

Effect of Light Regimens on Turkey Performance in the Subtropics. II. Sexual Maturity, Fertility, and Hatchability

M.A. Kicka, F.K.R. Stino, G.A.R. Kamal and S.Y.T Al-Sardary

Faculty of Agriculture, Cairo University, Egypt.

EXPOSING medium-weight turkey hens to artificially increased day lengths of 17 hr (either gradually or abruptly) following a restricted photoperiod resulted in earlier sexual maturity, heavier body and egg weights at sexual maturity, and higher egg fertility and hatchability percentages than hens exposed to natural day length. Hens exposed to abruptly increased day length reached sexual maturity earlier and had heavier body and egg weights at sexual maturity than those exposed to a gradually increased day length. High light intensity of 22 lux resulted in a younger age at sexual maturity, and better egg fertility and hatchability than the low light intensity. Hens exposed to a gradual increase in day length with high light intensity of 22 lux reached sexual maturity earlier and had the highest egg fertility and hatchability than all the other groups.

Sexual maturity can be advanced or delayed by the lighting and feeding programmes followed during rearing. The influence of light is probably the most important environmental factor affecting this characteristic in laying hens (Card and Nesheim, 1966).

Broad Breasted White (BBW) turkey females exposed to restricted light for 6 weeks at 24, 26, 28, and 30 weeks of age reached sexual maturity approximately 25 to 27 days after receiving 16 hr of stimulatory light (Woodard and Abplanalp, 1972). Potter and Leighton (1973) concluded that restricted light of 6 hr daily during the 12 week-prebreeding period of Medium White turkey females increased their 32-week body weight by 5.1%.

Both fertility and hatchability tended to be better for turkey hens restricted to 9 hr of light daily for either 1, 3, or 6 weeks prior to 26 weeks of age than those which were unrestricted (McCartney *et al.*, 1961). They also concluded that better fertility and hatchability resulted when turkey hens were exposed to a gradual increase in day length (from 9 to 15 hr), than those exposed to an abrupt increase in day length. However, contradictory results were reported by Marsden *et al.* (1962). Thomason *et al.* (1972) reported that low light intensity (5.4 lux) resulted in a better fertility and hatchability than high light intensity (86.1 lux) for Large White turkey eggs. On the other hand, Garland *et al.* (1961) showed that fertility and hatchability of turkey eggs were not affected by light intensity.

The purpose of this study was to evaluate different light durations and intensities on age, body weight, and egg weight at sexual maturity. Fertility and hatchability of medium-weight turkey hens were also compared under different light durations and intensities under the subtropical conditions of Egypt.

M a t e r i a l a n d M e t h o d s

Medium-weight BBW Studler turkey poults, hatched March 1, 1978, were reared under similar conditions at the Poultry Research Centre, Faculty of Agriculture, Cairo University, Giza, Egypt. (For complete management procedures, see Stino *et al.*, 1981).

Ninety hens and eighteen toms, 30 weeks old, were chosen at random and restricted separately to 6 hr of natural light for 4 weeks. Thereafter, the hens were divided at random into 5 equal groups and were exposed to the following light regimens :

Group 1 was exposed abruptly to 17 hr of light daily : 8 hr of natural light, plus 9 hr of the artificial light of 11 lux.

Group 2 was exposed to the same light regimen as Group 1 but the light intensity was 22 lux.

Group 3 was exposed to 8 hr of natural light, plus 2 hr of artificial light daily. The 10 hr day length of this group was increased 1 hr weekly for 7 weeks until the birds were exposed to 17 hr of light. This level remained constant for the remaining part of the experiment, with a light intensity of 11 lux.

Group 4 was exposed to the same light regimes as in Group 3, but with a light intensity of 22 lux.

Group 5, the controls, was exposed to natural day length only. Day length ranged from 10 hr and 39 min in November to 13 hr and 39 min in May.

The toms were exposed to the same light regimen as Group 1 hens, but with a light intensity of 33 lux.

