AN ABSTRACT OF THE THESIS OF

Allen John Feltmann for the degree of Master of Science in

Poultry Science presented on July 23, 1980

Title: Intermittent Light in Conventional and Light-Tight Floor Pen Houses on Broiler Performance and Nutrient Utilization

Redacted for Privacy

Abstract approved: _____

Dr. Harry Nakaue

Three experiments were conducted with broilers to study the effects of natural lighting on intermittent lighting programs at night and to determine the nutrient retention values for nitrogen, fat, and phosphorus for broilers grown under continuous and intermittent lighting.

In two experiments, broilers grown in a conventional-type house under natural lighting with intermittent lighting at night were compared to continuous (24 hour) lighting. Broiler growth and feed conversion at seven weeks were not significantly affected by treatments in either experiment. Economic comparisons of the different treatments showed savings ranging from 2.43 to 4.39 cents per bird for the intermittent lighting treatments compared to continuous lighting. Retention of nitrogen and phosphorus varied with the length of the light and dark periods found in the different treatments.

The third experiment was conducted in a light-tight house to further evaluate the effect of intermittent light on broiler performance,

retention of nitrogen, fat, and phosphorus, and feed passage rates. There were no significant differences in mean body weights, feed conversion, feed consumption, and mortality at seven weeks of age between treatments for this experiment. Results showed that a treatment with a long light period (10 hours) interrupting an intermittent lighting sequence of ¼L:2D, had retention values approximately 15 percent lower for nitrogen and phosphorus than broilers grown under continuous lighting. Other intermittent lighting treatments had retention values similar to continuous lighting. A study on the rate of feed passage time between continuous (24L:0D) and an intermittent lighting treatment (1L:3D, recycled), suggested an overall slower rate of feed passage for the intermittent treatment. Economic comparisons showed savings of .25 to 1.36 cents per bird for the intermittent lighting treatments over the continuous lighting treatment.

Intermittent Light in Conventional and Light-Tight Floor Pen Houses on Broiler Performance and Nutrient Utilization

by

Allen John Feltmann

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Completed July 23, 1980

Commencement June 1981

APPROVED:

Redacted for Privacy

Professor of Poultry Science in charge of major

Redacted for Privacy

Head of Department of Poultry Science

Redacted for Privacy

Dean of Graduate School

Date thesis is presented July 23, 1980

Typed by Mary VanElswyk for Allen John Feltmann

ACKNOWLEDGMENT

I would like to give special thanks to my major professor, Dr. Harry Nakaue, for his help and encouragement in the completion of this paper. A word of thanks is also given to the other members of my committee, Dr. George Arscott, Glenn Klein, and Russell Youmans for their suggestions for completing the final copy of this paper.

I would also like to express my appreciation to Frank Adams and the Agricultural Chemistry Department for their help and use of their facilities in doing my chemical analysis.

My friend Bill Brown must also be recognized for his help in analyzing the passage rate sequence of this experiment. Finally, a special thanks must go to my wife, Nina, for her help in typing rough drafts, encouraging me, and believing in me.

TABLE OF CONTENTS

LIST OF TABLES

INTERMITTENT LIGHT IN CONVENTIONAL AND LIGHT-TIGHT FLOOR PEN HOUSES ON BROILER PERFORMANCE AND NUTRIENT UTILIZATION

Chapter I

INTRODUCTION

Intermittent lighting is a system of varying periods of light and dark in a cyclic manner over 24 hours in contrast to continuous lighting for 24 hours.

Intermittent lighting may be an easy and low cost way to increase body weight gains and feed efficiencies in broilers (Buckland et al., 1973; McDaniel et al., 1977). Bird density may be increased due to less stress on the birds (Buckland et al., 1971, 1976).

Long Light Periods and Intermittent Lighting

Buckland et al. (1973, 1976) reported that a long light period (13 hours) interrupting the intermittent lighting cycle adversely affected broiler body weight gain and feed conversion when compared to other intermittent lighting treatments and continuous lighting.

Quarles and Kling (1974) compared lighting treatments of ¼ hour light, (¼L):2 hours dark, (2D), recycled and 12 hours continuous light followed by intermittent light (¼L:2D) for 12 hours with continuous (24L:0D) lighting. There were no significant differences in broiler body weight among treatments at four or seven weeks. Feed efficiency was significantly improved at seven weeks by the two intermittent treatments.

