

The Effect of Crossing of Chickens on Egg Characters

G. A. R. Kamar, M. Mostageer and S. Kotby

Animal Production Department, Faculty of Agriculture, Cairo University, and Ain Shams University, Cairo, Egypt.

THREE pure breeds, Fayoumi, White Baladi and Rhode Island Red, and their reciprocal crosses FR, RF, BR and RB were used to study the effect of crossing and the factors involved in the inheritance of egg weight, components weights and percentages, age at sexual maturity and body weight at 12 months of age. A throughout maternal effect was observed in the inheritance of all studied characters when crossing either Baladi or Fayoumi, with the dual purpose breed, the Rhode Island Red. Hybrid vigour was observed in the crosses of Rhode Island Red dam and Baladi or Fayoumi sires with respect to egg and components weights and yearling body weight. Most of the maternal effect that caused the increase in egg weight of crosses was due to increased albumen rather than yolk weights. The crossbred having the Fayoumi as sire and the Rhode Island Red as dam is suggested as larger sized egg produces.

In a series of studies, a number of crosses were done between the different foreign standard breeds and the indigenous breeds to detect, as far as possible, the most suitable crosses, either for egg or meat production. In all these studies only the indigenous Fayoumi breed was used, while the foreign breeds were represented by the egg and dual purpose breeds. Most of these studies recommended the crossing of Fayoumi with the dual purpose breed, *i.e.* the Rhode Island Red, either for egg or meat production (Ragab and Samak, 1956 ; Ghoneim *et al.*, 1956 ; 1958 a ; 1958 b ; 1958 c ; Badreldin *et al.*, 1959 ; 1961 a ; 1961 b ; Mostageer and Kamar, 1961). However, in most of these studies the other important native breed was not used, *i.e.* the White Baladi.

In this work, it is hoped to compare the two native breeds and their crosses with the Rhode Island Red, as the successful dual purpose breed in Egypt, with respect to their egg characters and related phenomena.

Material and Methods

Seven matings including the pure Fayoumi (F), White Baladi (B) and Rhode Island Red (RIR) and four reciprocal crosses of Rhode Island Red males with Fayoumi females (RF), Rhode Island Red females with Fayoumi males (FR), Rhode Island Red males with White Baladi females (RB) and Rhode Island Red females with white Baladi males (BR) were made and their offsprings were reared. Chicks were hatched by the middle of January. At the age of 14 months, after 2 to 5 months from sexual maturity, 48 eggs out of 16 hens from each breed and cross (each represented by 3 eggs) were used to estimate the various components of the egg according to the method used by Hafez *et al.* (1955). The experiment was done during the first week of February. After weighing the egg, it was broken and the yolk was freed from the albumen and weighed. The shell was cleaned by delicate filter paper to remove the remains of albumen. The shell was then weighed with the two shell membranes. The weight of the albumen was calculated by difference. Shell thickness was also estimated to the nearest 0.05 ml. Age at sexual maturity was recorded for each hen. Also, the weight of each hen at one year of age was recorded. All the birds were treated alike with respect to feeding and managerial conditions prevailing on the farm. Statistical analysis were done after Snedecor (1956), for the analysis of variance of subsample means of equal subsample numbers.

Results and Discussion

The two indigenous F and B breeds had the same egg weight, components weights, components percentages and shell thickness. However, the B hens had heavier body weights, although attaining sexual maturity at slightly earlier age. RIR hens had significantly heavier egg, albumen and yolk weights than the two native breeds. The B and F eggs were of significantly lower albumen percentage and higher yolk and shell percentage than the RIR eggs. Also the two native breeds had heavier and thicker shells than the RIR shells. RIR hens had significantly heavier bodies and older age at sexual maturity than the other two breeds (Table 1). In the previous studies, the trend of variations between the pure F and RIR breeds with respect to egg characters, body weight and age at sexual maturity (Badreldin *et al.* 1959 ; Mostageer and Kamar, 1961) are in agreement with the present findings.

In general, most of the egg characters of the crossbred hens had nearly similar values as their purebred dams suggesting the existence of maternal effect. Although the egg and components weights of the two native breeds were low, yet the crossbred hens produced eggs of somewhat heavier weights as compared to their purebred native breeds. This is more obvious in the crossbred of B with R than of the F with R. Similar trend was also clearly observed in shell thickness, which could be due to hybrid vigour in addition to the suggested maternal effect. Albumen percentages of the crossbred

TABLE 1. Breed and cross differences in egg characters and related phenomena.

