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Preliminary Results of Short-Term Egg Laying Performance of Pure and Crossbred Chicken Progeny in a Humid Environment

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Abstract: Egg laying performance of 120 pullets sired by four different strains- three Nigerian indigenous (Naked-neck, Frizzle feathered and Normal feathered) and one exotic (White Leghorn) was studied over an 18-week period. The traits considered were egg number and egg weight. Sire genotype significantly ($p<0.05$) affected mean egg number and egg weight while season had no significant effect ($p>0.05$). Frizzle feathered progeny laid more eggs (4.61±0.27- 6.25±0.35) comparable to the progeny of White Leghorn while Naked neck progeny laid heavier eggs (44.26±1.12-47.76±1.41 gm). Estimate of heritabilities (h^2_s) was low for egg number (h^2_s=0.07) and moderate ((h^2_s=0.31) for egg weight (genotypes combined). Negatively low genetic and phenotypic correlations were recorded between egg number and egg weight. This study therefore revealed the existence of genetic variability and potentials for genetic improvement in egg traits amongst the Nigerian local chickens.

Key words: Sire strain, purebred, crossbred, egg number, egg weight, chicken

INTRODUCTION

The profitability and survivability of any poultry enterprise engaged in egg production are hinged on the productive performance of its stock. The average number of eggs laid per bird for a given period measures the productive capacity of a hen in a specified period and under specific environmental conditions. The Nigerian local chicken has been reported to constitute 80% of the total chicken population in Nigeria[1]. These chicken have been reported to adapt very well to the traditional small scale system of production that is prevalent in most areas of Nigeria[2]. However, the characteristic poor growth, small body and small egg size of these chickens have made them to be non-attractive and non-desirable in a competitive economic situation[3]. This led to the crossing between the exotic and the local stock to take advantage of the faster growth and egg production genes in the former. [4]reported that Nigerian local chicken possess genetic raw material for layer chicken production if appropriate genes can be transferred from the exotic strain into the local chicken population. Also, the possession of high genetic variability vis-a-vis hardiness, disease tolerance and adaptation to adverse environment made[5] to suggest their development into layer strain for the tropical environment.

The assessment of the laying phase of chickens intended to be used in the development of a layer line in the tropics is important because reproductive performance is an economic trait whose improvement will go a long way in raising animal protein production. This study therefore sought to evaluate the laying performance of crossbred progenies.

MATERIALS AND METHODS

The research was carried out at the Poultry Breeding Unit of the Department of Animal Breeding and Genetics, University of Agriculture, Abeokuta, Nigeria (7°10[1] N and 3°2[1]E). The area lies in the southwestern part of Nigeria and has a prevailing tropical climate with mean annual rainfall, temperature and relative humidity of 1037 mm, 34°C and 82%, respectively. The vegetation represents an interphase between the tropical rainforest and the derived Savannah.

The genotypes used for this study were selected from the stock of crosses of Nigerian local chicken maintained at the university aforementioned. Records of 120 pullets sired by four different strains three Nigerian indigenous (Naked Neck, Frizzle feathered and Normal feathered) and one exotic (White Leghorn) from first week of lay to eighteen weeks were studied for egg number

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and egg weight. The data generated were statistically analysed. These birds were caged individually in a three-tier battery cage in a floor space of $0.4m^2$. The crossbred were generated through artificial insemination using the massage technique described by[6]. Semen samples collected from individual sires within the sire groups were used to inseminate White Leghorns assigned to them to generate fertile eggs. The mating design was; Naked Neck x White Leghorn; Frizzle x White Leghorn; Normal x White Leghorn and White Leghorn x White Leghorn. The fertile eggs were accrued for about seven days and pedigreed along sire and dam lines before incubation and hatching. At day old, all the resulting chicks were properly identified and wing-tagged along sire and dam lines and brooded under standard management practices[7]. The management procedure at the brooder house and feeding systems up to the laying stage were previously described[8]. Records of egg number and egg weight were taken and recorded on weekly basis. These data were subjected to two-way analysis of variance using the PROC GLM of[9]. The model was fitted for the effects of sire strain and season. Interaction of sire and season was not significant; therefore it was not included in the final model.

