

EGG PRODUCTION PATTERNS IN LOCAL CHICKENS AND THEIR CROSSES IN THE SHORT-TERM

By

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ABSTRACT

The results of a battery cage study to characterize the short-term (120 days) egg production patterns of randombred and non-selected population of local chickens (LC) and their crosses with parent stock of Gold-Link chickens (GL) are presented. It was found that LC (male) × LC (female) and LC × GL pullets produced their first egg at a significantly ($P < 0.01$) earlier age of 157.8 days ± 3.21 and 155.4 days ± 1.49 respectively than GL × GL and GL × LC pullets with corresponding ages of 169.2 days ± 1.65 and 169.7 days ± 3.74. Similarly LC × LC and LC × GL pullets had significantly ($P < 0.01$) less number of clutches than GL × GL and GL × LC pullets. There were no significant differences ($P < 0.05$) in clutch size of the pullets of the four breeding groups. Whereas the LC × LC and LC × GL had significantly ($P < 0.01$) less number of pauses but apparently longer pause lengths, the GL × GL and GL × LC had more number of pauses ($P < 0.05$) with short pause lengths. The low ($P < 0.01$) short-term egg production of 48.5 eggs ± 4.1 LC × LC pullets in contrast to over 60 eggs for each of the other breeding groups was probably due to their long pause length of 3 days ± 0.4 which, just like their lower clutch number and size, was found to be related with the Local Chicken's low egg number. The results indicate that local cocks transmitted genes for early age at first egg and lower clutch and pause numbers. The crossbreds had higher broodiness than their parents; it is suggested then that overdominance is the mode of inheritance of the broody character in the chicken.

INTRODUCTION

There are a few published reports on the egg production and patterns of the Local Chickens and their crosses with the exotic under the tropical conditions in Nigeria. Hill (1954) reported that the local fowl averaged 50 eggs per annum if kept in the extensive system. Under intensive management and improved dietary regime quite twice this number in the extensive has been achieved by the indigenous chickens (Hill and Modebe, 1961; Akinokun, 1971; and Nwosu, 1979). The *Nigerian Journal of Animal Production* 10 (1 & 2) 1983

local fowl was also reported to lay, under extensive system, up to three clutches of 12—18 eggs each year, and it was very broody (Williamson and Payne, 1978). When compared with the exotic and their crosses the local chickens have been found inferior in egg production (Hill and Modebe, 1961; Akinokun and Dettmers, 1977, and Nwosu, 1979). Several workers (Abdel-Kader and El-Hossari, 1976; Poggenpoel and Erasmus, 1978; Thangaraju, *et al* 1978; Singth, *et al* 1980) have demonstrated that the number of eggs produced by the hen either as part or full record was a result of correlated responses to other production components which included age and body weight at first egg, clutch number and size, pause number and length, and broodiness. Therefore, an efficient method of making a reliable assessment of the improvement in egg production of the local fowl through crossbreeding, is to examine, as many as possible, the component traits of the egg production pattern of the fowl. The following report deals with some component traits of egg production of the Local Chicken of Nigeria in comparison with its crosses with the parent stock of Gold-Link under the battery cage system of management.

MATERIALS AND METHODS

The experiment was begun in August 1981 at the Poultry Unit of the University of Nigeria Farm when two groups of females — 30 each — from the Local Chicken (LC) foundation stock, and B72 strain parent stock of Gold-Link (GL) base population were crossmated reciprocally to 2 groups of males — 3 each — from the GL and LC foundation stocks. The Local Chicken foundation

stock was established earlier (February/March) that year from 3 hatches of fertile eggs collected from homes and market places in Anambra, Imo, and Benue States. The base stock of the B72 strain parent stock of Gold-Link was obtained (also in February/March, 1981) as day-old chicks ordered from the Parks Poultry Company, Altoona, Pennsylvania, U.S.A. in collaboration with Enyeribe Farms, Owerri.

