

**EFFECT OF ARTIFICIAL MODIFICATIONS IN  
ENVIRONMENTAL AND MANAGERIAL  
CONDITIONS ON SEXUAL MATURITY OF  
CHICKENS**

*By*

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The effect of some managerial treatments on the sexual maturity performance of winter and summer months was studied. The experiments started in May, 1964, where 495 pullets, about 4 months old, were divided at random into 9 equal groups of nearly similar body fitness. One group was managed in the usual conventional routine, while the other groups were subjected to variable modifications: artificial light (from 8-12 p.m.), mid-day shutting-in, cool feeding, soft and grain feeding, roosts, fresh litter and deep litter.

Results obtained could be summarized as follows:—

1. All the treated groups came to lay earlier than the control.
2. Exposing the pullets to four hours of artificial light reduced age and increased body weight and egg weight at sexual maturity than non-illuminated groups.
3. Mid-day shutting-in or cool feeding seemed to help in accelerating sexual maturity and in increasing early egg size than where no mid-day darkness or no cool feeding were applied.
4. Using roosts, fresh litter or deep litter were generally less advantageous in affecting the maturity of birds.
5. Birds treated with excess lighting + shutting-in + wet feeding + fresh litter + roosts showed the best results in age: body weight and first egg weight at sexual maturity.

It is recommended that light treatments and cooling devices should be introduced in our managerial systems for raising laying stocks.

The hatching season in the northern hemispheres generally extends from September to May. Under conventional practice pullets of later hatches lay their first eggs at older ages than those of earlier hatches. Egg production was generally found to be negatively associated with age of sexual maturity. Consequently factors affecting this age were repeatedly studied, especially those connected with light and temperature.

Sexual maturity was earlier in pullets receiving more than 12 hours of light daily. (Mueller et al, 1950; Carson, et al, 1956; and Karapetjan, 1953). King (1961), reported that pullets grown on a light schedule where

the hours of light per day were increasing, matured slightly earlier than pullets grown on a constant amount of light. Also providing light for growing pullets in 2, or 6 periods per day hastened sexual maturity over birds receiving the same amount of light per day in one period. Meanwhile birds on restricted light during the growing period matured, later than birds grown under natural daylength. (Noles, et al; 1962; and Noles and Smith, 1963). Hens laid early when temperature was maintained as nearly as possible to 65°F with 13 hours artificial light (Mitchell and Kosin, 1954). Age at sexual maturity was earlier for pullets kept in a climatic room of 65°F, 60% relative humidity and 12 hours of artificial light daily than for pullets reared under natural temperature and humidity, with the same day-length. (Greenwood, 1954).

There seems to be lack of agreement on the effect of light on body weight at sexual maturity. Growth to sexual maturity was found to increase by extra pen illumination (Karapetjan, 1950). On the other hand, at 5 months of age birds weighed on the average 90 grams more when reared under 6 hours daylight and 18 hours darkness than birds reared under 12 hours of each, (Fangauf, 1959). Birds reared on restricted light during the growing period were lighter than birds reared on natural daylength (Noles, et al; 1962). So were birds exposed to 6 hours daily from day-old to sexual maturity (Bowman and Jones, 1963), or pullets reared in complete darkness, (King, 1962). However, other workers observed that restriction of daily light appeared favourable for greater body growth (Siegel, et al; 1963). On the other hand, Shutze, et al; (1962). Stated that light had no significant influence on body weight.

#### Materials and Methods

This work was carried out at the Poultry Experimental Centre, Animal Production Department, Faculty of Agriculture, Cairo University. Birds used in this study were hatched at late December, 1963. They were floor brooded and reared under similar conditions till nearly four months of age. Starting from May, 1964, 495 pullets were divided at random into 9 equal groups (55/group) of nearly similar body fitness. One group represented the control, while the others were subjected to variable to modifications as indicated in Table (1).

#### *General Procedure :*

The compared groups were housed separately in brick houses with open, fenced yards. The square room was nearly 208 feet per either house or yards. The ceilings and floors of houses were concrete, while yardfloors were of earth. In each house there were two (front and rear) mesh wire windows of nearly 2.5 × 6.5 feet each with a front door of 2.5 × 6 feet. Each house was provided with one unit of 12 aluminium trapnests, four hen feeders, and two waterers.

