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Research Article

EVALUATION OF PRODUCTION PERFORMANCE OF SOME ECONOMIC TRAITS IN WHITE LEGHORN BIRDS

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ABSTRACT

Change in mean performance of a synthetic population of a White Leghorn (WLH) birds under constant selection over generation was evaluated. The data, on 2416 pullets, progenies of 252 sires of WLH over five generations (2008-09 to 2012-13), maintained at the University Farm were utilized for this study. The traits studied were body weight (g) at 20 weeks of age (BW_{20}), age at first egg in days (AFE), egg weight(g) at 40 weeks of age (EW_{40}), egg number upto 40 weeks of age (EN_{40}), body weight(g) at 40 weeks of age (BW_{40}) and egg mass upto 40 weeks of age (EM_{40}). There was a significant change in all the traits over the different generations. There was no definite trend for $BW_{20,}$ EN_{40}, BW_{40} and EM_{40} over the successive generations. EW_{40} and AFE showed an increasing trend over the generation. There was highly significant ($P<0.01$) effect of hatch within a generation and generation on performance traits. It may be concluded that means of various performance traits differed significantly over the generations due to genetic and environmental reasons and there is a scope for improvement of performance of the flock under study.

Key words: Age, performance traits, White Leghorn birds

Poultry farming occupies a pivotal position in bringing about rapid economic growth. Today, the need of the farmer is for the birds which lay more eggs with optimum egg size and the least feed consumption. Poultry production is the fastest growing subsector of Indian agriculture. Relentless efforts and concerted research in poultry breeding has lead to the evolution of high producing layer stocks suited for different environment and management practices. White Leghorn is the main promising breed of layer industry well known for egg production. Growth and production traits of a bird indicate it's genetic constitution and adaptation with respect to the specific environment. This study was undertaken to evaluate the changes in phenotypic means over generation in a population of synthetic White Leghorn population.

MATERIALS AND METHODS

The data, on 2416 pullets, progenies of 252 sires of White Leghorn over five generations (2008-09 to 2012-13), maintained at the Poultry Breeding Farm of the Department of Animal Genetics and Breeding of this university were utilized for the present study. The birds were maintained under uniform practices of feeding, housing and management under cage system. The traits studied were body weight (g) at 20 weeks of age (BW_{20}), age at first egg in days (AFE), egg weight (g) at 40 weeks of age (EW_{40}), egg number upto 40 weeks of age (EN_{40}), body weight (g) at 40 weeks of age (BW_{40}) and egg mass upto 40 weeks of age (EM_{40}). No specific criteria of selection were followed to propagate the population over the generation, however, some emphasis were given to select the parents on the basis of sire family average for egg number and egg weight. The analysis of variance was conducted to test the effect of generation and hatch within generation by using maximum likelihood method of Harvey (1990).

$$Y_{ijkl} = \mu + G_i + H_{ij} + S_{ik} + e_{ijkl}$$

Where, Y_{ijkl} is observation on l^{th} progeny of kth sire in j^{th} hatch of ith generation; μ is the overall mean; G_i is the fixed effect of ith generation (i=1,2.. .5); H_{ij} is the fixed effect of jth hatch in i^{th} generation (j=1,2 h); S_i is the random effect of kth sire in i^{th} generation and e_{ijkl} is the random error associated with each observation and assumed to be NID $(0,ó^2_e)$.

RESULTS AND DISCUSSION

The means along with standard errors for various economic traits are presented in Table 1.

Body Weight at 20 Weeks of Age (BW_{20}): The averages for BW_{20} ranged from 1246.52 g to 1412.25 g in different generations. There was a significant change in body weight over the different generations. However, there was not any definite trend for BW_{20} over the successive generations. The pooled value for BW_{20} was 1336.82 g. Mean body weight was the lowest in G_2 and

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highest in G_4. Our findings are similar to those reported earlier by Paleja *et al*. (2008) and Jadhao *et al*. (2012). On the contrary, lower (Godara *et al*., 2007; Bais *et al*., 2008; Barot *et al*., 2008; Chaudhary *et al*., 2009; Jayalaxmi *et al*., 2010) and higher (Devi and Reedy, 2005; Giriraj *et al*., 2008) BW_{20} were reported in some of the previous studies.

Age at First Egg (AFE): The pooled over mean for AFE was 149.77 days. There was a significant (P<0.05) change in AFE over the different generations and it showed an increasing trend over the successive generations except in generation G_2. Paleja *et al*. (2008), Jayalaxmi *et al*. (2010), Jadhao *et al*. (2012) and Veeramani *et al*. (2012) also reported a similar range for AFE. On the contrary, Giriraj *et al*. (2008) and Bais *et al*. (2008) in White Leghorn lines (IWH) reported lower AFE, while Bais *et al*. (2008) in IWH reported higher AFE than that observed in this study. The variability could be attributed to genetic and environmental differences in the different flock.

Egg Weight at 40 Weeks of Age (EW_{40}): The average EW_{40} ranged from 48.98 g to 51.77 g in different generations. Pooled mean value for EW_{40} was 50.87 g. The EW_{40} showed an increasing trend over the generations. However, there was 6% change in the egg weight over the base year. The egg weight was maintained at a constant level over the generations, which may be due to inclusion of egg weight as a selection criterion. Similar results were reported by Paleja *et al*. (2008) and Bais *et al*. (2008). On the contrary, Devi and Reedy (2005), Jayalaxmi *et al*. (2010), Jadhao *et al*. (2012) and Veeramani *et al*. (2012) reported higher EW_{40} than that observed in this study.

