

HETEROSIS OF EARLY GROWTH IN CROSSES BETWEEN GOLD-LINK PARENT STOCKS AND LOCAL CHICKENS OF NIGERIA

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INTRODUCTION

The bulk of the Local Chicken population of Nigeria consists of unimproved and non-selected mongrel varieties characterized by small size (0.7-1.6 kg adult body weight) and low egg production of 60-128 eggs/hen/year (Hill, 1954; Hill and Modebe, 1961 and Nwosu, 1979). A method of selective breeding among local breeds has been shown to be inappropriate in terms of speed and significant improvement because some of the traits show low response to selection (Iyer, 1950; Buvanendran, 1979 and Oluyemi, 1979). A crossbreeding programme is considered a better and faster alternative than the selective breeding method for a genetic improvement of Local Chickens in Nigeria. Local Chicken parents are crossed with Gold-Link parent stocks with the objective of improving the body weight and egg size of the Local Chickens to place them as possible commercial egg producers in Nigeria. This paper reports of the body weight heterosis and superiority as well as feed efficiency performance of the main and reciprocal F₁ crossbred chicks over their parental counterparts at the University of Nigeria Farm.

MATERIALS AND METHODS

There were four mating groups as follows: three Local Chicken (LC) males x 30 Local Chicken (LC) females; three B-1 Gold-Link (GL) cocks x 30 Local Chicken hens; three Local cocks x 30 B-72 Gold-Link (GL) hens and three B-1 Gold-Link (GL) males x 30 B-72 Gold-Link (GL) females. The F₁ chicks, from these mating groups consisting of 206, 109, 429 and 576 day-old chicks respectively were evaluated for heterosis, superiority and feed efficiency. Body weight and feed efficiency of the chicks were measured at day-old (for body weight only), 4 weeks and 8 weeks. The birds ate ad libitum from previously weighed commercial rations. The conventional method of calculating percent heterosis was used, while percent superiority was obtained as:

$$\text{Superiority} = \frac{F_1 \text{ crossbred Average} - \text{"Purebred" Local Average}}{\text{"Purebred" Local Average}} \times 100$$

RESULTS AND DISCUSSION

The results in Table 1 indicated that the crossing of the Local Chicken with the Gold-Link parent stock appeared to be effective in narrowing the

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genetic gap in body weight between the two different breeds. The superiority of the mid-crossbred body weight over that of the purebred locals seemed obvious. The mid performance of the main and reciprocal crossbreds in this trait not only was higher than that of the Local x Local at day-old and week 4 but clearly outclassed the improved Gold-Link x Gold-Link in the 8th week. Starting from day-one, the F_1 reciprocal crossbred population (LC x GL) maintained superiority over the two purebred groups in body weight, while the main cross (GL x LC) which seemed to have been held back in the first month, remarkably recovered and almost caught up with their reciprocal counterpart in the 8th week when they weighed 316.2 g as against 319.4 g made by the LC x GL F_1 cross. This picture is reflected in the body weight heterosis and percent superiority achieved by the two crossbreds (see Table 1). The highest heterosis of 22.1% was scored by the LC x GL F_1 reciprocal cross in the 4th week of growth. It had started with 21.8% at day-old, but in the 8th week it showed a decline with 16.5%, probably due to the gradual withdrawal of their dam's breed body weight effect, and a less favourable effect due to interaction between the maternal effect and the emerging paternal inheritance. On the other hand, the main cross (GL x LC) exhibited a fast but linear increase in heterosis from -22.2% at day-old to 15.4% in the 8th week. It appeared that the sire effect was being expressed very rapidly. The overall picture of heterosis and superiority of the crossbred groups indicated that the two crosses were moving in opposite directions, and were likely to reach a meeting point soon. At this point, no significant differences would be found in their body weights, heterosis of body weight, and superiority in body weight over the purebred locals. The expectation is that after this meeting point, the GL x LC F_1 main cross will have better prospects for leadership.

The exact genetic basis on which the observed heterosis is acting could not be determined in the time being with only the F_1 cross. It is hoped that a clearer picture would be got when data on F_2 and backcross generations are obtained. However, in this experiment, it is suspected that one of two heterosis theories or even both could explain the situation. The first theory possible is that of overdominance heterosis which is achieved when the heterozygote is superior to either of the homozygotes (Sheridan, 1979, and 1980). The other possible case is the heterosis due to "parental epistasis", explained by Hayman and Mather (1955), and by Sheridan (1981). It arises when different homozygous epistatic gene combinations (or pathways) present in the parental lines are passed across to the crossbred in a manner analogous to the "dominance" situation.