ARTIFICIAL MODIFICATIONS ON SEXUAL MATURITY OF CHICKENS 223

The ration used for all groups were composed of 55% crushed grains and 45% mash. The grain mixture included 10% barley, 25% maize, 10% wheat and 10% horse beans. The mash ingredients were 12.5% wheat bran, 12.5% rice bran, 15% decorticated cottonseed meal, 4% fish meal and 1% meat meal. Half per cent salt (Sodium chloride), 2% bone meal, 1% vitamin A + D<sub>3</sub> and 0.1% terramycin, egg formulæ were added as feed supplements. Meals were offered twice daily (morning and afternoon) as whole ration or in separate portions of mash and grains, as experimentally designed. Fresh water was adequately supplied.

TABLE I.—GENERAL OUTLINE OF EXPERIMENTAL DESIGN OF TREATMENTS APPLIED (+) ON THE DIFFERENT GROUPS OF THE EXPERIMENT (MAY - AUG. 1961)

| Groups      | Specifications |               |                       |                      |                                   |             |                       |                      |
|-------------|----------------|---------------|-----------------------|----------------------|-----------------------------------|-------------|-----------------------|----------------------|
|             | Light<br>L     | Darkness<br>D | Cool<br>feeding<br>cF | Dry<br>feeding<br>dF | Mash &<br>grain<br>feeding<br>MGF | Roosts<br>R | Fresh<br>litter<br>FL | Deep<br>litter<br>DL |
| 1           | +              | +             | —                     | —                    | —                                 | —           | —                     | —                    |
| 2           | +              | —             | +                     | —                    | —                                 | —           | —                     | —                    |
| 3           | +              | —             | —                     | +                    | —                                 | —           | —                     | —                    |
| 4           | +              | —             | —                     | —                    | +                                 | —           | —                     | —                    |
| 5           | —              | —             | —                     | —                    | —                                 | +           | —                     | —                    |
| 6           | —              | —             | —                     | —                    | —                                 | —           | +                     | —                    |
| 7           | —              | —             | —                     | —                    | —                                 | —           | —                     | +                    |
| 8           | +              | +             | +                     | —                    | —                                 | +           | +                     | —                    |
| Control . . | —              | —             | —                     | —                    | —                                 | —           | —                     | —                    |

*The atmospheric trials :*

1. The birds were shut-in from 12 - 4 p.m., inside their houses. House openings were thoroughly covered with heavy canvas for complete inside darkness.

2. Houses were artificially lighted for four hours from 8 - 12 p.m. A 60 watt lamps were used that allowed a light exposure of nearly 0.5 foot-candle in the illuminated houses.

*Feed trials :*

1. Meals were offered in separate mixtures of mash or grains at feeding time. The mash was given in the morning while the grains were given in the afternoon.

2. The mash meal was cooled by adding cool tap water.

*Floor trials :*

1. Rice straw deep litter was maintained all through the whole months of experiment.
2. Fresh rice straw was supplied weekly, allowing 3 c.m. in depth.
3. Houses were provided with ample roosts of wire and wood, the legs of which were dipped in gamatox-solution containers.

*Statistical analysis and data collection :*

Records were obtained for age, body weight and egg weight at sexual maturity within the different groups. The statistical analysis was done after Snedecor (1956). The observed differences and least significant differences (L.S.D.), were considered significant or highly significant when the probability was less than 0.05 or 0.01 respectively. Analysis of variance was used for testing the differences of age, body weight and first egg weight at sexual maturity.

