Effect of genotype on egg production traits of main and reciprocal crossbred Isa Brown and local chickens

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***Target Audience**: Poultry farmers, Poultry Breeders, Animal Scientists*

Abstract

A study was carried out to evaluate the egg production traits of 39 main and reciprocal crossbred Isa Brown and frizzle feathered, naked neck and normal feathered local chickens. Egg production data were collected on 1739 eggs for 70 days and *subjected to two-way analysis of variance in randomized complete block design. Results indicated that Isa Brown x frizzle feathered main cross (IBxF) recorded highest significant (P<0.05) short-term egg number to 70 days (41.21±1.59 eggs) while normal x Isa Brown reciprocal cross (NxIB) recorded highest significant (P<0.05) body weight at first egg (1333.77±18.93 g) and weight of first egg (39.12±0.31 g). Naked neck x Isa Brown reciprocal cross (NaxIB) had earliest significant (P<0.05) age at first egg (164.39±1.18 days). There was no significant difference (P>0.05) in average egg weight among the genotypes. However, the average egg weigh (49.20 ±0.38) of Isa brown x normal fathered main cross (IBxN) was numerically heavier, followed by that of NaxIB, (44.02±0.30). Isa Brown x frizzle feathered main cross and naked neck x Isa Brown reciprocal cross exhibited better egg production traits. Egg production can be improved by main and reciprocal crossbreeding of Isa Brown with frizzle and naked neck chickens.*

Keywords: *Crossbreeding, hybrid chickens, egg production*

Description of Problem

Research has shown that the egg production performance of the local chicken is low compared to that of improved exotic ones [1] due mainly to harsh environmental conditions and poor genetic profile [2]. However, strains such as frizzle feathered and naked neck, found in the local chicken population, are known to possess thermoregulatory genes which enable them cope with heat stress in tropical environment and hence improve productivity. The thermoregulatory effect of these genes is reported to be evident during the laying phase of production where birds suffer from additional stress from laying [3]. Hence, the birds should be engaged in crossbreeding with exotic ones to improve egg production. The objective of this study was to determine the effect of genotype on egg production traits of main and reciprocal crossbred Isa Brown and frizzle feathered, naked neck and normal feathered local chickens produced in tropical humid environment.

Materials and Methods

Experimental location

The experiment was conducted at the Poultry Unit of the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike. The University is located on Latitude $05^0 29´$ North and Longitude 07^0 33´ East. It is approximately 122m above sea level. The area is characterized by maximum and minimum daily temperature ranges of $27\text{-}36^0$ C and $20\text{-}26^0$ C, respectively, average annual rainfall of 2177 mm, monthly ambient temperature range of 22-33°C and relative humidity of 50- 95 % [4]. It is located within the tropical rainforest zone of Nigeria.

Experimental stock and management

The parent stock used consisted of 36 exotic Isa Brown (9 cocks and 27 hens), 11 frizzle feathered (3 cocks and 8 hens), 10 naked neck (3 cocks and 7 hens) and 12 normal feathered (3 cocks and 9 hens) chickens. These were fed layer mash containing 2650 metabolisable energy per kilogram weight (ME/kg) and 16.5 % crude protein (CP) *ad libitum* and mated in main and reciprocal order to produce fertile eggs which were set in locally constructed incubator in batches at weekly intervals. The birds were produced in twelve consecutive hatches. The genotypes of the F_1 crossbreds produced were Isa Brown x frizzle feathered main cross (IBxF), Isa Brown x naked neck main cross (IBxNa), Isa Brown x normal feathered main cross (IBxN), frizzle feathered x Isa Brown reciprocal cross (FxIB), naked neck x Isa Brown reciprocal cross (NaxIB) and normal feathered x Isa Brown reciprocal (NxIB) cross. The F_1 birds were fed during starting, growing and laying stages with recommended diets containing 2800 kcal ME/kg and 20% CP, 2550 kcal ME/kg and 15% CP and 2650 ME/kg and 16.5 % CP, respectively. At week 20, 39 hens of all the genotypes were transferred to laying pens. The hens laid a total of 1739 eggs in 70 days which were used for the study.

Parameters measured

Short-term egg number to 70 days (EN_{70}) was counted as the number of eggs laid in the first 70 days of a hen. **Age at first egg (AFE)** was counted as the number of days it took a hen to lay its first egg. **Body weight at first egg (WTAFE)** was measured in gram (g) as the body weight attained by a hen at first egg. **Weight of first egg (WTFE)** was measured as the weight of first egg of a hen. **Average egg weight for 70 days of lay (AEWT)** was obtained in g by dividing the total egg weight by the total number of eggs laid in 70 days. Body weight at first egg, WTFE and AEWT of individual hens were measured using Ohaus electronic sensitive weighing scale (Model CS 5,000) with sensitivity of 2.00 g

Experimental design and statistical analysis

The design of the experiment was randomized complete block design with hatch as block and genotype as treatment. The fixed effect model for the design is as follows.

$$\mathbf{Y_{ijk} = \mu + H_i + G_j + \epsilon_{ijk}},$$

where Y_{ijk} is single observation on k^{th} progeny of j^{th} genotype in i^{th} hatch, μis population mean, H_i is fixed effect of hatch (i = 1,…, 12), G_j is fixed effect of genotype (j = 1,…, 6) and ϵ_{ijk} is random error, assumed to be independently and identically normally distributed with zero mean and constant variance [iind (0, σ^2)]. Data were analysed by analysis of variance using [5] software. Significant genotype means were separated using New Multiple Range Test [6].

