EVALUATION OF PURE AND CROSSBRED PARENT STOCK PULLETS: 1. EGG WEIGHT, BODY WEIGHT AND SEXUAL MATURITY

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ABSTRACT

The relationships between egg weight, body weight and sexual maturity and their inheritance were studied in the F₁ of two grandparent strains of laying birds. Each strain had two lines. Data used for analyses comprised body weight at first egg, 30 weeks and 40 weeks of age (BFE, B30 and B40); weight of first egg (WFE), weight of egg at 30 weeks and 40 weeks (W30, W40) and age of birds at first egg (AFE). Phenotypic correlations between AFE and BFE, AFE and WFE and between WFE and BFE were 0.45 and 0.40; 0.96 and 0.11, 0.65 and 0.85 for male and female lines respectively. While AFE generally showed additive inheritance which was sire influenced, BFE and WFE were line dependent. The crossbred groups however, appeared to be at advantage over the purebreds in respect of these three traits.

Key words: Parent stock, pullets, egg weight, body weight, sexual maturity.

INTRODUCTION

Until very recently, Nigeria had depended so much on the importation of the foundation stocks and other inputs in the poultry industry. The dwindling foreign exchange had forced Nigeria to attempt to develop indigenous stocks for the country. Such stocks must possess genetic make-up which permits them to cope with the inadequacies of locally available ingredients (Buvanendran, 1979). There is also the need to select among the stocks, those that meet the farmer's and consumer's demands. In selection, care is taken to prevent loss of already gained genetic

progress because of the problem of the negative correlation. A number of researches have been conducted into the relationship between egg weight, body weight, sexual maturity and egg production in imported strains and also their crosses with the local strains (Akinokun and Dettmers, 1977a, b; Omeje and Nwosu, 1984a; Oni *et al.*, 1991). This paper reports on the performance of two strains of laying hens and their crosses.

MATERIALS AND METHODS

The pullets used in this experiment were the parent stock, the F₁ progeny of two original grandparent strains - shaver (S) and Hubbard (H) described by Omeje *et al.* (1991). A total of 2,954 pullets from 8 genotypes obtained from a reciprocal crossing of the two strains were housed close to maturity. Housing comprised four short-walled, open sided buildings for each replicate. Birds were allowed a minimum of 12 hour/day of natural daylight.

Compounded breeder ration containing 17.35% crude protein, 2,640.69Kcal/kg metabolizable energy, 3.62% calcium, 0.86% available phosphorus, 0.67% lysine and 0.33% methionine were fed *ad libitum* with water throughout the experimental period. Routine inoculation and necessary medications were given.

Age at sexual maturity (AFE) was taken to be age (in days) from hatch to the day of first egg. Body weights and egg weights were taken at sexual maturity, and at 30 and 40 weeks of age. At sexual maturity, weight of first ten eggs laid consecutively were taken and weight of ten randomly picked eggs were used for other ages.

Pen means of body weight (converted to log 10) and egg weights were analysed using the model:

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- X_{ijk} = $U + A_i + L_j + (AL)_{ij} + e_{ijk}$
 where X_{ijk} = Mean Observation (egg weight, body weight) on pullets of the i th breeding group (i.e. different mating combinations) and the j th line.
 U = Overall estimated population mean for each trait.
 A_i = Effect of the i th breeding groups. $i = 1, \dots, 4$.
 L_j = Effect of the j th line. $j = 1, 2$.
 $(AL)_{ij}$ = Effect of the interaction between the i th breeding group and the j th line.
 e_{ijk} = random error associated with each measurement.

Significant means were further tested using Duncan's Multiple Range Test as presented by Middlebrooks (1976).

RESULTS AND DISCUSSION

Mean and standard errors for the traits measured are given in Table 1 for the four genotypes in each of the two lines. Results of Analyses of Variance (Table 2) indicated that line significantly ($P < 0.01$) influenced body weight at 30 weeks (B30). Similarly, weight at 30 and 40 weeks (B30, B40) as well as weight of first egg (WFE) were also significantly ($P < 0.01$) influenced by breeding group difference and breeding group by line interaction. By these results, the different genotypes of one line are shown to react independently of those in the other line in

TABLE 1: MEAN AND STANDARD ERROR ($\pm$ SE) FOR THE TRAITS MEASURED IN THE PURE AND CROSSBRED GROUPS BY LINE.

Traits	S X S		S X H		H X S		H X H	
	Mean $\pm$	SE	Mean $\pm$	SE	Mean $\pm$	SE	Mean $\pm$	SE
Male Line								
¹ Age weight at First Egg (days)	202	-	201	-	177	-	149	-
Body weight at 1st Egg (kg)	1.41	0.21	1.21	0.03	1.25	0.07	1.23	0.06
**Body weight at 30 wks (kg)	1.41 ^b	0.03	1.29 ^c	0.01	1.58	0.01	1.26 ^c	0.02
*Body weight at 40 wks (kg)	1.59 ^a	0.02	1.51 ^b	0.01	1.54 ^b	0.01	1.40 ^c	0.02
Weight of 1st Egg (g)	50.71 ^a	0.77	47.63 ^b	1.12	45.60 ^c	1.24	39.73 ^c	0.73
Egg weight at 30 wks (g)	50.61	0.62	48.28	0.79	47.50	0.80	45.38	0.38
Egg weight at 40 wks (g)	56.39	0.87	54.08	0.23	53.30	0.35	51.18	1.08
Female Line								
¹ Age at First Egg (days)	217	-	193	-	163	-	154	-
*Body weight at 1st Egg (kg)	1.40 ^a	0.07	1.46 ^a	0.04	1.23 ^b	0.07	1.41 ^a	0.10
*Body weight at 30 wks	1.32 ^c	0.02	1.55 ^a	0.02	1.45 ^b	0.07	1.51 ^a	0.02
*Body weight at 40 wks	1.55 ^b	0.02	1.63 ^a	0.02	1.49 ^c	0.02	1.46 ^c	0.02
*Weight of First Egg	42.61 ^b	1.38	44.24 ^a	1.02	40.06 ^c	0.76	45.67 ^a	1.10
Egg weight at 30 wks	47.21	0.77	48.54	0.54	46.87	1.22	48.04	0.002
Egg weight at 40 wks	53.00	1.15	54.74	1.37	52.67	1.99	55.15	0.89

