase productivity (Rahman *et al.*, 1998). Despite of several constraints annual growth of poultry is about 15% in Bangladesh. Steady growth of poultry industry contributing increasing the income and nutritional status of the people, particularly the rural people and also creating employment opportunity and helping poverty alleviation. It is worthwhile t point out that the economically important commercially poultry industry is almost cent percent import oriented, thus incur huge foreign currency every year and also makes the country venerable for

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introducing more new diseases. Development of pure lines from imported grandparent lines or pure lines may be helpful for the local poultry industry. Selection within pure lines is the most commonly employed breeding technique for the production of commercial poultry (Cole and hutt, 1993). Minimizing the effects of gene-environment interaction, ability to utilize locally available diets are some of the processes involved in selection of lines with relevant major genes for local adaptation. With that view, Bangladesh Livestock Research Institute (BLRI) obtained 4 pure lines from National Livestock Breeding Centre (NLBC), Okazaki, Japan and has been working to improve their performances through selective breeding and these lines have been maintaining for more than ten generations. Considering those facts, the research was aimed to maintenance and conservation of pure lines at BLRI and to know the production performances of purelines under on-station condition.

Material and Methods

The study was conducted at the poultry research farm of Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh. A total of 3000 pedigree hatched day old chicks (500 from each line) were identified individually by using wing band. After completion of brooding a total of 85 males and 200 females were selected at 16 weeks of age on the basis of physical appearance. Finally, 17 males and 85 females were selected at 38 weeks of age on the basis of selection index for AI purpose. The parent stock were reared in an open sided house in individual cages and exposed to natural daylight of 12 hours/day and 4 hours of artificial light per day. During brooding period data were kept on weekly body weight, feed consumption, mortality, house temperature and relative humidity. Body weight was measured of 10 males and 10 females of each breed randomly to have the average body weight at every week and individual body weight and egg weight of all birds was recorded at 24, 28, 32, 36 and 38 weeks of age. At 16 weeks of age 200 females were selected on the basis of physical appearance and vigor. Depending on season and day length, photoperiod and air movement were also maintained. Female breeders were housed in individual cages and male breeders were caged individually in a separate house. Restricted feeding program with required nutrients according to age was practiced during growing and laying period. All birds were fed diets containing 17.50% crude protein (CP) and 2750-kcal/kg metabolizable energy (ME) per kg diet during laying period. The individual records were kept to evaluate the individual performance. Data collected from the breeder females were age at sexual maturity (day), body weight (g), egg production (%) and egg weight (g). Females were finally selected on individuals own egg production record on index and males were selected from the high producing female groups. Since the birds were kept in individual cages, artificial insemination has been practiced to get fertile eggs. For producing next generation both independent culling level and selection index method were used. For avoid inbreeding depression, mating between full-sibs and half-sibs were avoided. Rotational mating method, that means each sire had one selected cock and the selected cock mated with hens the different sire produced.. The data were analyzed using SAS computer program. The differences in means were tested using LSD.

Results and Discussion

Fertility and hatchability of pure lines

There were no significant differences ($P>0.05$) in fertility, hatchability, dead in germ, sound chick and dead in shell percentage among the treatment groups except cull chick percentage which differ significantly ($p<0.01$) among the treatment groups (Table 1). The rate of cull chick was lowest in line3 (10.74) followed by line 4 (11.17), line2 (12.75) and line1 (17.04). However, the differences might be of hatchery origin where different lines hatched at a time and the temperature and humidity along with the surrounding environment may have the influence on the variation of cull chicks.

The reproductive parameters of the current study got partial support by the study of Monira *et al.,* (2012) where the dead-in-germ does not vary for different lines. However, the reproductive traits are influenced by the genetic, environment and management like storage and care of eggs, quality of eggs, nutrition of layers, season etc. (Kirk *et al.*, 1980).

Egg production, body weight and egg weight of pure lines

There were highly significant differences ($p<0.01$) in body weight and egg weight at 38 weeks, age at sexual maturity, and egg production up to 40 weeks of age among the treatment groups (Table 2). Line$_1$ had the lowest body weight (1417.97g) at 38 weeks followed by line$_2$ (1855.91g), line$_3$ (1904.21g), and line$_4$ (1963.92g). Age at sexual maturity was lowest ($p<0.01$) in line$_2$ (142.19d) compared to other pure lines (L$_1$-147.56d, L$_4$-158.27d and L$_3$-168.73d). The early sexual maturity in L$_2$ may be of breed characteristics. However, the findings partially agreed with the Monira *et al.*,

Table 1. Fertility and hatchability of 4 pure lines

Pure lines	Parameters					
	Fertility (%) (Mean ±SE)	Hatchability (%) (Mean±SE)	Dead in germ (%) (Mean±SE)	Cull chick (%) (Mean±SE)	Sound chick (%) (Mean ±SE)	Dead in shell (%) (Mean ± SE)
L$_1$	92.71 ±1.19	86.41±2.05	0.91±0.32	17.04^a±1.31	69.36 ±2.60	9.95 ±1.79
L$_2$	94.46±0.86	88.18±1.30	1.86±0.48	12.76^b±1.88	75.46±2.20	11.68 =1.34
L$_3$	94.97±0.93	85.48±2.55	2.17±0.72	10.74^b±1.09	74.75±3.43	14.35±2.23
L$_4$	93.55±1.59	83.21±2.22	1.05±0.38	11.17^b±1.19	72.03±2.61	15.35±1.67
Level of sig.	NS	NS	NS	**	NS	NS

