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SEASONAL VARIATION IN EGG PRODUCTION IN RELATION TO TIME OF SEXUAL MATURITY UNDER EGYPTIAN CONDITIONS

By

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SUMMARY

Pullets used in this study were taken at random from the flock bred by the poultry Research Station, Animal Breeding Department, Faculty of Agriculture, Cairo University. The experiment included about 300 pullets composed of equal numbers of Fayoumi, Baladi and Rhode Island Reds. Nearly half of them reached sexual maturity during the period from July to September 1959, while the other half matured from October to December. The main points of the study were concentrated on 68 F., 75 B. and 52 R.I.R. birds that completed their first laying year. The following results were obtained:

(1) Egg laying is highly variable within months and seasons of the year. Spring egg number represented 50% of the full production while winter, summer and autumn represented 40-50, 30 and 24% respectively.

(2) This effect of season was reflected on both early and late maturing birds, a fact which means that seasonal atmospheric conditions dominate the final expression of the laying birds.

(3) Egg weight showed less variability with seasons especially in the late maturing groups. This means that methods of improvement in egg weight could achieve quicker gains under the prevailing conditions.

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INTRODUCTION

For purposes of studying annual egg production many workers have divided it into a number of subgroups. Dividing annual egg production into four seasons has been widely practised and the number of eggs produced in each month and in each season has been analysed by several workers. Behind all this attention to the subgrouping of annual egg production and the study of its several phases, is probably a realization of the complexity and multiplicity of the factors influencing the egg production of a bird. Not only does the egg laying capacity depend largely on genetic factors but is also influenced to a great extent by varying environmental conditions.

It is observed in Egypt that environmental factors exert a great influence on egg production due to the wide variation in atmospheric conditions between seasons of the year. Meanwhile, early sexually maturing birds usually suffer at sexual maturity from the adverse summer conditions. It was thought advisable in this connection to study the seasonal flactuations in egg production in a group of summer and a comparable group of autumn maturing pullets, for the sake of scientific and economic comparison.

PREVIOUS WORK

It is regularily observed that egg production varies greatly with seasons. The peak of egg yield occures generally during winter and spring months while production was lower during summer and fall months. It seems that air temperature and light are the main factors responsible for such fluctuations, and that egg yield is negatively correlated with the increase in climatic temperature.

Riyor (1934) found that the peak in egg number of W.L. occurred during January and March.

Funk and Kempster (1934) indicated that the weight of the eggs laid by pullets during their first few months of production is very definitely related to the month in which sexual maturity occurs. Birds which began laying at an early age laid smaller eggs than did pullets which began older. Eggs of maximum weight were produced during the early spring months (Feb. and March) while smaller eggs were laid during summer months (June - July, and August). Hays (1944) showed similar results with R.I.R.

Under the Egyptian environmental conditions, Assem (1951) showed that maximum egg yield in Fayoumi and Baladi was obtained in December and January, while the minimum was reached in August and September. The maximum egg weight was that of January and February and the minimum was in July and August. Results of Hossary(1958) also showed that the maximum egg number in Fayoumi occurred at March and the minimum was at October. Samkary (1962) came to similar conclusions.

MATERIALS AND METHODS

The experiment included about 300 pullets composed of equal numbers of Fayoumi, Baladi and Rhode Island Reds which were hatched during December, 1958 and January 1959. Nearly half of them reached sexual maturity during the period from July to September 1959, while the other half matured from October to December. These two groups were taken for comparison. The main points of the study were concentrated on 68 Fayoumi, 75 Baladi and 52 R.I.R. birds that completed their first laying year. Uniform managerial practices were maintained for both groups.

Eggs were gathered hourly from trapnests and daily individual records were obtained for the whole pullet year (365 days after sexual maturity). The monthly averages in egg number and egg weight throughout the laying year were subsequently obtained.