Semen was collected according to the method of Burrows and Marsden (1938) and modified by Parker (1946). Starting 25 days from the onset of the stimulatory light, the hens were inseminated deep in the vagina with pooled semen, 2 days in a row, with .05 ml of fresh semen. This was followed by weekly inseminations thereafter according to the method of Ferebee and Ernst (1967).

Age at sexual maturity was recorded for each hen. The weight of the first egg (to the nearest gram) and the body weight (to the nearest 10 g) at sexual maturity were also recorded. During the laying period the hens were trapnested and pedigreed eggs were incubated weekly in a Secura-type incubator.

Fertility was checked visually and all the unhatched eggs were broken to identify any embryonic development. Hatchability was considered to be the percent poults hatched from the fertile eggs.

Statistical analysis was carried out according to Steel and Torrie (1960). The analysis of variance of fertility and hatchability percentages used the arc sine transformed data. The separation of means was done according to Duncan (1955).

Results and Discussion

Age at sexual maturity

In general, turkey hens exposed to extra artificial light following a restricted photoperiod reached sexual maturity earlier than those exposed only to natural day length (Table 1). However,

the group exposed to a gradual light increase (1 hr weekly increments) of 11 lux matured sexually later than the other treated groups.

The hens which received the abrupt increase in day length reached sexual maturity earlier than those exposed to the gradual increase in day length (Table 1). Similar results were reported by Marsden *et al.* (1962). The groups exposed to high light intensity (22 lux) reached sexual maturity earlier than those exposed to low light intensity (11 lux). The hens receiving a gradual increase in day length with high light intensity reached sexual maturity earlier than any other group.

Body weight and egg weight at sexual maturity

The body weights and egg weights at sexual maturity of the different groups are shown in Table 1. In general, the light-treated turkey hens were larger at sexual maturity than the control group. Also the weight of first egg was greater. However, the differences between groups were in most cases not significant. It is also apparent that the birds exposed to the light intensity of 11 lux weighed more at sexual maturity and laid heavier first eggs than those exposed to 22 lux of light intensity. McCartney *et al.* (1961) and McCartney (1971) reported no significant difference between the body weights or first egg weights of turkey hens exposed to stimulatory light or under natural day length.

Fertility and hatchability

In general, the stimulatory light-treated groups showed slightly better fertility than the control groups. Similar results were reported earlier by Zimmermann and Wentworth (1974). The group receiving a gradual increase in day length with high light intensity (22 lux) had better fertility than the other treated groups.

The stimulatory light-treated groups also showed a higher hatchability than the control group. However, there were no significant differences in the hatchability of the different light-treated groups. Comparable results were also reported by McCartney *et al.* (1961).

EFFECT OF LIGHT REGIMES.

TABLE 1 Average age and body weight at sexual maturity, first egg weight, fertility and hatchability for the light-treated medium-weight turkey hens.

Traits	Treatments				
	17 hr 11 lux	abrupt light 22 lux	17 hr 11 lux	gradual light 22 lux	Control
No. of hens per group	18	18	18	18	18
No. of eggs tested	781	979	854	1096	676
Age at sexual maturity (days)	263 ^{b*}	262 ^b	281 ^a	260 ^b	290 ^b
Body weight (Kg)	7.05 ^{a*}	6.35 ^{bc}	6.63 ^{ab}	6.26 ^{bc}	6.03 ^c
First egg weight (g)	74.4 ^{a*}	70.3 ^{ab}	72.1 ^{ab}	69.6 ^t	68.2 ^b
Fertility %	66.5 ^{ab**}	65.1 ^b	67.4 ^{ab}	70.1 ^a	62.7 ^b
Hatchability %	51.8 ^{a**}	50.4 ^a	48.9 ^{ab}	52.9 ^a	46.7 ^b

*Treatment averages within traits followed by different letters differ significantly (P ≤ .01) from each other (Duncan, 1955).

