EFFECT OF LIGHT STIMULATION ON PULLETS[1]

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Primary Audience: Pullet Growers, Extension Workers, Egg Producers, Management Specialists

SUMMARY

Two experiments were conducted in successive years to determine the performance of pullets lighted at 16, 18, or 20 wk. Pullets were grown on a step down protein feed formulation. Twelve hr of light/day were supplied through 12 wk. Thereafter, light was reduced to 10 hr/day. When pullets reached 16, 18, or 20 wk they were moved to a laying house and subjected to natural daylight. At 20 wk all were placed on a stimulatory lighting program of 15 hr/day.

Onset of egg production, days to 50% production, egg production at 147 days, and body weight at 20 or 21 wk of age were significantly increased by delaying age at lighting. Neither egg weight nor feed intake were significantly affected during the laying period. Feed efficiency to 28 wk significantly improved when pullets were lighted at 16 wk of age. However, from 29 to 40 wk feed efficiency significantly improved for hens lighted at a later age. This improvement was not sufficient to offset results of late maturity that pullets lighted at 20 wk exhibited from 21 to 24 wk.

Key words: Commercial layers, egg production, lighting time, pullets
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DESCRIPTION OF PROBLEM

The importance of lighting during the growing and laying period has long been recognized as an important management concern for commercial poultry production. Lillie and Denton [1] published a review of literature on the influence of lighting. These workers found that reduced light during the growing period resulted in delayed sexual maturity and reduced body weight (BW) at 22 wk. Goldrosen and Buckland [2] found that the influence of lighting during the growing period could be modified by lighting pullets when they were placed in the layer house. Leeson and Summers [3] grew pullets on a constant 8 hr/day and placed them in the laying house at 15, 18, or 21 wk, where they received a constant light of 14 hr/day. These workers found that age of lighting did not affect egg weight (EW) after 26 wk. However, grading eggs to commercial weight at 30, 48, and 63 wk indicated that pullets housed at a later time produced fewer small eggs. Leeson and Summers suggested that average EW was not a good indicator for economic pro-

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duction of market eggs. They also found that time of lighting did not affect egg production (EP), feed efficiency (FE), or shell quality after 26 wk. A later study by Leeson and Summers [4] found early light stimulation had no effect on early EP but resulted in fewer eggs to 52 wk.

Our experiments offer further study of the performance of pullets grown on a controlled lighting program and lighted at various ages.

Materials and Methods

Two experiments each used 2304 pullets that had hatched in March and May of successive years. This resulted in pullets maturing during warm weather with decreasing daylight length. Pullets were grown in cages in a darkout house with forced air ventilation. The pullets received 12 hr of light/day until they were 12 wk of age. Light was then reduced to 10 hr/day. During the growing period the pullets were fed a commercial corn-soybean pullet growing diet formulated on the Florida step down protein program [5]. Feed and water were supplied *ad libitum*. At 16, 18, and 20 wk, 768 pullets were randomly selected and moved to a layer house with a density of 581 cm^2/pullet. Pullets experienced normal daylight until 20 wk of age (Table 1). Pullets began receiving a layer diet [6] when placed in the laying house. At 20 wk all pullets were placed on a corn-soybean diet formulated based on daily nutrient requirements and feed intake [6]. At this time all pullets received morning and evening lighting to supply a total of 15 hr of light/day.

Age at first egg and age at 50% production were determined for each treatment. Body weight was measured periodically during the laying phase of each experiment. Daily egg production was recorded and calculated for each of five 28-day periods. The few eggs laid before 20 wk were not considered in this study. We weighed eggs from one day's production each week. Feed intake (FI) was determined at the end of each 28-day period and feed efficiency calculated as grams of feed required to produce a gram of egg. Specific gravity of eggs was determined at the end of periods one and two.

EP, EW, FI, and FE data were summarized for 28-day periods. Other data were measured at various intervals. The data were subjected to a two-way ANOVA, and Duncan's Multiple Range Test [7] determined differences ($P < .05$) among treatments.

Results and Discussion

EXPERIMENT 1

Age at first egg, days to 50% production, and eggs at the end of period one (21–24 wk) decreased significantly as age of lighting was delayed (Table 2). Body weight of pullets was significantly different between each group comparison at 20 wk. This difference in BW disappeared by 23 wk of age when all pullets had matured. At 36 wk pullets lighted at 16 wk were significantly heavier than those lighted at 20 wk.

Egg production for the second (25–28 wk), third (29–32 wk), and fourth (33–36 wk) periods was significantly greater for pullets lighted at 18 and 20 wk than EP for the pullets lighted at 16 wk. Furthermore, during the fifth 28-day period, hens lighted at 20 wk had significantly greater EP than hens lighted at either 16 or 18 wk. Cumulative EP for the five periods was significantly lower for hens lighted at 20 wk.