Means with different superscripts in the same column differ significantly; **, $p<0.01$; $P>0.05$; NS=non significant

Table 2. Performances of pure lines at 38 and 40 weeks of age

Parameters	Pure lines				SEM	*P*-value
	L_1 (Mean ± SE)	L_2 (Mean ± SE)	L_3 (Mean ± SE)	L_4 (Mean ± SE)		
Body weight at 38 weeks (g/bird)	$1417.97^c±11.11$	$1855.91^b±49.11$	$1904.21^{ab}±14.31$	$1963.92^a±21.17$	23.93	*<0.01*
Age at sexual maturity (d)	$147.56^c±0.87$	$142.19^d±0.78$	$168.73^a±1.14$	$158.27^b±1.19$	1.0	*<0.01*
Egg production rate up to 40 weeks of age	$76.48^b±0.97$	$84.01^a±1.59$	$70.76^c±2.02$	$74.86^{bc}±1.08$	1.42	*<0.01*
Egg weight at 38weeks (g/egg)	$61.20^a± 0.26$	$59.37^b± 0.27$	$59.24^b±0.25$	$60.71^a±0.31$	0.27	*<0.01*

Means with different superscripts in the same row differ significantly; **, p<0.01; Significant

(2013) who got 151 days as lowest and 169 days as highest span of sexual maturity for two lines of chicken. The egg production at 40 weeks of age was highest (p<0.01) in L_2 (84.01%) followed by L_1 (76.48%), L_4 (74.86%) and L3 (70.76%). L1 and line4 had highest egg weight at 38 weeks 61.20g and 60.71g respectively followed by L_2 (59.37g) and L_3 (59.24g) and the differences were highly significant (p<0.01). The variation in egg production and egg weight might be due to the different genetic make up of the birds. The current results for egg production was higher than Monira *et al.*(2013) who found 82.18 and 73.8% egg production for L_2 and L_4 respectively. The results of egg weight also got support from Monira *et al.*, (2013) who got 61, 60 and 58g egg weight for some purelines.

Table 4 implies that egg production, body weight and egg weight at different weeks of age showed significant differences (p<0.01) among the treatment groups. Highest egg production percent was found for L_2 lines (86.53) at all ages followed by L_1 (80.08), L_4 (81.42) and L_3 (78.57) lines. The variations might be due to the different genetic make up of the lines. The results got support from the study of Monira and Islam (2013) who got significant variations in egg production for different purelines. The highest body weight at 20-24, 28-32 and 36-40 weeks of age were observed in L_3, L_4 and L_4 treatment groups. Egg weight at 28-32 and 36-40 weeks of age was significantly higher (p<0.01) in L_1, while L_4 showed highest egg weight at 20-24 weeks of age. However, the findings got support from Monira *et al.*, (2011) who reported 62.7, 60.3, 60.2 and 59.2 g of egg weight for different purlines.

Table 3. Egg production, body weight and egg weight of pure lines at different ages

Parameters	Pure lines L_1	L_2	L_3	L_4	SEM	*P*-value
Egg production (%)						
23-28 week	74.60^{b}	86.83^{a}	51.46^{d}	63.07^{c}	4.54	*<0.01*
29-34 week	78.63^{b}	84.34^{a}	78.57^{b}	76.84^{bc}	2.27	*<0.05*
35-40 week	80.08^{bc}	86.53^{a}	77.97^{d}	81.42^{b}	4.53	*<0.01*
Body weight (g/bird)						
20-24 week	1327.18^{d}	1632.70^{c}	1746.83^{a}	1688.44^{b}	10.00	*<0.01*
28-32 week	1375.79^{c}	1801.08^{b}	1842.07^{a}	1853.81^{a}	10.50	*<0.01*
36-40 week	1417.64^{c}	1897.37^{b}	1904.20^{a}	1963.92^{a}	17.50	*<0.01*
Egg weight (g/egg)						
20-24 week	45.06^{b}	43.81^{c}	43.06^{c}	46.61^{a}	0.35	*<0.01*
28-32 week	55.16^{a}	52.99^{b}	53.83^{b}	54.86^{a}	0.29	*<0.01*
36-40 week	60.62^{a}	57.65^{c}	58.87^{b}	58.48^{b}	0.14	*<0.01*