TABLE 2.—AVERAGE AIR TEMPERATURE, DAYLENGTH AND AIR VELOCITY DURING THE EXPERIMENTAL MONTHS

| Months           | Air Temperature<br>°C | Daylength |    | Air velocity<br>"Knots" |
|------------------|-----------------------|-----------|----|-------------------------|
|                  |                       | Hr.       | m. |                         |
| May . . . . .    | 23.5                  | 13        | 35 | 5.6                     |
| June . . . . .   | 28.2                  | 13        | 59 | 5.0                     |
| July . . . . .   | 27.4                  | 13        | 49 | 4.3                     |
| August . . . . . | 26.7                  | 13        | 11 | 5.0                     |

### Results and Discussion

#### I. *Effect of treatments on sexual maturity :*

##### 1. *Effect of Artificial light :*

The results given in Table (3) show that exposing the growing pullets to four hours artificial light (8-12 p.m.) after 4 months of age generally reduced age and increased body weight and egg weight at sexual maturity than non-illuminated groups. On the average, the difference between the control birds and the lighted groups was about 15 days in age of maturity, 25 grams in body weight and over 4 grams in egg weight. These differences in age and body weight and first egg weight were significant. (Table 4).

This result indicates that light stimulated maturity characteristics in the treated birds. It is generally accepted that light rays falling on the bird's eyes increase the activity of the pituitary gland and thus increase the secretion of the follicle stimulating hormone, causing the activation of the ovary. Therefore, the ovary itself liberates its chain reaction hormones, following which the oviduct increases in both size and function (Margolf, et al; 1947; Leighton and Shoffner, 1960; and Siegel, et al; 1963).

This explanation is substantiated by the finding that the egg weight to body weight ratios in pullets receiving light were relatively higher than in non-lighted ones in most cases. (Table 3), a fact that confirms more ovarian and oviduct activities by light exposure.

### 2. *Effect of shutting-in and cool feeding :*

Shutting-in the birds during the hot time of the day or cool feeding seemed to help in accelerating sexual maturity and increasing early egg size than when no mid-day shutting or no cool feeding were applied, (Table 3). Differences in age, body weight and first egg weight at sexual maturity were significant (Table 4).

This suffering of the non-treated group may be due to the heat stress during the hot days of the experimental period (May-August). Extra body heat caused by solar radiation of feed intake would be less in the treated groups and their heat exhaustion would be lower.

### 3. *Effect of Roosting and type of Litter :*

Using roosts, fresh litter or deep litter seemed to be of less advantage in affecting the maturity of birds than when light was practiced and modifications in feeding and light exposure were applied (Table 3). Except for the relatively increased egg weight at point of lay in the roost floored group, no practical differences were observed between the three floor treatments in either age or body weight at sexual maturity. This relative advantage of the roost system may be due to the possible effect of comfortable and easy heat dissipation on roosts compared to litter. Meanwhile, using roosts lessens exposure to disease causing organisms and to the heat generated from the moisted litter.

It is justified in view of the previously mentioned findings, that group "8" which was subjected to lighting, mid-day darkness, wet feeding, fresh litter and roosting showed the best results at this stage of sexual maturity compared to the control conventional group. The low egg weight at sexual maturity in the control was less than in the modified treatments was remarkable despite the fact that they were older in age and their decrease in body weight was very slight.

TABLE 3.—AVERAGE AGE, FIRST EGG WEIGHT, BODY WEIGHT AND RATIO OF EGG WEIGHT TO BODY WEIGHT IN THE COMPARED GROUPS AT SEXUAL MATURITY

| Groups               | Sexual Maturity |             |                       | Egg wt./<br>Body wt,<br>% |
|----------------------|-----------------|-------------|-----------------------|---------------------------|
|                      | Age             | Body weight | First egg weight (gr) |                           |
| 1. L + D . . . . .   | 193.5           | 979.6       | 32.0                  | 3.266                     |
| 2. L + cF . . . . .  | 192.9           | 983.4       | 32.1                  | 3.264                     |
| 3. L + dF . . . . .  | 193.8           | 976.9       | 31.6                  | 3.234                     |
| 4. L + MGF . . . . . | 197.6           | 966.9       | 31.6                  | 3.268                     |
| 5. R . . . . .       | 200.5           | 961.4       | 31.4                  | 3.266                     |
| 6. FL . . . . .      | 200.5           | 960.0       | 30.6                  | 3.187                     |
| 7. DL . . . . .      | 200.6           | 959.0       | 30.0                  | 3.128                     |
| 8. L+D+cF+FL+R . . . | 192.5           | 985.2       | 32.2                  | 3.268                     |
| 9. Control . . . . . | 207.1           | 952.0       | 27.8                  | 2.920                     |