¹ Not statistically tested.

a b c

* $P < 0.05$

** $P < 0.01$

TABLE 2: VARIANCE ANALYSES FOR TRAITS MEASURED

Traits	Line (1)	Breeding group (3)	L & B (3)	Error	Error d.f.
Body weight at First Egg	0.020	0.008	0.008	0.0077	72
Body weight at 30 weeks	0.090**	0.090**	0.025**	0.004	842
Body weight at 40 weeks	0.006	0.057**	0.026**	0.002	773
Weight of First Egg	153.76**	84.99**	187.19**	11.27	72
Egg weight at 30 weeks	0.46	6.33	9.39	5.19	16
Egg weight at 40 weeks	0.14	4.49	14.02	12.07	16

DF (Degrees of freedom) for sources of variance are written in parentheses.

TABLE 3: SIMPLE LINEAR CORRELATION COEFFICIENTS AMONG TRAITS MEASURED BY LINE (PURE & CROSSBREDS COMBINED).

Traits	AFE	BFE	B30	B40	WFE	W30	W40
Age weight at First Egg		0.40	-0.60	0.70	-0.11	-0.40	-0.33
Body weight at First Egg	0.45		0.24	0.55	0.85	0.84	0.73
Body weight at 30 weeks	0.17	0.26		0.14	0.46	0.74	0.74
Body weight at 40 weeks	0.84	0.18	0.62		0.08	0.49	0.10
Weight of First Egg	0.96	0.65	0.33	0.94		0.84	0.94
Egg weight at 30 weeks	0.90	0.78	0.29	0.93	0.98		0.92
Egg weight at 40 weeks	0.91	0.78	0.29	0.93	0.98	1.00	

Male line values are below the diagonal line while those for female lines are above.

respect of these traits (Table 1). This probably means that there is a high genetic variance between the two lines which will likely be of advantage when the lines are finally combined. The estimates of phenotypic correlation (Table 3), showed that the traits being considered are mostly positively correlated. The only exceptions were the correlations between Age at first egg and B30, WFE, W30 and W40 on female line. These positive correlations agreed with results reported in literature by other workers (Akinokun and Dettmers, 1977a,b; El-Hossari, 1978; Oluyemi, 1978; Omeje, 1983; Omeje and Nwosu, 1984b; Oni *et al.*, 1991) and showed that selection for one of these traits could give positive response in the others. However, selection for lower age at maturity (AFE), on female line, will likely cause increase in those traits with which it was negatively correlated. This seems desirable.

From Table 1 and Figure 1, AFE can be seen to be sire influenced. On both lines, H-sired progenies matured earlier relative to those of S-sires, whereas purebred shavers matured much later. The fact that the value for the crossbred groups lie between those of the purebreds suggests the additive nature of the inheritance. Omeje (1983) made similar observations with crosses between local chicken and imported Gold Link. Body weight is said to be responsible for the delay in sexual maturity. Though egg-type chicken must reach a minimum age and body weight before commencing egg production, the specific values vary with population (Oni *et al.*, 1991). Whereas purebred Shavers on both lines mature at about the same weight, there were differences in AFE for this group and in both AFE and BFE for the other groups. Since these values are subject to modification by factors such as feeding and management practices (Oni *et al.*, 1991), it means that with

favourable non-genetic factors, crossbred pullets, even with local chicken, can be brought to lay earlier using early maturing sire lines. This agrees with the findings of Omeje (1983).

Body weight at first egg (BFE) seemed to be controlled by non-additive effect since the means of crossbred in the male line was equal to the value for one of the pure breeds and in the female line, the mean crossbred value fell below those of the two purebreds (figs. 1). With regard to WFE, additive gene action appeared to be more important in the male line while non-additive and/or maternal effect would be the case for the female line birds. The observation for the male line is in line with the works of Blyth and Sang (1960), Arad and Marder (1982) and Omeje and Nwosu (1984a). Blyth and Sang (1960) had observed that hybrid means for body weight at sexual maturity were constantly close to the mid-parent value and averaging less than one gramme above the latter. The observation for the female line may be a part of the general deviations of the female line from the usual observations.

CONCLUSION

Since these traits (AFE, BFE, WFE, B30 and W40) are positively correlated and mostly non-additively inherited, selection based on one or few of them, especially in the crossbred will produce favourable response in the other traits. With slightly delayed sexual maturity in the crossbred, egg weight and body weight could be increased.

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