Model:

$$Y_{ijk} = \mu + S_i + Se_j + e_{ijk} \quad (3)$$

Where,

Y_{ijk} = observation on egg numbers and egg weight
μ = overall mean
S_i = effect of i^{th} sire strain (i =1- 4)
Se = effect of j^{th} season (j =1- 3)
e_{ijk} = random residual error.

Means were separated using Duncan's Multiple Range test[10]. Heritability, genetic and phenotypic correlations of egg weight and egg number was also calculated using the formulae previously described[11].

RESULTS

The least square means of egg number and egg weight of pure and crossbred progenies as affected by sire strain and season are presented in Table 1-4. Sire strain was found to significantly ($p<0.05$) affect egg number except at weeks 1, 12 and 15 while egg weight was significantly ($p<0.05$) affected at all ages. Season had no

Table 1: Mean egg number of four layer chicken genotypes at different laying phase and seasons

			egg no/bird			
			Genotype			
Age (week)	No. of birds	Overall mean	Naked neck	Frizzle	Normal	White Leghorn
1	120	4.19±0.26	3.89±0.25	4.61±0.27	4.13±0.26	4.14±0.26
3	120	4.42±0.25	4.14 ± 0.21^{bc}	3.91 ± 0.28^{c}	4.89 ± 0.21^{a}	4.74 ± 0.26^{ab}
6	120	4.58±0.24	4.35 ± 0.26^{b}	4.19 ± 0.27^{b}	4.63 ± 0.20^{ab}	5.14 ± 0.25^{a}
9	120	5.80±0.30	5.71 ± 0.25^{a}	5.27 ± 0.26^{a}	5.93 ± 0.24^{a}	6.29 ± 0.32^{b}
12	120	5.88±0.35	5.76±0.27	5.26±1.42	5.96±0.24	6.52±0.22
15	120	5.38±0.29	4.65±0.26	5.96±0.33	4.89±0.27	6.00±0.25
Season						
Early dry	116	4.46±0.14	4.33±0.11	4.33±0.11	4.36±0.10	4.96±0.13
Late dry	118	5.66±0.58	4.88±0.11	5.77±0.41	5.38±0.11	6.60±0.11
Early wet	112	5.49±0.42	4.75±0.31	5.88±0.38	5.22±0.01	6.09±0.13

a, b, c = Subclass means across same row having different superscripts are significantly different ($p<0.05$)

Table 2: Mean egg weight (g) of four genotypes at different laying phase and seasons

			egg no/bird			
			Genotype			
Age (week)	No. of birds	Overall mean	Naked neck	Frizzle Feathered	Normal Feathered	White Leghorn
1	120	39.82±1.15	44.26 ± 1.12^{a}	43.53 ± 0.89^{a}	38.87 ± 0.82^{b}	32.61 ± 0.72^{c}
3	120	41.80±0.98	43.81 ± 0.72^{a}	45.58 ± 0.96^{a}	40.37 ± 1.02^{b}	37.43 ± 0.53^{c}
6	120	42.89±0.87	45.46 ± 0.62^{a}	46.58 ± 0.78^{a}	39.32 ± 0.91^{b}	40.20 ± 0.63^{b}
9	120	44.74±1.25	47.52 ± 0.60^{a}	46.83 ± 0.84^{a}	41.36 ± 0.98^{b}	43.23 ± 0.47^{b}
12	120	44.30±1.02	47.37 ± 0.61^{a}	43.89 ± 1.20^{bc}	41.37 ± 1.02^{c}	44.63 ± 0.43^{b}
15	120	45.57±1.24	47.99 ± 1.46^{a}	44.25 ± 0.85^{bc}	44.23 ± 0.94^{c}	45.88 ± 0.52^{ab}
18	120	45.75±2.31	47.76 ± 1.41^{a}	45.23 ± 0.76^{ab}	43.97 ± 1.04^{b}	46.05 ± 0.53^{a}
Season						
Early dry	116	41.46±1.35	43.64±0.47	45.30±0.36	39.64±0.38	37.25±0.35
Late dry	118	44.32±0.87	46.40±0.30	46.28±0.39	41.24±0.41	43.36±0.21
Early-wet	112	45.43±0.45	48.24±0.38	44.88±0.38	42.81±0.37	45.79±0.25