RESULTS AND DISCUSSION

(1) *Egg Number* :

It is apparent from (Table 1) that the annual egg number showed a wide variation between months and seasons of the year in both groups and in the three breeds studied. Egg production was affected by month of laying and consequently by seasons, in a similar characteristic trend although slightly of variable magnitude. The lowest months in production were those of summer (June- August) and Autumn (September-November). Production was resumed in winter (December-February). and was highest during spring (March-May). It is of particular interest to note that this seasonal effect was clearly pronounced in the two groups studied despite their differences in months of sexual maturity (June or October). This fact means that egg production under local climatic conditions is mainly affected by atmospheric conditions and that other factors

involved in egg production are of minor influences in this connection.

The picture is more fully illustrated when considering the figures of (Table 2) on rate of production. It is clear that in both groups of the three breeds studied, spring production was the highest followed by winter, summer and autumn respectively. The rate of production was over 50% in spring in all breeds while it ranged between 40-50% in winter. In summer months it was generally less than 30% and was much lower (24% and less) in autumn. I other words, the spring production represented about 37% of the annual production in the general bulk of the data, while that of winter, summer and autumn represented generally 32%, 18% and 13% respectively.

These results are in full agreement with those reported on the subject, especially those stated by Hays (1944) Lerner (1947) and Nugent (1951). On the other hand Assem (1951), showed that production in winter months was higher than that of spring. This may be attributed to differences in experimental conditions.

The given results could be explained in the light of atmospheric conditions as well as managerial and biological factors involved in the laying season. The spring and winter months represent the best time of the year as regards the range of environmental daily temperature (23.6 °C in spring, 14.0 °C in winter). Romanoff (1949), showed that the optimum temperature for egg production is around 21.1 °C. The initiative effect of mild temperature on egg production and other features of biological functions in the fowl has been repeatedly reported by several workers (Sturkie 1954). Hygienic conditions under our conditions are far better during winter and spring than in hot summer. Moreover,prolonged summer moult and the humid hot air are mainly responsible for the lack of production during autumn.

Comparing breeds, the Fayoumi showed a higher total production in both early and late maturing groups, followed by Rhode Island Red, while the Baladi was of somewhat lower annual production (Table 1, 2). The early maturing groups of Fayoumi and Rhode Island Red birds showed a slightly greater total production than late maturing groups. The Baladi showed the opposite. Differences between breeds and between early and late maturing groups were non significant.

The greatest breed differences were observed during summer and autumn. There was no distinct trend in this respect, as the three breeds showed irregular fluctuations although the Fayoumi generally seemed some what better able to withstand the hot weather than the other two breeds.

(2) *Clutches* :

A study of clutch size confirmed the previous picture observed on gross rate of production. The month and seasonal effects were of similar significant within breeds within the two groups (Table 3).

In general the bigger egg clutch size was that of spring (1.9-2.3 eggs) followed by winter clutch size (1.7-2.1) Summer and autumn were of about the same clutch size (around 1.5 eggs).

The picture on clutch size is more complete with the listing of clutch number (Table 4). In general clutch number and clutch size follow the same trend within the laying year. However, it seems from the critical observation of the above figures and tables that clutch size bears more relation to egg production than number of clutches. This is clearly seen in case of the Baladi breed, where although the clutch number was generally higher than Rhode Island Red, yet the total annual production in Baladi was lower than in Rhode Island Red. On the other hand clutch size was markedly lower in Baladi than Rhode Island Red.

This confirms the findings of Hays (1944) that clutch size is a better indicator of egg production than clutch numbers.

Another proof on this feature is also seen from both (Tables 3, 4) where the noticeable reduction in summer production for the three breeds of the late maturing group was more closely associated with a decrease in clutch size than clutch number. It was clearly stated by Romanoff (1949) that poor weather conditions adversely affect birds rate of laying and consequently reduce the mean clutch size.