Means with different superscripts in the same row differ significantly

Table 4. Feed conversion ratio (FCR), egg mass and feed intake of pure lines

Parameters	Pure lines L_1 (Mean ± SE)	L_2 (Mean ± SE)	L_3 (Mean ± SE)	L_4 (Mean ± SE)	Level of sig.
Egg mass (g)					
23-28 week	37.70^{ab}±1.41	43.98^{a}±0.65	24.84±5.47	32.04^{bc}±2.86	**
29-34 week	43.73±1.12	44.80±1.47	42.15±0.97	42.8±0.80	NS
35-40 week	48.73^{b}±0.43	49.88^{a}±0.25	45.89^{d}±0.33	47.64^{c}±0.33	**
Mean	43.29^{ab}±0.53	46.22^{a}±0.44	37.21^{c}±1.68	40.62^{b}±0.97	**
Feed intake (g/hen/day)					
23-28 week	93.32^{b}±1.11	97.39^{a}±1.61	90.76^{b}±1.10	92.43^{b}±0.94	**
29-34 week	107.90±2.36	112.79±2.54	106.38±3.46	109.18±2.89	NS
35-40 week	105.84^{b}±2.69	114.92^{a}±0.04	114.78^{a}±1.92	115.10^{a}±1.79	**
Mean	102.35±1.32	108.37±1.26	103.97±1.93	105.57±1.58	NS
FCR (g feed/g egg)					
23-28 week	2.49±0.079	2.22±0.03	5.85±2.26	3.01±0.30	NS
29-34 week	2.48±0.09	2.54±0.12	2.54±0.13	2.56±0.09	NS
35-40 week	2.17^{c}± 0.07	2.31^{bc}±0.01	2.50^{a}±0.05	2.42^{ab}±0.05	**
Mean	2.37^{c}±0.04	2.35^{c}±0.042	2.81^{a}±0.09	2.60^{b}±0.05	**

Means with different superscripts in the same row differ significantly; **, p<0.01; NS= (non significant)

Feed conversion ratio (FCR), egg mass and feed intake

Egg mass at 23-28 and 35-40 weeks of age differ significantly ($p<0.01$).The highest egg mass was observed in L2 line at all ages than other treatment groups. Feed intake at 23 -28 and 35-40 weeks of age differ significantly ($p<0.01$) while at 29-34 weeks did not vary among the different lines. The highest average feed intake (g/bird/day) was observed in L_2 (108) followed by L_4 (106), L_3 (104) and L_1 (102). The mean FCR for different ages were 2.37, 2.35, 2.81 and 2.6 for L_1, L_2, L_3 and L_4 lines respectively. The FCR for 35-40 weeks of age differ significantly ($p<0.01$) but, at 23-28 and 29-34 weeks of age did not differ ($p>0.05$) among the treatment groups. The lowest value of FCR was observed in L_2 (2.35) means that L_2 was more efficient in conversion of feed into egg mass compared to other lines. However, such variation might be due to the breed, feed and management origin. The FCR value got partial support from the findings of Rashid *et. al.,* (2015) who reported 2.24, 2.34, 2.44 FCR at 30 week of age in different farm conditions for a commercial layer. The results also supported by the study of Monira *et al.,* (2012) who found 2.51 FCR for a hybrid layer. They further mentioned the support from another study of Abeke *et al.,* (2003).

Relationship between egg weight (g) and egg production (%) is shown in (Fig-1) which indicates that egg weight is negatively related to the changes in egg production. The equation also showed that egg production (%) decreases by 1.503 percent for every 1g increase in egg weight. The finding is comparable with the findings of André *et al.,* (2011) who reported genetic correlation between egg weight and total egg production for some quail lines where they get positive and moderate relation for the yellow line, while the other lines were low, but positive for the blue and red lines and negative in the meat line. They explain as the selection process attributed to this relationship. The finding however, disagree with the Lacin *et al.,* (2008) who reported that mean egg weight increased with the increase of egg production up to 67 weeks of age. However, the differences might be arises from the different type of laying birds.

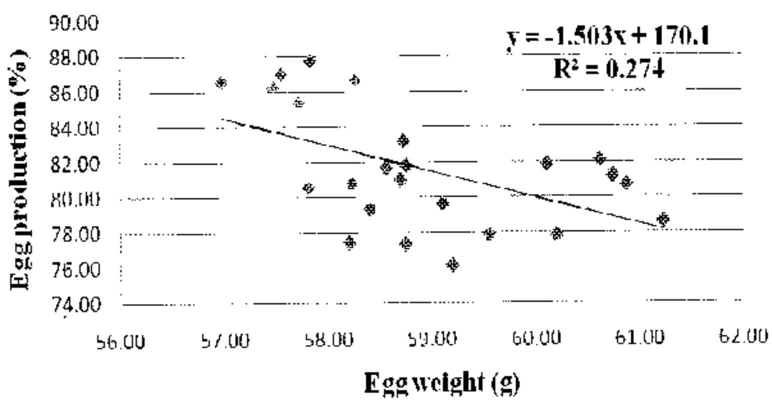

Figure 1. Relationship between egg weight (g) and egg production (%) at 35-40 weeks of age of four lines

Conclusion

Considering the results it may be concluded that there are significant variations regarding egg production performances among the experimental pure lines, those could be utilized successfully for the production of high yielding strains through proper breeding programme.

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