Egg weight during period one was significantly higher for hens lighted at 20 wk than for pullets lighted at 18 wk (Table 2). There was no significant difference between pullets lighted at 18 wk and those lighted at 16 wk. During the second period EW was significantly higher for pullets lighted at 16 wk than for pullets lighted at either 18 or 20 wk of age. During periods three and four there was no significant difference in EW among the three groups of hens. During the fifth period eggs from hens lighted at 16 or 20 wk were significantly heavier than those from pullets lighted at 18 wk. Cumulative values for the five-month period displayed no significant differences in EW due to time

TABLE 1. Day length at moving

Experiment	16 WK	18 WK	20 WK
1	13 hr 51 min	13 hr 35 min	13 hr 12 min
2	12 hr 52 min	12 hr 27 min	12 hr 02 min

TABLE 2. Performance of pullets housed and given supplemental light at three different ages (Experiment 1)[A]

	HOUSING TIME			PSEM
	16 Wk	18 Wk	20 Wk	
Age at first egg (days)	131[c]	140[b]	145[a]	0.35
Age at 50% production	144[c]	147[b]	156[a]	0.28
Body Weight (g)				
Week 20	1401[a]	1357[b]	1236[c]	12
Week 23	1457	1493	1494	14
Week 27	1551	1537	1532	15
Week 36	1710[a]	1648[ab]	1637[b]	26
Egg Production (%)				
Period 1	74.4[a]	66.5[b]	42.7[c]	0.65
Period 2	89.8[b]	93.5[a]	94.0[a]	0.39
Period 3	89.0[b]	92.1[a]	92.9[a]	0.48
Period 4	86.9[b]	90.1[a]	91.4[a]	0.45
Period 5	83.4[b]	85.3[b]	88.4[a]	0.47
Cumulative	84.7[a]	85.5[a]	82.0[b]	0.49
Egg Weight (g)				
Period 1	49.2[ab]	48.8[b]	49.5[a]	0.22
Period 2	54.8[a]	54.1[b]	54.3[b]	0.12
Period 3	56.9	57.0	57.3	0.13
Period 4	59.2	59.0	59.2	0.12
Period 5	62.1[a]	61.1[b]	61.9[a]	0.16
Cumulative	56.4	56.0	56.2	0.15
Percentage Large Eggs and Above				
Week 26	40.8	37.6	40.3	1.77
Week 33	82.9	81.6	85.0	1.36
Week 40	98.5	97.7	97.2	1.39

[A]Periods 1–5 are 4-wk units beginning at 20 wk.

[a–c]Means within row with different superscripts differ significantly ($P < .05$).

of lighting, and no significant differences occurred in percent large and greater eggs. These findings do not agree with those previously cited [3]. Feed intake during all periods was not significantly different among the three treatments (Table 3). During the first period FE decreased as the age at lighting increased (Table 3). However, during periods two, three, and four FE significantly improved as the age of lighting increased. During period five the pullets lighted at 18 and 20 wk had significantly better FE than those lighted at 16 wk. This difference in FE seemed attributable chiefly to the difference in egg production during the fifth period. Cumulative FE for hens lighted at 20 wk was significantly poorer than for those lighted at 16 or 18 wk.

Specific gravity of eggs increased significantly during period one as the age at lighting increased (Table 3). However, during period two the specific gravity of eggs was not significantly different. Mortality was within acceptable levels with no significant differences among treatment groups.

EXPERIMENT 2

Age at first egg increased significantly as the age of lighting increased (Table 4). Body weight decreased significantly during period one as the age at lighting increased (Table 4). However, there was no significant difference

TABLE 3. Performance of pullets housed and given supplemental light at three different ages (Experiment 1)[A]

	HOUSING TIME			PSEM
	16 Wk	18 Wk	20 Wk	
Feed Intake (g/hen/day)				
Period 1	72.6	72.6	73.9	0.73
Period 2	95.2	96.2	94.3	0.73
Period 3	108.0	109.3	108.4	0.54
Period 4	112.5	113.4	111.6	0.82
Period 5	113.9	114.3	115.2	0.82
Cumulative	100.2	101.2	100.7	0.73
Feed Efficiency (g feed/g egg)				
Period 1	1.99[c]	2.24[b]	3.49[a]	0.03
Period 2	1.94[a]	1.90[b]	1.87[c]	0.01
Period 3	2.15[a]	2.09[b]	2.04[c]	0.01
Period 4	2.19[a]	2.15[b]	2.08[c]	0.01
Period 5	2.23[a]	2.16[b]	2.13[b]	0.01
Cumulative	2.10[b]	2.11[b]	2.32[a]	0.01
Specific Gravity of Eggs[2]				
Period 1	859[c]	873[b]	880[a]	2.3
Period 2	849	849	856	1.6

[A]Periods 1–5 are 4-wk units beginning at 20 wk

[B]Coded 1.0 xxx

[a–c]Means within row with different superscripts differ significantly ($P < .05$).

in BW among the three treatments during periods two and four.

Egg production during period one decreased significantly as the age of lighting increased (Table 4). However, during period two there were no significant differences among the three treatments. During periods three, four, and five EP was not significantly affected. Cumulative EP for the five 28-day periods was significantly greater for hens lighted at 16 wk than for those lighted at 20 wk. There were no significant differences among the three treatments for EW at any period (Table 4). Feed intake was not significantly affected by age of lighting (Table 5).