There was not much breed difference in clutch size, (in Fayoumi and R.I.R. about 1.8 eggs. However, this figure is much lower than that reported for R.I.R. by Hays (1946) '3.2 eggs'. The Baladi had the lowest clutch size (1.6 eggs). The estimates of Assem (1951) for Fayoumi and Baladi are somewhat higher than in the present estimation. Figures on clutch numbers in the different breeds showed dissimilarity. The Fayoumi however, possessed more clutch numbers than the Baladi or Rhode Island Red.

(3) *Egg Weight* :

It is seen that egg weight showed monthly and seasonal variations. The trend of fluctuations was similar in the three breeds within each of the two groups studied. This proves the dominant effect of season on egg weight. It is obvious from Table 5 that maximum weights were obtained during winter and spring months while summer and fall months showed lower average weights.

These lower averages were particularly so with the early maturing group where the birds took a longer time to attain their maximum egg size and adult body weight. This was not the case with the late maturing group where the birds were of heavier egg and body weights at the point of lay. The maximum egg weight was reached in this late group only within four months of laying whereas it was

not before 8 months that this level was reached in the early maturing birds. Consequently the differences between the seasons of high and low egg weights were remarkable in birds of the early group, and their average annual egg weight was smaller, compared with the late maturing group.

It is clear that the high air temperature prevailing during summer as well as the moult stress, were responsible for the noticeable decrease in egg weight. The effect of smaller body weight added to this handicap in the early maturing group. This early sexual maturity of birds under summer conditions, may cause the birds to lay fewer, and smaller eggs and they may exhibit partial moult after a short period of laying.

Practical Application

As can be seen from the previous results, the total annual egg yield was about the same in both early and late maturing groups, where as the average egg weight was markedly higher for the late maturing group of birds. This makes an allowance in the total weight of eggs produced by the latter birds. In the mean time their eggs were of marketable size nearly all the year round while the early group produced below average sized eggs for nearly the first third of the year.

So, it seems that the best solution under our conditions is to try to avoid the deleterious effects of summer on the newly laying birds by more successful means of management and selection, otherwise they may tend to give less profitable return. It may be also suggested that concentration for egg production should be on winter hatches, so as to have birds that approach sexual maturity when the summer conditions are over. This pratice may need more

modifications in our hatching and brooding systems as the early hatches are usually preferable for better growth and higher vitality. However, this aspect of pullet maturity prevailing needs further experimentation with regard to the conditions. Such investigations should take into consideration the net advantages of considerable numbers of hatches that reach maturity within the different months of the year.

TABLE 1.—Monthly and Seasonal Egg Number for Fayoumi, Baladi and Rhode Island Red

Group I				Group II			
Months	Fayoumi	Baladi	R.I.R.	Months	Fayoumi	Baladi	R.I.R.
June	7.1	4.1		Octo.	5.4	6.4	11.5
July	11.2	8.0	2.0	November	7.3	5.1	5.7
August	4.9	5.4	8.1	December	10.6	9.1	12.1
September	4.9	4.5	6.3	Jan.	13.5	12.4	14.2
October	5.4	3.9	7.7	February	15.6	15.4	16.3
November	9.0	3.8	8.2	March	15.5	17.5	17.9
December	11.5	11.1	11.9	April	15.6	15.5	15.5
January	13.7	14.4	13.2	May	15.0	15.6	12.0
February	17.5	15.5	16.3	June	11.1	10.6	12.0
March	17.8	17.7	18.6	July	8.2	8.2	8.1
April	18.1	16.2	16.3	August	7.4	4.6	6.1
May	13.2	13.7	12.6	September	5.5	2.6	4.0
June			11.0				
Total	136.2	120.3	132.4	Total	130.7	124.0	126.0
Summer	23.1	17.5	21.1	Summer	26.7	24.4	26.8
Autumn	19.3	14.2	22.2	Autumn	18.7	14.1	11.2
Winter	44.7	41.0	41.4	Winter	39.7	36.9	42.6
Spring	49.1	47.6	47.7	Spring	46.1	48.6	45.4