a, b, c = Subclass means across same row having different superscripts are significantly different ($p<0.05$)

Table 3: Coefficients of heritability, phenotypic and genetic correlation of egg number and egg weight (genotypes combined)

	Egg number	Egg weight
Egg number	0.07	-0.114
Egg weight	-0.098	0.31

Lower and upper parts are the genetic and phenotypic correlation coefficients, respectively while the diagonal values represent the heritability estimates

significant ($p<0.05$) effect on egg number and egg weight. The mean egg number and egg weight per bird increased generally as the birds advanced in laying phase. The progeny of the Frizzles laid more eggs per bird than other genotypes, increasing from 4.61 eggs in the first week to 6.25 eggs in the18th week. However, the progenies of Naked Necks laid consistently heavier eggs weight from the first week through to eighteen weeks. Meanwhile, at 18^{th} week, the mean egg weight of the Naked necks was not significantly ($p<0.05$) better than that of the Frizzle crossbreds.

Although, season was not significant ($p<0.05$) on egg number and egg weight, however, White Leghorn purebred laid more consistently throughout the season. In contrast, Frizzles had superior mean egg weight in the early dry; naked-neck individuals in the late dry and early wet (Tables 1 and 2). Heritability estimates of egg number and egg weight at 18-week period from sire component of variance (genotypes combined) are shown in Table 3. Heritability estimates of egg number and egg weight were low and moderate, respectively. The values of both genetic and phenotypic correlations were generally low and negative (Table 3).

DISCUSSION

The significant differences in the mean egg number and egg weight per bird of the tested strain are consistent with reports of[12-14]. These authors reported significant strain/breed differences in the laying performance of different strain of birds studied. As observed in this study, the consistent increase in egg weights at different laying phase agrees with the observations of[15] that egg weight in chicken increases with increase in age of laying birds. The superior performance of the Frizzle and Naked crossbreds in terms of egg number and egg weight, respectively agrees with the findings of[16]. These workers reported a higher egg production in the crossbreds than purebreds under a commercial production system. The superior performance of the crossbreds could be as a result of their feather structure, which enables them to dissipate heat more easily thus, conferring better adaptation to the tropical weather[17]. Although, there was no significant effect of season on the parameters studied[18], reported that seasonal variations do affect egg type chickens differently.

The reported heritability estimates of egg production and egg weight from the sire components of variance are consistent with past findings[19]. These authors noted that a low heritability estimate indicates low additive genetic variance while a moderate estimate indicates presence of appreciable additive genetic variance. Therefore, mass selection could be employed. Low heritability estimate for egg number in this study is expected because of its association with the reproductive structure, which is more responsive to environmental influences, e.g. nutrition, management, etc. The relationship between egg number and egg size is important to the breeder as it concerns the most economic factors determining egg production, thus, an antagonistic correlation usually exists between these two traits when examined on a phenotypic basis[5]. Generally, low genetic and phenotypic correlations indicate that birds with lower egg weights are inclined to produce more eggs as a correlated response. Therefore, selection for one of these traits will bring about a negative correlated response in the other trait.

CONCLUSION

Arising from the results of this study, it can therefore be concluded that there are presence of large genetic variations in the egg number and weight within the chicken population and this present better opportunity for selection.

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