Four F_1 progeny populations were hatched as follows: 206 LC (male) \times LC (female), 159 GL (male) \times LC (female); 429 LC (male) \times GL (female), and 576

GL (male) \times GL (female) chicks. These were brooded on deep-litter floors using kerosene stoves under hover brooders to eight weeks, reared also on deep-litter floors until 18 weeks of age when they were transferred into laying cages where they were housed singly. There was no artificial lighting regime introduced in the laying house during the production test period between March and July/August 1982. Rather the birds benefitted from natural daylight of 13hr daily on the average throughout the test.

The pullets were fed *ad libitum* from commercial rations which, on analysis, had the following average compositions:

	Chick Mash	Growers Mash	Layers Mash
Crude Protein, %	20.00	16.00	16.50
Fat, %	3.50	3.70	3.70
Fibre, %	5.00	7.50	6.50
Calcium, %	1.00	1.00	3.00
Phosphorus, %	0.76	0.68	0.62
Period fed (wk of age)	0—8	9—18	19—40

Chicks were given regular inoculations against Newcastle, fowl cholera, gumboro and fowl pox diseases by the Veterinary unit of the Department of Animal Science, University of Nigeria, Nsukka.

Age at first egg (AFE) in days of each pullet was recorded. Also eggs laid daily by individual pullets were collected and recorded. Similarly recorded were individual laying clutches and clutch sizes, pauses and pause lengths, and the proportion of those that went broody. The egg production experiment lasted from day of first egg to 4 months of lay within each breeding group. Data were collected on monthly basis in order to isolate or partition the environmental source of variance due to month of lay during analysis. As the birds were studied individually in each breeding group, all pullets in the group were considered as replicates, so that any measurement taken on one bird was repeated as many times as the number of individuals in the breeding group. Mortality and broodiness data were based on monthly records collected per group.

Statistical Procedure:

Data from all traits studied (except mortality and broodiness) were subjected to a one-way analysis of variance in a simple completely randomized design (CRD) using the following model:

$$\times_{ijk} = U + a_i + b_j + e_{ijk}$$

where \times_{ijk} = an observation (AFE, survivor's egg number, clutch size, clutch number, pause number or length) made on the k th pullet of the i th breeding group during the j th month of lay.

U = Overall estimate of the population mean for each trait measured.

a_i = the effect of the i th breeding group; $i = 1, \dots, 4$.

b_j = the effect of month of lay; $j = 1, \dots, 4$.

e_{ijk} = random error associated with each measurement. Breeding group

and month of lay effects were tested against F values for significance at the 5% and 1% levels of probability. Significant mean differences were separated by the Duncan's Multiple Range Test (DMRT) method. Before obtaining the means and standard errors, all mortality and

broodiness percentages were transformed into arcsine angles in degrees.

RESULTS AND DISCUSSION

The mean squares and descriptive statistics of the production traits studies are shown in Tables 1 and 2 respectively.

As shown in Table 2, the LC and LC ×

TABLE 1

Mean Squares and F values of some production traits

Trait	Source of Variation	d.f.	Mean square	F value
Age at first egg (days)	Breeding groups	3	1628.99	12.67**
	Error	111	128.61	
Survivor's Egg No.	Breeding groups	3	1687.46	22.76**
	Month of lay	3	221.49	2.99*
	Error	110	74.14	
Clutch No.	Breeding groups	3	129.36	6.93**
	Month of lay	3	36.17	1.99 ^{NS}
	Error	110	18.18	
Clutch Size	Breeding groups	3	3.46	1.92 ^{NS}
	Month of lay	3	4.35	2.51 ^{NS}
	Error	110	1.73	
No. of Pauses	Breeding groups	3	143.30	7.87**
	Month of lay	3	81.33	4.47**
	Error	110	18.21	
Pause length (days)	Breeding groups	3	8.08	6.79**
	Month of lay	3	5.14	4.32**
	Error	110	1.90	

* P 0.05

** P 0.01

NS Not significant (P 0.05).

