Egypt. J. Anim. Prod. 20, No. 2 ,pp. 91-100 (1980)

Managerial Trials to Improve the Laying Capacity of the Fowl

K.A.O. Yamany, S.A. El-Aggori, H.A. Gabr, I.F.M Maria and A.F.M. El-Labban

Dpt. Anim. Prod., Fac. Agric., Zagazig University, Egypt.

THIS EXPERIMENT was conducted to study the effect of breed ration, light and their interaction on laying performance, feed consumption and net return, using a factorial design (2 breeds×2 rations t× 2 regimes). Eight groups totalling 800 day-old chicks of Rhode Island Red (RIR) and Dokki $_4$ were raised on two different starting, growing and laying rations, similar in protein level but differed in major protein sources.

The first ration (improved) was composed of soybean meal (50% CP) and imported fish meal (70% CP) and second ration (convential) was composed of cotton seed meal (40.6% CP) and local fish meal (40.7% CP).

The experimental groups were subjected to artificial light regime versus natural daylight regime. The laying performance, the feed consumption and efficiency and the net return of 30 layers per each group were studied after sexual maturity throughout 10 months laying period.

The results obtained could be summarized as follows :

The body weight of RIR layers was heavier than the Dokki one at sexual maturity and at the end of laying period. The RIR laid 12% more eggs than Dokki $_4$ layers. Average egg weight was 49.3 and 47.0 g for the RIR and Dokki $_4$, respectively. The difference between the two breeds in egg mass was 17.3%. The RIR surpassed Dokki $_4$ layers in feed efficiency with 26.5%. The improved ration gave 24% more egg number, 0.4% egg weight, 23.5% egg mass, 23.5% rate of laying, 0.7% feed intake, 21.9% feed conversion and 14.3% net return than the conventional ration. Lighting regimes showed no significant effect on layers' body weight using the improved ration realized more net return and was more economical for RIR than Dokki $_4$ layers. In general, the improved ration was more economical for the two breeds than the conventional ration although it was more expensive in costs of production. Significant interaction effects were found between breed and ration, ration and light, and breed and light, on body weight a sexual maturity, final weight, egg number and egg mass.

Managerial trials should be carried out on layers to increase their laying capacity on economical basis. Therefore, many systems of management should be practised on the laying birds to estimate their laying capacity under different nutritional and light regimes. Scientific bases for this regimes are lacking in literature.

It was intended to study the effect of breed, ration light and their interactions in relation to egg production in Dokki $_4$ and RIR (Rhode island Red).

Material and Methods

This work was carried out in the Poultry Research Farm at Anshas, Sharkia, Animal Production and Poultry Research Institute, Minstry of Agriculture, in the period from December, 1974 till March, 1976.

800 day old chicks of each of Dokki $_4$ and RIR breeds hatched at December 8, 1974 were used in the present study. The chicks were wing-banded and then each breed was divided into four groups. The birds of each four groups were treated as follows :

Birds of the first group were provided with ration 1 (Table 1) and gradual artificial light regime (Table 2).

The second group was provided with ration 2 (Table 1) and gradual artificial light (Table 2). The third group was provided with ration 1 and natural day light. The fourth group was provided with ration 2 and natural day light.

The two rations (1 and 2) used in this study were designed and formulated to be as nearely similar in their proximate analysis. They were provided according to a restricted feeding program started with 12 g per chick in the first week, reached 126g per hen daily at the peak of egg production and terminated with 114g in the last week.

Soybean meal of 50.0% CP and imported fish meal of 70% CP were used as major plant and animal protein sources in the first ration (R_1). While, the second ration (R_2) major plant and animal protein sources were decorticated cottonseed meal 40.6% CP and local fish meal of 40.7% CP. 125g of vitamin premix and 875 g of mineral mixture were provided to ration 1 and ration 2, respectively. Vitamin premix and mineral mixture in each kg composed of :

tamin premix:

A : 40 million I.U./kg	B_2 : 24000 Mg/kg
D_3: 8 million I.U./kg	B_6 : 24000 Mg/kg
K : 12000 Mg/kg	B_{12} : 64000 Mg/kg
E : 24000 Mg/kg	C : 24000 Mg/kg

Mineral mixture:

Fe : 114g	Mn : 343g
I : 17g	Zn : 11/g
Cu : 17g	

TABLE 1.—Composition and feeding value of rations 1 and 2 (N.R.C., 1972 and Erb, 1976).