Egg Number upto 40 Weeks of Age (EN_{40}): The average EN_{40} ranged from 74.14 eggs to 90.09 eggs in different generations and the pooled mean for EN_{40} was 80.85 eggs. There was a significant (P<0.05) change in EN_{40} over the different generations. However, no specific trend was observed over the successive generations. The performance of G_1 generation was found to be superior over all generations. Godara *et al*. (2007) reported lower EN_{40}, while Devi and Reedy (2005), Ahmad and Singh (2007), Barot *et al*. (2008), Paleja *et al*. (2008), Jayalaxmi *et al*. (2010) and Veeramani *et al*. (2012) reported higher EN_{40} than that observed in the present study. While selecting the pullets, more emphasis was given on egg weight, thus causing decline in egg production and secondly because of negative correlation between the two traits and other non-genetic factors.

Body Weight at 40 Weeks of Age (BW_{40}): The pooled mean for BW_{40} was 1568.64 g. with a significant change over generations. Mean body weight was the highest in G_4 and the lowest in G_2 generation. The trend of mean body weight over the successive generations was similar to the trend of BW_{20}. The results are in close conformity with the findings of Paleja *et al*. (2008) and Veeramani *et al*. (2012). Bais *et al*. (2008) and Chaudhary *et al*. (2009) and Jayalaxmi *et al*. (2010) reported lower BW_{40} while Giriraj *et al*. (2008) reported higher BW_{40} than that observed in this study. Higher BW_{20} and BW_{40} may probably be due to good feeding and management conditions.

Egg Mass upto 40 Weeks of Age (EM_{40}): The pooled mean value for this trait was 4103.24 g with a significant change over the different generations. The performance of G_1 generation was found to be superior over all generations. There was no specific trend over the successive generations for EM_{40}, however, Paleja *et al*. (2008) reported lower EM_{40} in IWH.

Effect of Hatch: Effect of hatch within generation was highly significant (P<0.01) on BW_{20}, AFE, EW_{40}, EN_{40}, BW_{40} and EM_{40} (Table 2). Singh *et al*. (2001) and Rahman *et al*. (2003) reported a significant effect of hatch on body weight at 20 and 40 weeks of age, egg weight, egg number

Table 1

Generation-wise least-squares means along with standard error for performance traits of pullets

Generation	Traits					
	BW_{20} (g)	AFE (days)	EW_{40} (g)	EN_{40}	BW_{40} (g)	EM_{40} (g)
G_1	1326.22^c±6.65 (380)	143.37^e±0.42 (380)	48.98^d±0.14 (380)	90.09^a±0.63 (380)	1517.18^d±7.28 (380)	406.15^a±32.14 (380)
G_2	1246.52^d±5.33 (731)	154.19^a±0.34 (731)	50.43^c±0.11 (731)	76.61^d±0.51 (731)	1485.65^e±5.84 (731)	858.45^c±25.77 (731)
G_3	1372.24^b±5.44 (566)	148.03^d±0.35 (566)	51.77^a±0.11 (566)	84.95^b±0.51 (566)	1575.24^c±5.95 (566)	393.84^a±26.28 (566)
G_4	1412.25^a±7.33 (345)	150.75^c±0.47 (345)	51.46^b±0.15 (345)	74.14^e±0.69 (345)	1669.39^a±8.03 (345)	814.37^c±35.43 (345)
G_5	1326.87^c±6.58 (394)	152.53^b±0.42 (394)	51.71^{ab}±0.14 (394)	78.48^c±0.62 (394)	1595.72^b±7.20 (394)	043.41^b±31.79 (394)
Pooled	1336.82±3.36 (2416)	149.77±0.21 (2416)	50.87±0.07 (2416)	80.85±0.32 (2416)	1568.64±3.68 (2416)	103.24±16.23 (2416)

Means bearing different superscripts in a generation differ significantly (P<0.05).
Figures in parenthesis are the numbers of observations.

Table 2

Analysis of variance for testing the effects of generation and hatch on various performance traits of pullets

Source	d.f.	Effect on various performance traits					
		BW_{20} (g)	AFE (days)	EW_{40} (g)	EN_{40}	BW_{40} (g)	EM_{40} (g)
Generations	4	1992758.60**	8607.22**	591.45**	17053.05**	2292708.06**	36145180.7**
Hatch	18	140690.70**	506.14**	56.32**	1758.98**	167749.521**	4307652.5**
Sire	251	20420.24**	68.30*	9.19**	181.24**	22177.65**	433208.3**
Error	2128	13920.35	59.10	6.02	120.68	17044.48	321347.8

*P<0.05; **P<0.01

and egg mass upto 40 weeks of age. Veeramani *et al*. (2005) reported significant effect of hatch on AFE, EW_{20}, EW_{40}, egg production upto 40 and 64 weeks of age.

It may be concluded from this study that means of various performance traits differ significantly over the successive generations probably due to genetic and environmental reasons and there is a scope for improvement of performance of the flock.

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