Least significant difference (L : S.D)

|       |      |       |      |
|-------|------|-------|------|
| at 5% | 5.40 | 53.45 | 0.75 |
| at 1% | 7.10 | 70.34 | 0.99 |

TABLE 4.—ANALYSIS OF VARIANCE FOR AGE, EGG WEIGHT AND BODY WEIGHT AT SEXUAL MATURITY

| Items                                    | S.V.   | d.F. | S.S.      | M.S.    | F. Value |
|--|--------|------|-----------|---------|----------|
| Age at Sexual maturity                   | Groups | 8    | 10684.58  | 1335.57 | 14.6**   |
|  | Error  | 486  | 46168.26  | 94.99   |          |
|  | Total  | 494  | 56852.84  |         |          |
| Weight of first egg .                    | Groups | 8    | 863.89    | 107.98  | 25.35    |
|  | Error  | 486  | 2070.20   | 4.25    |          |
|  | Total  | 494  | 2934.09   |         |          |
| Body weight at sexual maturity . . . . . | Groups | 8    | 68732.0   | 8591.5  | 2.37     |
|  | Error  | 486  | 9898440.6 | 20367.1 |          |
|  | Total  | 494  | 9967172.6 |         |          |

\* Significant at 5% level.

\*\* Significant at 1% level.

## Acknowledgement

Many thanks are expressed to Professor Dr. M.T. Ragab and Dr. M.M. Shafae, staff members of our Department, for their helpful interest, and thorough criticism in the present work.

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## تأثير التحسينات في الظروف البيئية والرعاية على النضج الجنسي في الدجاج

### الملخص

جمال قهر ومحمد عبد الفنى ومختار قيقه

اجرى هذا البحث بمركز أبحاث الدواجن بكلية الزراعة جامعة القاهرة على الدجاج الفيومى . وكان الهدف الأساسى هو دراسة تأثير بعض المعاملات البيئية على النضج الجنسي وقد بدأت التجربة في أول مايو ١٩٦٤ حيث استخدم ٤٩٥ من البرابر عمر أربعة شهور قسمت عشوائيا الى تسعة مجاميع متساوية وضعت مجموعة منها تحت الظروف البيئية العادية أما المجاميع الأخرى فقد وضعت تحت ظروف بيئية مختلفة الضوء الصناعى ( من ٨ - ١٢ مساء ) الاظلام ( من ١٢ - ٤ مساء ) الغذاء المرطب ، غذاء ناعم وحبوب ، المجاثم ، الفرشة المتغيرة ، الفرشة العميقة . ويمكن تلخيص النتائج التى تم الحصول عليها فى الآتى :

- ١ - كل المجاميع المعاملة بكرت فى النضج الجنسي عن المجموعة الغير معاملة .
  - ٢ - تعريض الدجاج الى أربعة ساعات ضوء صناعى أدى الى التذكير فى النضج وزيادة وزن الجسم ووزن أول بيضة عند النضج الجنسي عن الغير معرضة للضوء الصناعى .
  - ٣ - قيلولة الدجاج من ١٢ - ٤ مساء أو تقديم الغذاء المبتل ساعد على التذكير فى النضج الجنسي وزيادة وزن أول بيضة .
  - ٤ - كان تأثير المجاثم والفرشة المستديمة والمتغيرة على النضج الجنسي ضئيلا ، الا ان استخدام المجاثم أدى الى زيادة وزن أول بيضة قليلا عند النضج الجنسي .
  - ٥ - الطيور التى عرضت الى ضوء صناعى مع قيلولة الظهر وغذاء مبتل وفرشة متغيرة ومجاثم أعطت أحسن نتائج بالنسبة للعمر ووزن الجسم ووزن أول بيضة عند النضج الجنسي .
- وعلى ضوء هذه النتائج ينصح باتباع مثل هذه التحسينات فى وسائل الرعاية لتحسين صفات الانتاج فى القطمان التى تصادف ظروف ارتفاع الحرارة عند مرحلة النضج الجنسي .