Ingredients %	Ration 1			Ration 2		
	Starting	Growing	Laying	Starting	Growing	Laying
Yellow corn	65.0	66.0	68.0	60.0	65.0	66.0
Rice bran	4.0	12.0	4.0	3.0	8.0	—
Wheat bran	3.0	6.0	10.0	4.0	6.0	10.0
Soybean meal	20.0	10.0	10.0	—	—	—
Cottonseed meal	—	—	—	25.0	15.0	16.0
Fish meal local	—	—	—	5.0	3.0	3.0
Fish meal imported	5.0	3.0	3.0	—	—	—
Limstone	1.0	1.0	3.0	1.0	1.0	3.0
Bone meal	1.5	1.5	1.5	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Feeding value :						

	N.R C			Erb.			N.R.C.			Erb.		
	Starting	Growing	Laying	Starting	Growing	Laying	Starting	Growing	Laying	Starting	Crowing	Laying
C.P. %	19.9	15.2	14.9	20.40	16.00	15.20	18.0	14.7	14.8	18.60	15.40	14.90
Fat %	2.8	2.8	3.0	3.70	4.30	3.80	4.4	3.8	4.0	4.00	4.30	3.70
Fiber %	3.3	4.4	3.8	3.20	3.90	3.30	5.6	5.4	4.9	5.40	5.00	4.80
Lysine %	—	—	—	1.15	0.81	0.76	—	—	—	0.74	0.59	0.56
Methionine %	—	—	—	0.38	0.33	0.32	—	—	—	0.35	0.30	0.29
Calcium %	—	—	—	1.01	0.96	1.72	—	—	—	1.35	1.16	1.93
Av. P. %	—	—	—	0.39	0.45	0.43	—	—	—	0.63	0.38	0.56
M.E.Kcal/kg.	2929.0	2856.0	2819.0	2997.0	2925.00	2888.00	2836.0	2840.0	2797.0	2766.00	2823.00	2772.00
C/P ratio	147:1	187:1	188:1	146:1	181:1	189:1	157:1	192:1	188:1	148:1	182:1	183:1

TABLE 2. **Artificial lighting program.**

Weeks	Hours light	Weeks	Hours light
Keeps lights on for first 482		26	12
1	18	27	12½
2	15	28	13
3	13	29	13½
4	11	30	14
5 — 20	9	31	14½
21	9	32	15
22	10	continue increasing ½ hr per week until 17 hr are reached. Remain on 17 hr until depletion.	
23	10½		
24	11		
25	11½		

Egg number, egg weight, egg mass, changes in body weight, efficiency of feed utilization, efficiency of energy, ME kg eggs/Meal, kg and efficiency of protein utilization, kg eggs/kg CP. and net return were studied in the different treatments. Analysis of variance was carried out on factorial design (2 breeds ×2 rations × 2 light regimes). Statistical analysis was carried out after Snedecor and Cochran, (1967).

Results and Discussion

Effect of breed, ration and light on layers performance

Table 3 and 4 showed the effect of breed, ration and light regime on different trials studied during the experimental period.

The RIR chicks were significantly heavier at sexual maturity and at the end of laying period than those of Dokki 4.

Chicks fed on ration 2 were significantly heavier in body weight by 42.9g than those fed on ration 1 at sexual "maturity" however this effect was not significant at the end of laying. The layers fed in natural day light were significantly heavier in body weight than those subjected to artificial light at the end of laying period. This may be due to the calming effect of the natural day light which induced increasing body weight in the former group of birds.

TABLE 3. **Test of significance (Fvalue) of the effect of breed, ration and light regime on the different traits studied during the whole experimental period (10 months).**

Items	Bree		Ration		Light	
	Dokki,	RIR	R_1	R_2	L_1	L_2
Body weight at sexual maturity	1557.5**	1717.0**	1615.8**	1658.7**	1625.5**	1648.9
Body weight at end of laying	1819.1**	2045.6**	1904.9	1959.8	1874.8	1989.4**
Egg number	149.3**	167.2**	175.2**	141.3**	158.8	17.75
Egg mass (g).	7023.6**	8239.6**	8440.8**	6832.4**	7562.7	7700.5

** <p.01

The RIR hens laid 12% more eggs of slightly heavier weight than those laid by Dokki $_4$ birds. The difference between the two breed groups was 17.3 % in egg mass. Statistical analysis showed a highly significant effect of breed as well as of ration on either the number of eggs laid or egg mass. El-Hossari, (1974) stated that negative phenotypic and genetic correlations were found between egg production and body weight at sexual maturity, as there was significant difference between egg production and body weight at 12 months of age.