Intermittent Lighting and Nutrition

Several studies have been carried out with nutrients and intermittent lighting. Buckland et al. (1971) reported that broilers fed higher protein rations gave better results than broilers fed lower protein rations under intermittent lighting.

Malone et al. (1980) compared three broiler diets with 3,087; 3,197; and 3,307 kilocalories metabolizable energy (ME) per kilogram under continuous lighting and intermittent lighting of ¼L:¾D, recycled. Feed conversion was significantly improved at four and eight weeks of age with the intermittent lighting. Average body weights, however, were significantly lower with intermittent lighting. The birds under intermittent lighting responded best to the diet with the lowest metabolizable energy at four weeks while at eight weeks the highest energy diet was most effective.

Cherry et al. (1978) compared four different lighting regimes and four rations with different energy levels in broiler studies. With continuous low intensity lighting, birds fed high density diets (3300/3355 and 3410/3465 kcal M.E./kg.) for starter and finisher diets produced significantly higher body weights than when fed low density diets (3080/3135 and 3190/3245 kcal M.E./kg.). However, the higher density diets did not improve body weights under any of the intermittent lighting regimes.

Purpose

The studies reported here were conducted to determine if intermittent lighting during the night would be compatible with the

continuous natural lighting during the day found in open curtain-type houses still used in the broiler industry. The retentions of nitrogen, fat, and phosphorus were studied in both conventional and light-tight floor pen houses under different lighting programs to determine whether improvement in feed efficiency previously reported under intermittent lighting resulted from better utilization of nutrients. Economic comparisons were made to determine monetary gains or loses from lighting, feed consumption, and body weight gains when comparing the intermittent lighting treatments to continuous lighting.

Chapter II

MATERIALS AND METHODS

Experiments 1 and 2 were conducted at different times, December-January and March-May, respectively, in an uninsulated, naturally-ventilated, curtain-type house. Experiment 3 was run later, July-August, in an uninsulated, fan ventilated, light-tight house. Each house contained eight pens, with each pen measuring 3m x 4.5m.

Each experiment had four treatments with two replicates or pens per treatment. Approximately 70 day-old Hubbard broiler chicks of each sex were assigned to each pen and each bird was allowed .096 square meter of floor space in all experiments.

Brooding methods and equipment in all experiments were similar to those described by Dorminey and Nakaue (1977).

In Experiments 1 and 2 the natural daylight was an integral part of the lighting system. The intermittent programs in these two experiments were carried out during the dark (night) periods of each day. The total lighting program would then consist of continuous natural light (NL) + intermittent light recycled during the night period.

In Experiment 1, the daylight was approximately eight hours. The light treatments were continuous (24 hour light:0 hour dark; 24L:0D) lighting; 8 hours natural light (NL) + $1\frac{3}{4}$D:$\frac{3}{4}$L, recycled during the night; 8NL + $1\frac{1}{2}$D:$\frac{1}{2}$L, recycled during the night; 8NL + $\frac{3}{4}$D:$\frac{1}{4}$L, recycled during the night.

In Experiment 2, the length of daylight was increasing rapidly. Therefore, to standardize the long light period from the start to the end of the experiment, artificial lights were provided from 5:00am to 6:30am and again from 6:00pm to 7:30pm at the beginning of the experiment to give a total of 14½ hours of continuous light during the day. The light treatments were continuous (24L:0D) lighting; 14½L:9½D; 14½L + 2½D:1L; and 14½L + ¾D:¼L, with intermittent light recycled during the night. Light intensities were measured with a Weston illumination meter, and they ranged from 38 lux in the corners to 215 lux in the center of the rooms during the daylight hours.

The light treatments in Experiment 3 were continuous (24L:0D); ¼L:¾D, recycled; 1L:3D, recycled; and 10 hours continuous light followed by intermittent light (¼L:2D) for 14 hours. The light intensities ranged from 3.2 lux in the corners and 5.4 lux in the center of the pens. All the light in this experiment was provided artificially.

Dayton time clocks were used to regulate the light and dark periods in all the experiments. One 25 watt light bulb suspended about 2 m above the center of the pen provided the light in each pen when needed.

During the first week, however, birds were provided with continuous light, after which intermittent treatments were begun in Experiments 1 and 2. In Experiment 3, intermittent lighting was initiated at 3 days of age.

