THE EFFECT OF ARTIFICIAL LIGHT ON REPRODUCTION IN POULTRY, WITH SPECIAL REFERENCE TO TURKEYS

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The practice of using artificial light to increase the length of day for laying chicken hens during the winter months is not new. According to Lippincott (1927) Dr. E. C. Waldorf used the method in 1895. Halpin secured favorable results in increasing winter egg production from the experimental use of lights at Michigan Agricultural College as early as 1906. By about 1920 the practice was in general use commercially.

Card (1917) showed graphically the relation between temperature, hours of sunlight, and egg production. Whetham (1933) followed this principle further and noted that birds in the same latitudes in different parts of the world showed the same characteristic production curves. It was generally assumed that the longer day enabled the hens to consume more feed (Lippincott 1927, Jull 1938, Lippincott and Card 1934). The latter authors questioned this explanation, and Jull (1938) gave the true explanation in another part of his book.

Bissonette (1930) partially clarified this problem when he published the results of his researches with the European starling (*Sturnus vulgaris*). He showed that the use of artificial light to supplement daylight would cause the starling to become sexually active in the winter. The same author (1933) reviewed the work to date on wild birds and mammals and suggested that increased light absorption caused increased egg production in chickens by stimulating the anterior lobe of the pituitary to produce a hormone influencing the activity of the sex glands.

Burmester and Card (1939) were the first to demonstrate that extra hours of light were not necessary for the hens to eat enough feed. In fact they found that six hours out of the 24 was enough feeding time when a mash ration was fed and even less was needed if the feed was in pellet form.

Most of the experimenters with artificial lights for laying chicken hens agree that winter egg production is increased, but production declines in the spring below that of unlighted hens so that the total production for the year is about the same. Apparently after a time the anterior lobe of the pituitary becomes refractory to light and no longer produces an increased quantity of hormone. Byerly and Moore (1941) have reported that laying hens given 14 hours of light and 12 hours of darkness, a total of 26 hours, apparently do not become refractory to light but continue to lay at a high rate. Warren and Scott (1936) reported that the average time from ovulation to egg laying is 26 hours. They stated that there seemed to be a psychological factor causing the termination of clutches when the last egg is laid late in the afternoon. If Byerly and Moore are correct, then synchronization of the time required to produce the egg with

the length of day removes this psychological factor and enables the hens to maintain a higher rate of production.

The Nebraska Agriculture Experiment Station (Anon., 1930) and Albright and Thompson (1933) demonstrated that artificial light was effective in stimulating early egg production in turkey hens. Scott and Payne (1937) confirmed this work. They reported that white and red lights were effective, but that blue light (shorter wave lengths) did not produce any effect on the hens. Turkey hens housed well but not lighted did not lay any sooner than those not housed.

Wilcke (1939) reported that fertility was low during the early part of the season in lighted pens, due to preferential mating. He found no difference in hatchability, though the number of hens in his pens was too small to warrant extensive conclusions.

EXPERIMENTAL

In the fall of 1939 an experiment was inaugurated by the Oklahoma Agricultural Experiment Station to determine the effect of artificial lights on egg production of Bronze turkey hens, and the fertility and hatchability of their eggs. Well-developed, early hatched pullets were divided at random into three pens of 25 hens each. Feeding and management was uniform for these pens except for the light schedule. The hens were mated to six young Bronze toms, which were rotated among the pens daily. To remove any possible effect of artificial light on the fertility of the toms, all of the males were removed each evening to a separate pen. Here they were given morning lights. The turkeys were housed on December 1. On December 7 the lights were started. Pen 4 was given morning lights (4 a. m. to daylight), Pen 5 was given all-night lights, and Pen 6 was not given any artificial light. All suitable eggs laid during January, February, and March were pedigree marked and incubated under uniform conditions.

The egg production of turkeys in the three pens is summarized in table I. In both years Pen 5 (all-night lights) responded most quickly to the lights. The hens reached their peak of production in five to six weeks after the lights were started. In Pen 4 laying was slightly slower in starting and slower in reaching peak production. The first year Pen 4 maintained a higher rate of production throughout the season than did Pen 5 but the following year the results were reversed. Both years Pen 6, without lights, was much slower to begin production, yielding fewer eggs during the hatching season and for the entire year in 1940-41. A few of the pullets were laying when they were housed December 1 and continued to lay a few eggs through the winter even without lights.