Egg number and consequently egg mass were increased on ration 1 than on ration 2 in different layer groups, while egg weight was approximately similar on both the two rations. The increase in rate of laying was 23.5%, in egg mass 23.5% and in egg weight 0.4%. It could be concluded that the increase in egg production on ration 1 might be due to the higher precentage of lysine and methionine in ration 1 than in ration 2 as shown in Table 1 (Erb, 1976) as stated by Chavez *et al.* (1966), Harms *et al.* (1967), Roberson (1970), Spacek and Prispevek (1966) N.R.C. (1972). and Poultry Worl, (1974). The lighting program showed insignificant effect either on egg number or on egg mass in different groups studied. This phenominon may indicate that light stimulus induced similar results in egg production to the nontreated birds in the present study.

Efficiency of feed utilization for egg production

The average feed intake and the average feed conversion for the different experimental groups are shown in Table 4. Results obtained showed no soundy difference between the two rations in feed intake. When the restricted feeding program was practised the difference was not more than ½kg. (0.7%) between the different treatments. However, it could be observed that ration 1 was more efficient with than ration 2 when feed conversion was concerned. The difference in feed conversion may be due to the difference in the major protein

sources in the two rations which were of higher lysine and methionine levels in he first than in the second ration. The RIR layer was more superior than he Dokki $_4$ layer in feed utilization under the restricted feeding program. This might be indicated by the superiority of the RIR in feed conversion either on ration 1 or on ration 2 than the Dokki $_4$ layer. It may be concluded that feed utilization efficient in RIR layers than in Dokki $_4$ under restricted feeding system. However, the lighting program was of unseliable effect not only on feed ntake but also on feed conversion. The average feed intake per hen was 35.039 gt and 34.633 kg in artificial and natural day light, respectively to 4.690 kg and 4.592 kgi for feed conversion.

Efficiency of energy and protein utilization for egg production

Despite the increase of energy and protein intake by the increase in feed intake, the efficiency of ME kg eggs/Mcal. kg and CP, kg eggs/kg CP. was better in ration 1 than in ration2 (Table 4). It was obvious that RIR layer was more eflicient than Dokki $_4$ layers in energy and protein utilization (Table 4). Ration 1 also surpassed ration 2 and normal day light exceeded the artificial light regime in this respect.

of feed and net return as affected by breed, ration and light

Net return, expressed as the difference between costs of feed and selling of eggs pe a layer in piasteres for the different treatments were illustrated in Table 4.

Results demonstrated that RIR layer was superior and more economical as it has given more net return (26.5%) than the Dokki $_4$ layer. Ration 1 1 was more economical than ration 2 from the production point of view by 14.3%, although the first ration was more expensive than the second ration. In case of light regime, the natural day light more favourable and hence more econcmical than the artificial light.

Within breed effect

The improved ration was favourable on egg number in the two studedi breeds. However, concerning the within breed effect the RIR layer laid 27.9 % more eggs on the improved ration than on the conventional ration corresponding to 19.7% only for Dokki $_4$ layer in the same respect (Table 4). The superiority of the improved ration for RIR layer was greater than that for Dokki $_4$ in egg number, egg mass, feed conversion, efficiency of ME kg egg 3/ Mcal. kg, and efficiency of crude protein, kg egg/kg CP. However it was noteworthy to indicate that althought ration 1 was higher in price than ration 2 it was more economical for both the two breeds, but the RIR layer showed more response in egg production than Dokki $_4$ layer and consequently more net return (Table 4). It could be concluded that the response of RIR layer to better feed may induce better and more economical production under the prevailing environmental conditions in Egypt.

The artificial light was more favourable, in general, on the productive traits of Dokki$_4$ layer while the natural day light was superior for the production of RIR layer. Using the artificial light of for Dokki$_4$ layers increased the net return by 9.3% corresponding to 14.2% increase in net return by using the natural day light for RIR layers. Further studied should be carried out to illustrate the requirement of light for the different breeds in Egypt 30° Northern latitude on the basis on economic return.

Interaction effect on laying performance

The significant interaction effect between ration and breed and between ration and light on chick body weight at sexual maturity and at the end of laying period was illustrated in Table 5.