Maternal (or rather dam's breed) effect was much remarkable in the two crosses in their first month. The F_1 crossbreds tended to lean toward their dam's breed in body weight. The body weights at day one and 4 weeks of the GL x LC F_1 chicks (20.7 g and 94.6 g) tended to resemble those of the "purebred" LC x LC F_1 (21.1 g and 88.5 g) when compared with those of the LC x GL reciprocal cross (32.4 g and 120.4 g) which were rather more close to the corresponding weights of the GL x GL chicks (32.1 g and 108.7 g). Walton and Hammond (1938) and Joubert and Hammond (1954) had made similar observations in their crosses involving big Shire horse and little Shetland ponies, and South Devon (big) with Dexter (little) cattle respectively, in which they found that the F_1 crosses resembled their dams in body weight from day-old. In our observation, the maternal effect appeared temporary more especially with

the GL x LC main cross in which it seemed to have cleared in the 8th week (Table 1). Hutt (1964) agreed that such maternal effect in the crossbred chicks suppressed by their mothers' small size was apt to clear after eight weeks. The maternal influence in the reciprocal cross (the LX x GL) appeared to have receded a little in the 8th week; it was not as obvious as in the GL x LC main cross.

Breed differences and dam's breed influences as well, were observed in the feed efficiency patterns of the 4 genotypes especially from day-old to week 4. The GL x GL purebred was the most efficient (3.3) followed by the LC x GL with 3.9; while the "purebred" locals were the least efficient (5.6) (Table 1). These results obviated the fact that the Local Chicken has not been selected or improved with regard to this trait. The 8th week performance, however, was a bit different in that the LC x LC "purebreds" became the most efficient (2.5) while the GL x LC and the GL x GL were the least. In general, the GL x GL group showed more consistency in feed efficiency to 8 weeks than did other groups, thereby indicating that it had been improved in this trait.

CONCLUSION AND RECOMMENDATIONS

From the results obtained in this experiment, there was indication that there are prospects of effectively narrowing the genetic difference in growth between the Local Chicken and the exotic. It is suggested that to maximise all possible improvement in the F_1 main cross, the prior exploitation of the additive variances in the separate breeds should be done by engaging mass selection at the intra-population level on both the local hens and the exotic cocks before they are crossmated.

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Table 1: Body weights; Heterosis and Superiority of body weights, and feed efficiency in Local Chicken - Gold-Link crosses (F₁)

	BODY WEIGHT (g)				HETEROSIS (%)				SUPERIORITY OF THE CROSSBREDS OVER LOCALS (%)				FEED EFFICIENCY			
	Breeds ^a				Breeds				Breeds				Breeds			
	LC x LC	LC x GL	GL x LC	GL x GL	$\bar{C}\bar{E}$	LC x GL	GL x LC	$\bar{C}\bar{E}$	LC x GL	GL x LC	$\bar{C}\bar{E}$	LCxLC	LCxGL	GLxLC	GL x GL	
Day-old	21.1	32.4	20.7	32.1	26.6	21.8	-22.2	0.0	53.6	-1.9	26.1					
Week 4	88.5	120.4	94.6	108.7	107.5	22.1	-4.1	9.0	36.0	6.9	21.5	5.6	3.9	5.0	3.3	
Week 8 ^c	255.5	319.4	316.2	292.7	317.8	16.5	15.4	15.9	25.0	23.8	24.4	2.5	2.8	3.5	3.2	

Note

^a Sire breed x Dam breed.

^b Mid-crossbred performance (average of the crossbred populations).

^c Both sexes were combined in all the breed groups until week 7 when the cockerels were removed.

ABSTRACT

In a study to examine the heterosis of growth in main and reciprocal F_1 crosses between Gold-Link parent stocks and Local Chicken parents of Nigeria, the average F_1 day-old chick body weights for 205 Local x Local, 576 Gold-Link x Gold-Link, 429 Local x Gold-Link, and 159 Gold-Link x Local were 21.1 g, 32.1 g, 32.4 g and 20.7 g respectively. Their 4th and 8th week body weights were 88.5 g and 255.5 g; 108.7 g and 292.2 g; 120 g and 319.4 g, and 94.6 g and 316.2 g respectively for the four genotypes. Estimates of heterosis of body weight at day-old, 4 weeks, and 8 weeks of age were respectively 21.8%, 22.1%, and 16.5% for the Local x Gold-Link reciprocal F_1 crossbred chicks; -22.2%, -4.1%, and 15.4% made by the Gold-Link x Local main F_1 crossbred chicks. Maternal influence was indicated in the body weights. The results seemed to indicate that the crossing of the improved cocks with the local hens of Nigeria could be an invaluable exercise in an attempt to narrow the genetic gap between the local and exotic chickens in their growth capabilities.

R E S U M E N

De los resultados obtenidos en este experimento se derivó la indicación de que existen perspectivas de disminuir efectivamente las diferencias genéticas en crecimiento entre las aves locales y las exóticas. Se sugiere que para maximizar toda posible mejora en el cruce principal F_1 , debería realizarse la exploración anterior de las varianzas aditivas de las razas por separado para dirigir la selección de masa al nivel intra-población ~~en~~ tanto ^{en} las gallinas locales como en los gallos exóticos antes de que se reproduzcan.

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