Items	Breeds and crosses						
	F	B	RIR	RF	FR	RB	BR
Egg wt.	46.7	46.9	54.5	45.3	59.2	47.6	59.9
Range	39.9— 57.0	42.6— 59.8	46.3— 63.9	37.7— 49.8	48.6— 72.1	41.1— 53.8	49.9— 73.9
Albumen wt.	25.5	25.4	32.4	24.6	35.2	26.0	36.8
Range	20.7— 30.8	22.0— 35.1	26.3— 39.7	20.1— 27.8	28.8— 45.8	21.8— 31.1	30.1— 48.6
Albumen %	54.6	54.2	59.1	54.3	59.4	54.6	61.2
Range	51.9— 57.9	44.8— 58.7	54.7— 70.7	48.6— 58.2	54.4— 63.5	50.5— 67.5	57.6— 67.7
Yolk wt.	15.4	15.6	16.7	15.2	17.9	15.7	17.0
Range	12.3— 20.0	13.8— 20.5	13.1— 18.8	12.2— 19.5	13.2— 20.6	13.0— 18.1	14.7— 19.3
Yolk %	33.0	33.3	30.9	33.5	30.2	33.0	28.7
Range	30.5— 35.1	28.4— 34.2	26.7— 35.0	30.1— 39.2	26.0— 34.1	29.3— 37.6	22.0— 32.8
Shell wt.	5.8	5.9	5.4	5.5	6.1	5.9	6.1
Range	4.8— 7.1	4.9— 7.7	3.6— 6.6	4.5— 6.5	4.9— 7.2	4.7— 6.9	4.6— 7.8
Shell %	12.4	12.5	10.0	12.2	10.4	12.4	10.1
Range	10.5— 14.8	11.2— 15.8	7.8— 11.3	10.7— 13.9	9.2— 12.4	10.9— 14.0	8.6— 13.1
Shell thick	7.4	7.2	6.2	7.2	6.4	7.1	6.5
Range	6.2— 9.0	6.5— 9.0	4.6— 7.2	6.0— 8.5	5.5— 7.4	5.8— 8.0	5.2— 7.5
Body wt.	1124	1277	2109	1213	2118	1422	2214
Range	930— 1250	1080— 1490	1610— 2570	1010— 1430	1670— 2440	1150— 1690	1840— 2640
Sex maturity	195	189	300	176	249	182	307
Range	138— 231	148— 305	210— 380	110— 227	185— 290	146— 246	265— 335

N.B.

1. Shell thickness in units of .05 mm.
2. Sexual maturity age in days.
3. Weights in g.
4. Body weights at 12 months of age.
5. Differences between breeds and crosses of all the items are highly significant at $P > .01$.

hens from F and B dams were similar to the percentages of their purebred dams, while the albumen percentages of the crossbred hens from R dams were higher than the percentage of their pure R dams. The contrary was observed in yolk percentages. The percentages of yolk of the crossbred hens from F and B dams were similar to their purebred F and B dams, while the percentages of the crossbred hens from R dams were lower than the percentage of their pure R dams. It could be suggested that most of the maternal effect that causes the increase in egg weight which was achieved by crossing F and B with R is mainly due to the increase in albumen weight, while few was attributed to yolk weight. Shell percentages of crossbred hens were similar to their purebred dams showing clear maternal effect.

In previous studies, also clear maternal effect was observed in egg and components weights and their percentages when the F was crossed with a dual purpose breed such as R (Badreldin *et al.*, 1959, Mostageer and Kamar, 1961). Meanwhile, the crossing of a light breed, such as White Leghorn with F produced a paternal effect on egg and components weights and percentages (Badreldin *et al.*, 1959 ; Mostageer and Kamar, 1961).

The most suitable cross for egg production, mainly for egg size, is the cross of the F males with the R females, as it produces the larger eggs, even heavier than the R with relatively larger yolk and shell weights and percentages. However, the crossing of B males with R females is also suggested. These crosses are also better than the crosses of F with White Leghorn, the egg producing breed (Badreldin *et al.*, 1959 ; Mostageer and Kamar, 1961).

Most of the crossbred hens attained sexual maturity at an earlier age than their purebred dams, except that of BR. However, a maternal effect can be clearly observed. This trend of results was also observed in the same reciprocal crosses studied by Badreldin *et al.* (1959). This also emphasize that FR cross is the most suitable cross for egg size as their age of sexual maturity is greatly earlier than the other large sized egg BR cross or the pure R hens. In general, all the purebred and crossbred hens attained sexual maturity at a later age than that previously observed by Badreldin *et al.* (1959). This is mainly due to the date of hatch, as the chicks that hatch later in the season attain sexual maturity at later ages (Hafez and Kamar, 1955). The hens of Badreldin *et al.* (1959) were hatched on November, early in the season, while the hens of the present study were hatched on January, late in the season.

Also, a clear maternal effect can be clearly observed with respect to body weight of crossbred hens at 12 months of age. The weights of the crossbred hens were even heavier than their purebred dams. This is more obvious in the B cross with R than in the F cross with R that may be due to the fact that the purebred B dams were heavier. The observed maternal effect in body weight seems to be increased by the hybrid vigour effect. Also, maternal effect was observed by Badreldin *et al.* (1959) in similar reciprocal crosses of F with R.

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تأثير الخلط على صفات البيض في الدجاج

محمد جمال الدين قهر ، أحمد مستجير والسيد قطبي
قسم الانتاج الحيوانى ، كلية الزراعة ، جامعة القاهرة

استخدم في هذا البحث ثلاث انواع من الدجاج وهى الفيومى والبلدى الابيض والبرود ايلاند رد والخلطان المكسيكية لهما وعددها اربعة وذلك لدراسة تأثير الخلط على صفات البيض مثل وزن البيضة ومكوناتها ونسب المكونات وعمر التفقيح الجنسى ووزن الجسم عند عمر ١٢ شهر وقد لوحظت ان هذه الصفات تسلك سلوكا وراثيا فيه تأثير الام واضحا . وقد لوحظت ايضا قوة التيجين في الخليط بين امهات البرود ايلاند رد وذكور الدجاج الفيومى او البلدى الابيض . وكانت معظم الزيادة في وزن البيضة راجعة الى الزيادة في وزن البياض .