TABLE 5. **The significant interaction effect between breed and ration, between light and ration and between breed and light on body weight at sexual maturity, body weight at end of laying period, egg number and egg mass.**

Items		R_1	R_2	L.S.D	
				.05	.01
Body weight at Sexual maturity	Dokki$_4$	1557.0	1558.0	1.5	2.0
	RIR	1674.6	1759.9		
Egg mass	Dokki$_4$	7626.2	6441.1	18.4	24.2
	RIR	9255.4	7223.8		
Body weight at end of laying	I_1	1879.0	1870.6	2.6	3.5
	L_2	1930.8	2049.0		
		L_1	I_2		
Egg number	Dokki 4	156.1	142.5	11.9	14.8
	RIR	161.4	172.9		
Egg mass	Dokki 4	7260.0	6887.0	18.4	24.2
	RIR	7865.0	8613.0		

TABLE 4. Effect of breed, ration and light on different items studied during the experimental period (10 months).

Items	Dokki$_4$				R.I.R.			
	B_1		B_2		B_1		B_2	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
Body weight at sexual maturity	1559.700	1554.300	1541.100	1574.900	1657.900	1691.300	1743.500	1776.300
Final body weight	1803.300	1797.600	1753.500	1922.100	1954.700	2064.100	1987.700	2176.000
Egg number	169.000	156.500	143.4	128.400	180.500	194.900	142.400	151.000
Egg weight	46.800	47.000	46.100	48.800	48.600	49.900	48.900	49.600
Egg mass	7904.300	7348.100	6616.000	6266.200	8771.400	8731.300	6959.300	7488.400
Feed intake (kg) / hen / whole period.	34.709	34.490	35.389	33.757	35.161	35.473	34.898	34.813
Feed conversion (kg) / kg egg	4.390	4.693	5.348	5.386	4.008	3.642	5.014	4.648
Egg weight/kg Feed	0.227	0.213	0.187	0.186	0.250	0.275	0.199	0.215
Feed intake (g)/hen/day.	111.000	112.000	113.000	111.000	114.000	116.000	114.000	115.000
Energy intake, Kcal / hen / day.	320.500	323.500	313.200	307.700	329.200	335.000	316.000	318.800
Protein intake, g / hen / day.	17.000	17.100	17.000	16.600	17.400	17.700	17.100	17.200
Efficiency of ME., kg egg/ Mcal kg	0.079	0.074	0.067	0.067	0.086	0.095	0.072	0.078
Efficiency of CP., kg egg/ kg CP.	1.490	1.395	1.250	1.241	1.633	1.797	1.333	1.438
Feed costs of eggs/layer/ piastres	187.400	186.200	134.500	128.300	185.900	191.600	132.600	132.300
Net return / Layer / piastres	286.800	254.900	262.500	247.700	336.400	392.800	284.900	317.000

Results obtained may emphasize the favourable effect of ration 1 on body weight of the two breeds. The light effect, however, showed a different effect in this respect with the two rations. Birds receiving ration 2 were heavier in body weight at the end of laying birds on natuzal light than on light zegime period. Although, the RIR layer surpassed the Dokki $_4$ in egg number either on both natural or artificial light. The artificial light induced more egg of Dokki $_4$ layers while the natural day light showed favourable effect on egg number of the RIR layer. It may be concluded that breeds may differ in egg production in their response to light stimulus.

Concerning the significant interaction effect of breed and ration on egg mass (Table 5), the RIR layers surpassed the Dokki $_4$ one either on ration 1 and ration 2, however, within each breed, the ration 1 increased egg mass more than ration 2. It may be concluded that production of the two breeds may response differently to variations in feeding regimes. However, it is undesirable to increase the body weight of layers in order to increase the rate of laying (Romanoff and Romanoff, 1949).

References

Chavez, R., Thomas, J.M., and Reid, B.L. (1966) The utilization of non-protein nitrogen by laying hens. *Poult. Sci.* 45, 547 -

El Hossari, M.R. (1974) Genetic, phenotypic tand environmental correlations between adults body weight and egg number in a flock of Fayoumi chicken. *Agric. Res. Rev Cairo*, 52 149

Erb, V. (1976) Row material list, Egypt, Hendrix Voe lers B.V., Hollan

Hamrs, R.H., Darmon, B.L., and Waldroup, P.W., (1967). Evaluation of the sulfuramino acids requirements of commercial egg production type pullets. *Poult. Sci.*, Vol. 46, 181 - 186.

National Research Council (N.R.C.) (1972)—Average Analysis of commonly used raw materials.

Poultry World (1974)—Nutrient requirement for poultry. November.

Roberson, R.H (1970) A comparison of glandless cottonseed meal and soybean meal in laying diets supplements with lysinge and methionine. *Poultry Sci.* 49, 1579.

Romanoff, A.L. and Romanoff, (1949) "*The Avian Egg.*" John Wiley and Sons, Inc., New York.