** (P ≤ .05)

References

- Burrows, W.H. and Marsden, S.J. (1938) Artificial breeding of turkeys. *Poultry Sci.* 17, 408.
- Card, L.E. and Nesheim, M.C. (1966) «Poultry Production». 10th ed., Lea and Febiger, New York.
- Duncan, D.B. (1955) Multiple range and multiple F tests. *Biometrics* 11, 1.
- Ferebee, D.C. and Ernst, R.A. (1967) Turkey fertility and hatchability as affected by method of artificial insemination. *Poultry Sci.* 46, 1258.
- Garland, F.W. Jr., Eaton, R.C., Greene, D.E., Wilcke, H.L. and Betnke, R.M. (1961) Duration and intensity of light for out-of-season egg production in turkeys. *Poultry Sci.* 40, 1406.
- Marsden, S.J., Cowen, N.S. and Lucas, L.M. (1962) Effect of gradual and abrupt lengthening of photoperiod on reproductive response of turkeys. *Poultry Sci.* 41, 1864.
- McCartney, M.G. (1971) Reproduction of turkeys as affected by age at lighting and light intensity. *Poultry Sci.* 50, 661.
- McCartney, M.G., Sanger, V.L., Brown, K.J. and Chamberlin, V.D. (1961) Photoperiodism as a factor in the reproduction of the turkeys. *Poultry Sci.* 40, 368.
- Parker, J.E. (1946) Semen production in Broad Breasted Bronze turkeys. *Poultry Sci.* 25, 65.
- Potter, L.M. and Leighton, A.T. (1973) Effects of diet and light during the pre-breeder period, and of diet during the breeder period on turkey breeder performance. *Poultry Sci.* 52, 1805.
- Steel, R.G.D. and Torrie, J.H. (1960) «Principles and Procedures of Statistics». McGraw-Hill Book Co., New York, N.Y.
- Stino, F.K.R., Kicka, M.A., Al-Sardary, S.Y.T. and Kamar, G.A.R. (1981) Effect of light regimens on turkey performance in the subtropics. 1. Egg production. *Egypt. J. Anim. Prod.*

- Thomason, D.M., Leighton, A.T. Jr., and Mason, J.P. Jr. (1972)
A study of certain environmental factors on the reproductive performance of Large White Turkeys. *Poultry Sci.* 51, 1438.
- Woodard, A.E. and Abplanalp, H. (1972) Lighting winter hatched turkeys of different ages for off-season egg production. *Poultry Sci.* 51, 1888.
- Zimmermann, N.G. and Wentworth, B.C. (1974) Effect of photoperiod on fertility and serum testosterone concentration in male turkeys. *Poultry Sci.* 53, 1994.

تأثير الإضاءة على إنتاجية الرومي في المناطق شبه الحارة ٢ - النضج الجنسي - نسبة الخصب ، نسبة الفقس

مختار عبد الفتاح قيقه ، فريد كمال رمزي استينو ، جمال الدين
عبدالرحمن فمر ، ياسين طه السردارى

كلية الزراعة ، جامعة القاهرة

عند تعريض دجاج الرومي المتوسط الوزن لإضاءة صناعية بزيادة عدد ساعات الإضاءة اليومية إلى ١٧ ساعة « سواء كانت الزيادة تدريجية أو فجائية » بعد فترة إضاءة محددة أدى ذلك إلى التبرير في النضج الجنسي وزيادة وزن الجسم والبيض عند النضج الجنسي ونسبة خصوبة وفقس أعلى عن الدجاج الذي تم تعريضه للإضاءة الطبيعية والدجاج الذي تم تعريضه لإضاءة فجائية وصل إلى النضج الجنسي مبكراً وأعطى وزناً أكبر بالنسبة للجسم والبيض عن الذي تعرض للزيادة التدريجية .

وقد لوحظ أن زيادة الكثافة الضوئية « ٢٢ وحدة ضوئية » أدت إلى نقص في عمر النضج الجنسي وزيادة نسبة الخصب والفقس عن الكثافة الضوئية المنخفضة . (١١ وحدة ضوئية) كما أضع أيضاً أن الدجاج الذي أعطى إضاءة تدريجية وشدة إضاءة عالية (٢٢ وحدة ضوئية) وصل إلى النضج الجنسي مبكراً وأعطى نسبة خصب وفقس أعلى من كل المجموع الأخرى . . .