Results and Discussion

Table 1 shows that genotypes differed significantly ($P<0.05$) in all the traits except for AEWT. Highest EN_{70} was laid by IBxF followed by NaxIB, IBxN, FxIB and NxIB genotypes. The IBxNa laid the least EN_{70}. The result of the EN_{70} differed from that of [7] who reported that naked neck x exotic hens laid the highest short term 90-days egg number. The observed difference may be due to different exotic parent stock used by the previous researchers since breed/strain has been reported to influence significant variation in the performance of animals [8]. Also, the highest EN_{70} observed from IBxF followed by NaxIB genotypes agrees with the findings of [9] and [7] and supports the fact that frizzle and naked neck genes may impart productive advantage in the crossbreds, especially in hot humid environment with constant high ambient temperature [2]. The mean EN_{70} ranged from 25.43 – 41.21eggs for the genotypes. These values were generally greater than the average range of 12.59-38.02 eggs laid in 56 days and 24-35 eggs laid in 90 days by the Nigerian local hens possessing Na, F and N feather genes as reported by [1] and [10], respectively. The greater comparative performance of hens in the present study is further evidence to support the findings of [11] that crossbreeding improves performance of the crossbreds. The superiority of these crossbreds over the pure local chickens is attributed to positive heterosis arising from crossbreeding [12].

Table 1: Mean (± se) egg production traits of main and reciprocal crosses of Isa Brown and local chickens

	Main cross			Reciprocal cross		
Trait	**IBxF**	**IBxNa**	**IBxN**	**FxIB**	**NaxIB**	**NxIB**
EN_{70}	41.21^a ±1.59	25.43^c ±1.30	31.69^b ±10.62	31.68^b ±1.47	33.45^b ±0.75	29.71^b ±1.55
AFE (days)	169.25^{ab} ± 2.27	167.86^b ±1.30	175.76^a ±1.98	170.51^{ab} ±3.03	164.39^b ±1.18	169.60^{ab} ±1.89
WTAFE (g)	1217.72^c ±15.51	1273.87^b ±18.86	1216.33^c ±17.96	1173.16^c ±19.27	1171.08^c 17.57	1333.77^a ±18.93
WTFE (g)	38.52^{ab} ±0.37	39.05^a ±0.41	38.93^a ±0.14	37.43^b ±0.40	38.17^{ab} ±0.35	39.12^a ±0.31
AEWT (g)	43.33 ±043	42.40 ±0.43	49.20 ±0.38	42.81 ±0.39	44.02 ±0.30	43.56 ±0.29

a,b,c Means on the same row bearing different superscripts are significantly different ($P<0.05$).
IBxF= Isa Brown x Frizzle feathered main cross, IBxNa = Isa Brown x Naked neck main cross, IBxN = Isa Brown x Normal feathered main cross, FxIB= Frizzle feathered x Isa Brown reciprocal cross, NaxIB = Naked neck x Isa Brown reciprocal cross, NxIB= Normal feathered x Isa Brown reciprocal cross
EN= Egg number to 70 days, AFE = Age at first egg, WTAFE = Weight at first egg, WTFE = Weight of first egg, AEWT = Average egg weight, se = standard error of mean

The mean AFE of the genotypes ranged from 164.39- 175.76 days. These means fell within the ranges of 157.00 -186.18 and 177.60- 199.00 days of age at first egg of different genotypes reported by [1 and 13], respectively and was slightly longer than 159.33- 169.11 and 159.47- 168.47 days reported by [13 and 14], respectively for local hens. These differences in the observed age at first egg may be due to differences in breeds, feed and managements employed by these researchers. The NaxIB and

IBxNa genotypes attained earliest AFE (164.39±1.18 days and 167.86 ±1.30 days, respectively) while the IBxN had the longest significant age at first egg (175.76±1.98 days). The attainment of early sexual maturity by naked neck carrying-genotypes is a consistent observation in poultry breeding by some researchers [15 and 1] and has often been associated with greater egg production [7] and reduced feed intake as a result of genetic correlation between these traits.

The highest significant ($P<0.05$) mean body weight at first egg and weight of first egg were obtained from NxIB. This result suggests positive correlation between the two traits, indicating that heavy birds may lay big sized eggs. This is in agreement with the findings of [16]. The weight of first egg of NxIB did not differ significantly from those of IBxNa and IBxN. This implies that three genotypes can be selected to improve egg size. The body weight at first egg of the birds fell within the range of 812.50 – 2072.00 g for main and reciprocal crossbreds reported by [7].

Average egg weight was not significant ($P>0.05$) among the genotypes. This indicates that the hens can all be involved in breeding experiment for improvement of egg weight. However, the average egg weight of IBxN was numerically bigger than those of the other genotypes, including its reciprocal cross (NxIB). This potential superiority seems to come from the exotic Isa brown cocks used in the mating. This suggests that egg weight may be better improved by crossing local hens with exotic cocks.

Conclusion and Application

1. Isa Brown x frizzle feathered main cross and naked neck x Isa Brown reciprocal cross performed better in egg number and age at first egg.
2. Normal x Isa Brow reciprocal cross was better in body weight and egg weight related traits.
3. Frizzle and naked chickens should be used in main and reciprocal crossbreeding respectively with Isa Brown chicken to improve total egg production while normal feathered chickens should be used in the reciprocal cross to improve egg size.

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