Snedecor, G.W. and Cochran, W.G. (1967)—"*Statistical Methods*" 6th Ed. Iowa State College Press, Ames, Iowa, U.S.A.

Spacek, F and Prispevek, K (1966)—Problematice no hardy zivocisych bilkoivzn rostlinnyami bilkovinami pomoci prisavku DL. ethionine a L. Lyzinum V. Krmny dekach msric. (Replacing animal protei in feed by plant protein and supple nents of DL-Methi nine and L-Lysine for laying hens.) *Bill, Chem. VYZ ZVRRAT*, 1, 47 -t54.

وسائل وعائيه لزيادة انتاج البيض فى الدجاج

ك٠ ا٠ و٠ يامانى ، س٠ ا٠ العجورى ، هـ٠ ا٠ جبر ، ى٠ ف٠ م٠ مريم ، ا٠ ف٠ م٠ اللبان

أجريت هذه التجربة لدراسة تأثير النوع والغذاء والضوء والتداخل بينهـا على أساس التصميم المتعدد العوامل (نوعين × عليقتين ـ برنامجى اضاءة) على انتاج البيض والكفاءة الغذائية وصافى الربح ٠

أستخدم فى هـذه التجربة ٨٠٠ كتكوت عمر يوم من نوعى الرود ايلاند الأحمر والدقى ٤ قسمت الى ثمانية مجاميع وغذيت على نوعين من علائق الابتداء والنمو والبياض متشابهان فى نسبة البروتين ومختلفـان فى مصدره ، الأولى عليقة محسنة تحتوى على كسب فول الصويا (٥٠٪ بروتين خام) ومسحوق سمك مستورد (٧٠٪ بروتين خام) ٠ والثانية تقليدية تحتوى على كسب قطن مقشور البذرة (٤٠ر٦٪ بروتين خام) ومسحوق سمك محلى (٤٠ر٧٪ بروتين خام) ٠ وعرضت نصف المجاميع فى كل نوع الى برنامج اضاءة صناعية تدريجية بينما عرضت المجاميع الباقية الى برنامج اضاءة الطبيعة اليومية منذ عمر الفقس وحتى نهاية فترة وضع البيض التى استمرت ١٠ شهور منذ عمر النضج الجنسى ٠

ويمكن تلخيص النتائج المتحصل عليها فيما يلى :

- كان الدجاج من النوع الرودايلاند الأحمر أثقل فى وزن الجسم الحى من الدجاج الدقى ٤ عند عمر النضج الجنسى وعند نهاية وضع البيض ٠ وكان الدجاج من نوع الرودايلاند الأحمر أعلى فى عدد البيض من الدجاج دقى ٤، كما كان متوسـط وزن البيضـة ٤٩ر٣ جم ٠ ٤٧ر٠ جم لكل من الرودايلاند الأحمـر عن دقى، على التـوالى ٠ كمـا كان الفـرق فى كتـلة البيض (العدد × الوزن) أعلى فى الرودايلاند الأحمر عن الدقى، بنسبة ١٧ر٣٪ ٠
- كان معدل الاستفادة من الغـذاء أعلى فى الرودايلاند الأحمر عن دقى، بنسبة ٢٦ر٥٪ ٠
- بصفة عامة كانت العليقة رقم (١) أفضل فى تأثيرها عن العليقة (٢) بنسبة ٢٤٪ فى عدد البيض ٠
- كان الاختلاف فى تأثير العليقتين (١) ، (٢) على وزن البيضة ٤ر٠٪ بينما كان هذا التأثير ٢٣ر٥٪ فى كتلة وزن البيض ، ٢٣ر٥٪ فى معدل الوضع ، ٧ر٠٪ فى الغذاء المستهلك ٢١ر٩٪ فى معدل التحول الغذائى ، ١٤ر٣٪ فى العائد الصافى ٠
- استعمال التغذية المحسنة يشير الى أن العـائد الصافى أعلى وأفضـل من الناحية الاقتصـادية فى الرودايلاند الأحمر عن دقى ٤ ٠ وكذلك أفضـل بالنسبة للنوعين المذكورين من الناحية الاقتصادية عن العليقة العادية ٠
- لايوجد تأثير معنوى لبرامج الاضاءة ، ويوجد تأثير معنوى للتداخل بين النوع والعليقة وبين العليقة والاضاءة وبين النوع والاضاءة على التوالى على وزن الجسم عند النضج الجنسى والوزن النهائى ، عدد البيض ، كتلة البيض ٠