Feed efficiency during period one was significantly poorer as the age of lighting increased (Table 5). This was a result of fewer eggs being produced due to delayed sexual maturity when pullets were lighted at a later age. During periods two through five FE, although not significantly different, consistently improved with increased lighting age. Due to later maturity, cumulative FE was significantly poorer for pullets subjected to light at 20 wk. Specific gravity of the eggs from the different treatments did not differ significantly during periods one, two, and three. Mortality was within acceptable levels with no significant differences among treatment groups.

Delaying the time of lighting to replacement pullets resulted in reduced body weight at 20 wk, delayed sexual maturity, and fewer eggs produced during the first period. Poorer feed efficiency reflected the reduced egg production. These findings agree with those previously cited [3], which showed that age at lighting did not affect EW or EP after 26 wk of age. However, these workers reported that grading eggs to commercial size indicated that hens housed at a later date produced more large eggs. This does not agree with the results in this study; however, hens in the present study were producing eggs when the tempera-

TABLE 4. Performance of pullets housed and given supplemental light at three different ages (Experiment 2)[A]

	HOUSING TIME			PSEM
	16 Wk	18 Wk	20 Wk	
Age at first egg (days)	128[c]	132[b]	141[a]	0.79
Age at 50% production (days)	139[c]	145[b]	153[a]	0.81
Body Weight (g)				
Week 20	1420[a]	1374[b]	1302[c]	36
Week 24	1551	1574	1578	38
Week 32	1724	1719	1751	41
Egg Production (%)				
Period 1	83.3[a]	71.6[b]	54.9[c]	2.20
Period 2	91.6	92.0	91.9	1.10
Period 3	91.5	92.4	92.8	1.09
Period 4	90.0	91.0	92.1	0.80
Period 5	87.0	89.0	89.3	1.07
Cumulative	88.7[a]	87.1[ab]	84.2[b]	1.28
Egg Weight (g)				
Period 1	51.3	50.7	50.5	0.65
Period 2	55.8	55.4	55.3	0.34
Period 3	58.9	58.9	59.0	0.48
Period 4	61.3	61.1	61.3	0.45
Period 5	62.8	62.7	62.8	0.47
Cumulative	58.0	57.8	57.8	0.49
Percentage Large Eggs and Above				
Period 1	54.9	55.2	50.1	2.57
Period 4	94.4	94.9	94.9	2.41
Period 5	98.8	99.4	98.9	0.63

[A]Periods 1–5 are 4-wk units beginning at 20 wk.

[a–c]Means within row with different superscripts differ significantly ($P < .05$).

ture was falling. Therefore, they consumed more feed, resulting in a greater energy intake and a very rapid increase in EW. Results might be different for pullets maturing during hot weather [8]. Also, production of birds housed at 16 and 18 wk of age was complicated by their receiving decreasing daylength until lighting at 20 wk.

TABLE 5. Performance of pullets housed and given supplemental light at three different ages (Experiment 2)[A]

	HOUSING TIME			PSEM
	16 Wk	18 Wk	20 Wk	
Feed Intake (g/hen/day)				
Period 1	94.0	93.3	93.7	2.40
Period 2	92.4	92.6	93.4	1.90
Period 3	116.4	117.5	117.1	1.11
Period 4	120.1	119.5	120.2	1.60
Period 5	118.1	119.1	119.3	1.26
Cumulative	108.0	108.1	109.0	1.74
Feed Efficiency (g feed/g egg)				
Period 1	2.22[c]	2.59[b]	3.42[a]	0.11
Period 2	1.90	1.81	1.82	0.06
Period 3	2.18	2.15	2.15	0.06
Period 4	2.18	2.16	2.13	0.08
Period 5	2.20	2.13	2.13	0.03
Cumulative	2.13[b]	2.16[b]	2.34[a]	0.04
Specific Gravity of Eggs[B]				
Week 24	879	889	889	6.6
Week 27	868	876	875	5.9
Week 32	871	875	872	6.1

[A]Periods 1–5 are 4-wk units beginning at 20 wk.

[B]Coded 1.0 xxx

[a–c]Means within row with different superscripts differ significantly ($P < .05$)

Conclusions and Applications

1. Age at first egg and age to 50% EP decreased significantly as the age of lighting the pullets at time of housing increased.
2. Egg production during the first 28 days decreased significantly as the age at time of lighting increased. However, EP improved slightly after the first 28-day period for hens lighted at 18 or 20 wk.
3. Egg weight was not significantly affected by time of lighting.
4. Pullets lighted at 20 wk were not able to overcome poorer cumulative hen-day production and FE values which resulted from later maturity.
5. Pullets may be lighted too early or too late for optimum performance. In most instances birds lighted at 18 wk of age yielded performance values comparable to or greater than those for birds lighted at 16 or 20 wk of age.

References and Notes

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