GL groups each of which had a local sire component, came into lay about 2 weeks significantly earlier (P 0.01) than either the GL or GL × LC group that was sired by the exotic. This indicated that the sire was responsible for passing on genes for early age at first egg. The short-term survivor egg number results, where the LC pullets had 48.5, GL × LC 65.8, LC × GL 61.1 and GL 66.6 eggs showed a different trend. While the locals were generally inferior to the other three groups there were no significant differences between the crossbred groups

themselves and the exotic. There are two possible explanations. Firstly, the GL sire carried the dominant alleles for higher egg number and/or that both sexes of the GL equally transmitted the dominant genes in the crossbreds. Secondly, it could be that AFE had diverse or contrasting correlations with egg number depending on the breeding groups. In Table 3, for example, AFE appeared to have near-perfect positive correlation with egg number in the reciprocal cross (RC) and Gold-Link (GL) groups whereas the relationship, though positive, was lower among the

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TABLE 2:
Descriptive statistics of some production traits

TRAIT	STATISTIC	BREEDING GROUP			
		LC	GLxCL	LCxGL	GL
Age at first egg (days)	Means ± S.E.	157.8 ± 3.2 ^a	169.7 ± 1.5 ^b	155.4 ± 1.5 ^a	169.2 ± 1.7 ^b
	C.V. ¹ (%)	9.5	7.0	6.4	6.1
	Spread	137—182	153—186	137—191	155—193
Survivor's Egg No.	Mean ± S.E.	48.5 ± 4.1 ^a	65.8 ± 4.1 ^b	61.1 ± 2.9 ^b	66.6 ± 2.1 ^b
	C.V. (%)	40.3	17.8	31.7	20.6
	Spread	3—80	52—86	9—92	30—91
Clutch No.	Mean ± S.E.	16 ± 1.0 ^a	20 ± 1.2 ^b	17 ± 0.7 ^a	20 ± 0.6 ^b
	C.V. (%)	32.3	17.5	27.9	17.9
	Spread	3—23	15—25	5—26	11—28
Clutch Size (eggs)	Mean ± S.E.	3.1 ± 0.2 ^a	3.4 ± 0.2 ^a	3.9 ± 0.3 ^a	3.5 ± 0.2 ^a
	C.V. (%)	32.1	13.3	46.2	27.2
	Spread	1—5	3—4	1—11	2—6
No. of Pauses	Mean ± S.E.	15 ± 1.1 ^a	20 ± 1.3 ^b	17 ± 0.7 ^a	20 ± 0.6 ^b
	C.V. (%)	34.7	18.9	29.4	18.6
	Spread	2—24	15—25	4—26	10—28
Pause Length (days)	Means ± S.E.	3.0 ± 0.4 ^b	1.5 ± 0.1 ^a	2.0 ± 0.2 ^a	1.8 ± 0.1 ^a
	C.V. (%)	66.8	22.0	45.6	21.1
	Spread	1—8	1—2	1—6	1—3
Broodiness ^{III} (%)	Mean ± S.E.	4.4 ± 0.00	4.6 ± 4.60	7.8 ± 0.04	0.0 ± 0.00
Montality ^{0/0} ^{III}	Mean ± S.E.	1.04 ± 1.04	6.82 ± 4.35	1.63 ± 1.04	0.60 ± 0.60

Means for each trait are significantly (P = 0.05) different if superscripted with different letters.

^{III}Not tested statistically
C.V. = Coefficient of variation.

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TABLE 3

Simple Correlation Coefficients Among Production Variables

Variable	AFE				Egg Number				Clutch Number				Clutch Size				Pause Number				Pause Length								
	LC	MC	RC	GL	LC	MC	RC	GL	LC	MC	RC	GL	LC	MC	RC	GL	LC	MC	RC	GL	LC	MC	RC	GL	LC	MC	RC	GL	
AFE																													
Egg Number		.50	.66	.99	.97																								
Clutch Number		.84	1.00	.75	.99	.92	.69	.78	.99																				
Clutch Size		.59	.93	.99	.97	-.53	.65	.99	.99	.30	.92	.73	1.00																
Pause Number		.87	.98	1.00	.97	.04	.75	1.00	.98	.99	.98	.74	1.00	.37	.96	.99	1.00												
Pause Length		-.13	-.17	.74	.22	-.20	.21	.72	.18	-.18	-.09	.26	.26	-.53	-.27	.71	.31	.07	-.17	.75	.34								