The fertility and hatchability results are given in table II. The first year there was not much difference in fertility, but hatchability was higher in Pen 6. Both fertility and hatchability were depressed by a severe January cold wave. The cold did not have any appreciable effect on Pen 6 since most of the hens were not laying. The winter of 1940-41 was unusually mild and fertility was excellent in all pens. Eggs from Pen 5 were lower in both fertility and hatchability than the average of all pens. Analysis of the records of individual hens indicated that the average in Pen 5 was reduced by a very few hens that had high egg production but with

very low fertility and hatchability. The results probably reflect lack of uniformity among the turkeys rather than differences due to treatment.

SUMMARY

Morning lights initiated egg laying in turkey hens about one month after the lights were started, while all-night lights brought them into production in about three weeks. All-night lights apparently produced greater stimulation of the anterior pituitary since the turkeys responded more quickly and with a higher rate of production. The use of lights by either method enabled turkey hens to produce many more eggs during the hatching season than turkeys not lighted, and with one exception more eggs during the entire year.

From the results obtained in this experiment it appears that fertility and hatchability might be slightly lower when hens are given all-night lights but the results are not consistent.

REFERENCES

Albright, W. P. and R. B. Thompson. 1933. Securing early turkeys by stimulated egg production. Poul. Sci. 12: 124-128.

Anon., 1930. Turkey Production. Nebr. Agr. Exp. Sta. Ann. Rpt. 1930: 39.

Bissonette, T. N., 1930. Studies on the sexual cycles in birds. I. Sexual maturity, its modification and possible control in the European starling (*Sturnus vulgaris*). Amer. Jour. Anat. 45: 280.

Bissonette, T. N., 1933. Does increased light absorption cause increased egg production? Poul. Sci. 12: 396.

Burmester, B. R. and L. E. Card. 1939. The effect of restricted feeding time on food intake, body weight and egg production. Poul. Sci. 18: 402.

Byerly, T. C. and O. K. Moore. 1941. Clutch length in relation to period of illumination in the domestic fowl. Poul. Sci. 20: 387.

Card, L. E. A study of egg production in the White Leghorn; records of five egg laying contests. Storrs Agr. Exp. Sta. Bull. 91: 41-90.

Jull. 1938. Poultry husbandry. 2nd ed., 548 p. New York: McGraw-Hill.

Lippincott, W. A. 1927. Poultry production. 4th ed., 602 p. Philadelphia: Lea & Febiger.

Lippincott, W. A. and L. E. Card. 1934. Poultry production. 5th ed., 723 p. Philadelphia: Lea & Febiger.

Scott, H. M. and L. F. Payne. 1937. Light in relation to the experimental modification of the breeding season of turkeys. Poul. Sci. 16: 90-96.

Warren, D. C. and H. M. Scott. 1936. Influence of light on ovulation in the fowl. J. Exp. Zool. 74: 137-156.

Whetham, E. O. 1933. Factors modifying egg production with special reference to seasonal changes. Jour. Agr. Sci. 23: 383.

Wilcke, H. L. 1939. The use of artificial lights for turkeys. Poul. Sci. 18: 236-243.

TABLE I

Egg production per hen per month

Pen		Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Total	Hatching season[1]
4	1939-40	0	9.0	13.8	15.9	14.0	16.0	11.3	7.6	5.2	92.8	52.7
	1940-41	0	14.6	14.8	17.7	13.0	9.1	5.6	3.2	0.4	78.4	60.1
5	1939-40	2.2	15.8	11.5	12.6	11.0	8.3	7.0	5.2	2.8	75.9	50.9
	1940-41	2.4	20.9	16.3	19.6	15.2	12.0	5.8	4.3	0.1	96.6	72.0
6	1939-40	0.3	0.5	2.9	11.7	15.5	17.1	11.7	10.3	5.9	75.9	30.6
	1940-41	0.4	2.0	4.8	12.2	12.6	10.8	9.4	5.4	1.5	59.1	31.6

[1]Total for normal hatching season (January, February, March and April).

TABLE II

Fertility and hatchability

Pen	Fertility		Hatch of fertile eggs		Total poults produced for the season	
	39-40	40-41	39-40	40-41	39-40	40-41
	%	%	%	%		
4	75.9	94.4	54.4	65.8	254	486
5	79.6	83.4	56.4	57.4	275	457
6	84.7	93.2	76.2	68.7	125	189