TABLE 2.—Monthly and Seasonal Rate of Production for Fayoumi, Baladi and Rhode Island Red

Group I				Group II			
Months	Fayoumi	Baladi	R.I.R.	Months	Fayoumi	Baladi	R.I.R.
June	23	14		October	17	21	5
July	36	26	7	November	24	17	19
August	16	17	26	December	34	29	39
September	16	15	21	January	44	40	46
October	17	13	25	February	54	53	56
November	30	19	27	March	50	57	58
December	37	36	38	April	52	52	52
January	51	46	43	May	48	50	40
February	60	53	56	June	37	35	40
March	57	57	61	July	27	30	28
April	58	54	54	August	24	15	20
May	43	44	41	September	18	9	13
June			37				
Average	37	33	36	Average	36	34	35
Summer	25	19	23	Summer	29	27	29
Autumn	21	16	24	Autumn	20	16	12
Winter	49	45	46	Winter	44	41	47
Spring	53	52	42	Spring	50	53	50

TABLE 3.—Monthly and Seasonal Clutch Size for Fayoumi, Baladi and Rhode Island Red. (eggs)

Group I				Group II			
Months	Fayoumi	Baladi	R.I.R.	Months	Fayoumi	Baladi	R.I.R.
June	1.81	1.36		October	1.49	1.53	1.50
July	1.59	1.44	1.00	November	1.39	1.32	1.36
August	1.26	1.44	1.55	December	1.51	1.36	1.53
September	1.46	1.36	1.61	January	1.92	1.63	1.91
October	1.62	1.39	1.84	February	2.34	2.07	2.29
November	1.46	1.28	1.42	March	2.24	2.01	2.07
December	1.74	1.46	1.67	April	2.02	1.93	2.16
January	2.09	1.74	1.93	May	1.93	1.90	1.79
February	2.53	1.94	2.32	June	1.54	1.65	1.76
March	2.40	2.15	2.75	July	1.28	1.56	1.72
April	2.19	1.95	2.29	August	1.31	1.31	1.65
May	1.67	1.73	1.83	September	1.33	1.20	1.67
June			1.82				
Average	1.81	1.60	1.84	Average	1.65	1.62	1.80
Summer	1.55	1.41	1.46	Summer	1.38	1.51	1.71
Autumn	1.51	1.34	1.62	Autumn	1.40	1.35	1.51
Winter	2.12	1.71	1.97	Winter	1.92	1.69	1.91
Spring	2.05	1.94	2.29	Spring	2.06	1.95	2.01

TABLE 4.—Monthly and Seasonal Clutch Number for Fayoumi, Baladi and Rhode Island Red.

Group I				Group II			
Months	Fayoumi	Baladi	R.I.R.	Months	Fayoumi	Baladi	R.I.R.
June	4.00	3.09		October	3.36	1.43	1.00
July	6.58	5.50	2.00	November	5.51	4.04	4.06
August	5.46	5.68	4.57	December	7.30	5.96	7.88
September	5.00	4.79	4.45	January	7.22	7.45	7.62
October	5.57	4.38	4.94	February	6.93	7.52	7.46
November	6.33	4.93	5.83	March	7.09	8.93	8.85
December	7.13	7.89	6.88	April	8.29	8.31	7.58
January	7.42	8.50	6.87	May	8.25	7.93	6.80
February...	7.04	7.78	7.31	June	7.50	6.86	7.17
March	7.83	8.43	7.19	July	6.11	6.69	5.95
April	8.75	8.48	7.27	August	6.88	5.09	5.17
May	8.21	8.04	6.87	September	5.62	4.21	3.83
June			6.00				
Total	79.32	77.19	70.19	Total	80.06	74.42	73.37
Summer	16.04	14.27	12.57	Summer	20.49	18.64	18.29
Autumn	16.90	14.10	15.23	Autumn	14.49	9.68	8.89
Winter	21.59	24.17	21.06	Winter	21.45	20.93	22.96
Spring	24.79	24.95	21.33	Spring	23.63	25.17	23.23

TABLE 5.—Monthly and Seasonal Egg Weight (grs.) for Fayoumi, Baladi and Rhode Island Red.