Note: AFE Age at First Egg
LC Local Chicken; MC GL × LC main cross; RC LC × GL reciprocal cross, GL parent stock of Gold-Link

estimated between egg number and clutch number showed high to almost perfect relationship between the traits among the groups; whereas between egg number and clutch size, the relationship was negative among the locals, moderately high within the GL \times LC group but very high among the groups (LC \times GL and GL) that possessed an exotic dam component. The negative phenotypic correlation (-0.53) between egg number and clutch size shows that the lower clutch size tendency negatively influences egg number in the local chicken pullets. Singh *et al* (1980) showed that there were no significant breed or reciprocal cross differences in clutch size to 40 weeks of age, but they reported significant correlations between egg production to 40 weeks and clutch size (0.42), and between clutch number and main cross (MC) and local (LC) populations. Therefore, the early age at first egg did not benefit local pullets but was beneficial to pullets of the reciprocal cross. Significant relationship between AFE and short-term egg production has been reported by a number of workers including Bohren *et al* (1981), and Abdel-Kader and El-Hossari (1976) who also stated that breed differences were possible with regard to magnitude and direction of correlation.

While breeding group effects were important for clutch number, they were not in the number of eggs per clutch (Tables 1 and 2). It meant that differences in clutch number and to a lesser extent clutch size were more effective in influencing the observed differences in egg number. The correlation coefficients (Table 3) clutch size (0.82). Thangaraju *et al* (1978) showed similar results.

The results of number of pauses and pause length in Tables 2 and 3 indicate that the disagreement between the two traits with regard to breed variations was partly responsible for the gap given to the local birds by the other breeding groups, particularly the LC \times GL, in egg number. The local pullets had definitely longer pause length ($3.0 \pm 0.4d$) than the other

genetic groups. The results also show that pause length exerted major influence to relegate the locals than did number of pauses because of the negative correlation (-0.20) obtained in the local population between pause length and egg number (Table 3). Published results by Singh *et al* (1980) indicated that egg production to 40 weeks of age was correlated negatively (-0.27) with the average length of each pause.

On the whole, and looking at the respective coefficients of variation, both the locals and the reciprocal cross (LC \times GL) showed much variability in the production traits already discussed as compared to the GL and GL \times LC maincross (Table 2). This could be that the local sire or the LC and LC \times GL groups came from a population that has not yet been selected or improved for any of the production traits, while sires of the GL and GL \times LC groups were from an improved and selected exotic stock. So it should be expected that there should be more variability in the groups sired by the local male, and more stable results from exotic sired groups.

The results of percent broodiness of the four groups are shown in Table 2. As expected the selected and improved exotic population had no broody pullets at all, whereas over 4 percent of the local pullets went broody. The more interesting aspect of these results was that the two crossbred groups (GL \times LC) and LC \times GL) were apparently more broody than even the LC themselves. This was an obvious example of over-dominance or/and "F₁ epistasis" as was suggested by Sheridan (1980, 1981). It might be postulated that there were inhibitor or suppressor genes (against those that influence broodiness) whose expressivity reached one hundred per cent in the exotic but a little in the locals. These inhibitor genes segregated very little during the crossing thereby leaving most of the genes for broodiness to pass from either parents into the crossbreds. Unless this was the case our results are contrary to some other

published reports. For example Saeki and Inoue (1979) showed that in the crosses between red jungle fowls (JF) and White Leghorn breed (WL) the per cent broodiness were 87.5% (JF), 11.1% (WL × JF), 63.0% (JF × WL), and 0.0% (WL) during the laying year. The lines of agreement of this report with that of Saeki and Inoue were that the GL like the WL had 0% broodiness and there were considerable reciprocal cross differences otherwise the mode of genic inheritance in the two experiments was quite different.

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