II. MATERIALS AND METHODS

Eggs were taken from two broiler flocks of different ages. Flock A was the seventh generation of the Seven Hills broiler breeding programme and flock B was derived from a random mating of birds in flock A. Birds in flock A were hatched over a six-week period and those in flock B were all of the same age. The experiment was made when flock A had been in production for one year, and flock B had just come into production and 50% of birds were laying each day. Eggs from flock A were collected and set one week earlier than those from flock B.

For each hatch, eggs were collected for one week and individually marked and weighed prior to incubation. The eggs were candled at seven and at 18 days to detect dead embryos. All apparent clears from the first test were broken out and examined macroscopically to detect early dead embryos. Pedigree trays were arranged so that each hatching chick could be identified with a particular egg. The day-old chicks were wingbanded, individually weighed to the nearest gram, sexed and placed under electric hover brooders in deep litter pens in a broiler shed. Progeny from both flocks were divided into groups of about 35 males and 35 females. Each group was reared in a pen with a floor area of 9.3 m^2, there being four pens for flock A and five pens for flock B. Any chickens suffering from any obvious physical disability (e.g. twisted hocks) were culled. Birds were individually weighed to the nearest gram at five and nine weeks and deaths were recorded daily. Birds were fed a high energy starter diet containing 21% crude protein to five weeks of age, and a high energy grower diet containing 19% crude protein from five to nine weeks of age.

Statistical analysis

All phenotypic correlations were calculated separately for males and females. For the correlation between egg weight and day-old weight, one coefficient was calculated for each sex within each flock. The following correlations were calculated for each sex within each pen: — egg weight and five-week weight; egg weight and nine-week weight; day-old weight and five-week weight; day-old weight and nine-week weight; and five-week weight and nine-week weight. They were then transformed to z values and tested for homogeneity for each sex within flock by chi-square test. If the r values did not differ significantly, then a mean r value was obtained from the mean $\bar{z}w$ value (Steel and Torrie 1960).

As the eggs were not divided into replicated weight groups it was not possible to evaluate statistically the effect of egg weight on hatchability, or of day-old weight on mortality. Histograms showing the effect of egg weight on hatchability are presented for each flock.

III. RESULTS

(a) Egg weight and hatchability

Egg weight frequencies in flocks A and B followed normal distributions with maxima of 64 g and 49 g respectively. The effect of egg weight on hatchability in flock A is shown in Figure 1. The graphs show best hatchability for eggs of

TABLE 1

Correlations between egg weight and chick weights at different ages

MALES (below diagonal: Flock A; above diagonal: Flock B)

	Egg weight	Day-old weight	Five-week weight	Nine-week weight
Egg weight		0.89 ± .02 ***	0.25 ± .08 ***	0.16 ± .08 *
Day-old weight	0.88 ± .02 ***		0.27 ± .08 ***	0.17 ± .08 *
Five-week weight	0.20 ± .09 *	0.22 ± .09 *		0.81 ± .03 ***
Nine-week weight	0.23 ± .09 *	0.25 ± .09 **	0.81 ± .03 ***	

FEMALES (below diagonal: Flock A; above diagonal: Flock B)

	Egg weight	Day-old weight	Five-week weight	Nine-week weight
Egg weight		0.89 ± .03 ***	0.12 ± .08 ns	0.06 ± .08 ns
Day-old weight	0.85 ± .03 ***		0.10 ± .08 ns	0.04 ± .08 ns
Five-week weight	0.10 ± .10 ns	0.14 ± .10 ns		0.77 ± .03 ***
Nine-week weight	0.13 ± .10 ns	0.12 ± .10 ns	0.81 ± .03 ***	

* $P < 0.05$.
** $P < 0.01$.
*** $P < 0.001$.
ns $P > 0.05$.

were unreliable and have not been presented. Overall mortality to nine weeks was 4.0% in flock A and 4.7% in flock B.

A summary of the correlations for each sex within flock is presented in Table 1. Average weights for each sex within flock are presented in Table 2.

(*c*) *Egg weight and chick weights*

There were highly significant positive correlations between egg weight and day-old weight for each sex in each flock. Day-old weight was approximately ***70%*** of egg weight in both flocks.

Low positive correlations between egg weight and five-week weight, and egg weight and nine-week weight were obtained for both sexes but only those in males were significant.

Low positive correlations between day-old weight and five-week weight, and day-old weight and nine-week weight were obtained for both sexes but only egg weight and body weight were higher and had a higher repeatability between strains for males than for females.

The high correlations obtained between five and nine-week body weight are in agreement with figures presented by Merritt (1966) on the phenotypic correlation between six and nine-week body weight. Both in his data and the present results from each flock, males showed a slightly higher correlation than females.

In nearly all cases in the present trial, correlations obtained for both flocks were very similar. Variation in egg weight in flock A was probably accounted for mainly by the hen's genetic potential for egg weight while in flock B, egg weight would have been principally a function of the relative size and sexual maturity of the pullets. As shown in Table 2, there were very large differences in egg weight, day-old weight, five-week weight and nine-week weight between the two flocks for each sex. As the genetic constitution of both flocks and the environmental conditions in rearing their progeny were similar, it appears that the age of the dam has a large effect on broiler performance. This has implications for broiler breeders who should select within hatch of dam as well as within hatch of progeny, particularly if the birds are mated at a fairly early age. If older birds are used, the dam hatch. correction is less likely to be important due to the slower rate of egg weight increase.

In the light of present knowledge and the findings presented here, hatcheries should endeavour to increase egg size in their broiler breeding flocks when the pullets first commence laying, either by stepdown lighting (Morris and Lean 1967) or restricted feeding during the rearing stage. Should the broiler industry in Australia change to the separate rearing of sexes, the present findings indicate that the smallest cockerel chickens should be culled if an excess is present. It appears that it is not so important to cull small female chicks.

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