Group I				Group II			
Months	Fayoumi	Baladi	R.I.R.	Months	Fayoumi	Baladi	R.I.R.
June	29.6	30.3	41.3	October	39.1	39.9	51.5
July	31.9	33.4	46.0	November	40.8	40.9	55.3
August	32.6	35.2	50.4	December	42.5	42.8	57.6
September	36.8	38.1	52.8	January	44.0	43.8	58.9
October	40.3	39.9	54.5	February	44.0	44.0	58.6
November	41.7	40.9	56.4	March	42.8	42.9	57.2
December	42.6	42.9	57.6	April	40.9	41.4	55.5
January	44.0	45.1	58.2	May	40.4	40.0	52.9
February	43.4	44.7	57.1	June	39.8	39.7	50.8
March	43.4	43.9	54.7	July	39.9	40.2	50.8
April	41.3	41.8	51.4	August	39.7	39.9	48.2
May	39.9	40.9	49.7	September	41.2	43.9	48.4
Average	39.0	39.8	52.5	Average	41.2	41.6	53.8
Summer	31.4	32.9	45.7	Summer	39.8	39.9	49.9
Autumn	39.9	39.6	52.6	Autumn	40.4	41.6	51.7
Winter	43.3	44.2	57.4	Winter	43.5	43.5	58.4
Spring	41.5	42.2	54.4	Spring	41.4	41.4	55.2

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ملخص

التغييرات الموسميـة فى إنتاج البيض وعلاقته لوقت النضج الجنسى تحت الظروف المحليـة

شملت هذه التجربة ٣٠٠ بدرية انتخبت عشوائياً من قطيع دجاج مزرعة قسم الإنتاج الحيوانى فى كلية الزراعة بجامعة القاهرة وقد قسمت هذه المجموعة إلى ثلاث مجموعات متساوية فى العدد من أنواع الفيومى والبلدى والرود أيلند . وقد أتم نصف العدد تقريباً الكلى من البدارى نضجه الجنسى فى المدة من يولية إلى سبتمبر بينما بلغ النصف الآخر النضج الجنسى فى المدة من أكتوبر إلى ديسمبر وقد تركزت الدراسة على ٦٨ دجاجة فيومى و ٧٥ بلدى و ٥٢ رود أيلند وهى التى أكملت سجلها السنوى للبيض . وتتلخص نتائج البحث فيما يلى :

أولاً : تباين إنتـاج البيض كثيراً بالنسبة لشهور السنة وفصولها فقد بلغ ناتج البيض فى فصل الربيع ٥٠ ٪ من الإنتاج الكلى مقابل ٤٠ و ٥٠ ٪ و ٣٠ ٪ و ٢٤ ٪ لناتج البيض فى كل من فصول الشتاء والصيف والخريف.

ثانياً : كان تأثير هذه العوامل السابقة الذكر واحداً لم يتغير بالنسبة للدجاج المبكر فى نضجه التناسلى وكذلك بالنسبة للدجاج المتأخر النضج مما يقطع بأن تأثير هذه العوامل الموسمية والجوية يسود التغيير النهائى لناتج البيض فى الدجاج .

ثالثاً : كان التباين فى وزن البيض بالنسبة لأثر هذه العوامل أقل مما لوحظ فى ناتج البيض ولا سيما فى الدجاج المتأخر النضج الجنسى مما يبعث على القول بأن وزن البيض يمكن أن يستجيب لطرق الانتخاب والتحسين أسرع من ناتج البيض تحت الظروف المماثلة .