Nutrient retention trials were run from 5½ to 6½ weeks in Experiments 2 and 3 and also from 2½ to 3½ weeks of age in Experiment 3. These trials were conducted by either constructing a small floor pen

3' x 5' within the large pen (Experiment 2) or by placing a battery (Experiment 3) within one pen of each light treatment. Eight birds of each sex were kept separate in the battery, while 10 birds, five of each sex were placed together in the small floor pen. Chromium oxide was mixed in the 25 pounds of feed for each treatment at the rate of 0.3 percent with a small Hobart mixer. In Experiment 3, birds were marked with colored bands on their legs and were released after the 3½ week chromium oxide feeding period to be caught again at 5½ weeks of age. Feed and water were provided ad libitum in each of the small experimental pens. After a five day equilibrium period, fecal samples from a three day period were collected and dried in small laboratory type thermostatically controlled electric ovens at temperatures ranging from 89.5°to 95.6°C. The dried fecal samples were ground in a small Wiley Mill using a 40 mm mesh screen. The feed and fecal samples were analyzed for chromium oxide and the nutrient retention calculated by the procedure described by Edward and Gillis (1959). Total nitrogen and fat in the feed and feces were analyzed by the proximate analysis methods described in AOAC (1975). Phosphorus was analyzed by the method of Koenig and Johnson (1942).

Rates of feed passage were measured with broilers 2½ and 5½ weeks of age for the continuous and intermittent light treatment (1L:3D) in Experiment 3. The broilers were housed in the same batteries used for the nutrient retention studies in Experiment 3. Fecal samples were collected every hour from the initial feeding of the chromium oxide feed for a five hour period. The chromium oxide present in the fecal samples was analyzed by atomic absorption spectroscopy. Approximately

.1 gram of dried ground feces was digested in 10 ml. of concentrated nitric acid and then diluted to 100 mls. with distilled water. This sample was then analyzed.

Broiler starter was fed from day-old to three weeks of age, and broiler finisher from three to seven weeks of age. The ration composition are listed in Table 1. Feed and water were provided ad libitum.

Insert Table 1. about here

Birds were bulk weighed by sexes for each pen and feed consumption determined at four and seven weeks for each experiment.

Data for mean body weight, feed conversion, and feed consumption from each of the experiments were analyzed using a one-way analysis of variance, and when significances were found treatment means were separated using Duncan's multiple range test (Steel and Torrie, 1960).

Economic comparisons were calculated for Experiments 2 and 3. Electrical costs for lighting, feed costs, and revenue from sale of the birds were compared between the continuously lighted group and the intermittently lighted groups in each experiment. All the other costs in the experiments were considered to be equal. Electrical cost was calculated at the 1977 rate of 2.21 cents per kilowatt hour. Electrical consumption for lighting was calculated by adding up the total hours of light used in each treatment throughout each experiment. Feed costs for the starter and finisher feeds calculated from the Poultry Science feed mill prices were 12.5 and 11 cents per pound, respectively, in Experiment 2. Revenue received per pound live weight for this

Table 1. Composition of Broiler Starter and Finisher Rations

Ingredients	Starter %	Finisher %
Corn, Yellow	55.02	56.00
Soybean meal, solvent 47.5%	32.75	33.50
Fat, animal	4.00	5.00
Fish meal, herring	3.00	--
Alfalfa meal, dehydrated 17%	2.00	2.00
Defluorinated phosphate	1.75	1.75
Limestone flour	0.75	1.00
Salt, iodized	0.25	0.25
Trace mineral premix[1]	0.10	0.10
Vitamin premix[2]	0.25	0.25
d,l-methionine, 98%	0.08	0.10
Zoamix, 25%[3]	0.05	0.05
Baciferm, 40g/lb[4]	+	+
Calculated analysis		
Protein, %	23.00	21.00
Metab. energy, kcal/kg.	3091	3135
Calcium, %	1.10	1.10
Avail. Phosphorus	0.48	0.44
Methionine + cystine	0.86	0.81

[1]Supplied per kilogram of ration: calcium, 97.5 mg.; manganese, 60 mg.; iron, 20 mg.; copper, 2 mg.; iodine, 1.2 mg.; zinc, 27.5 mg.

[2]Supplied per kilogram of ration: vit. A, 3304 I.U.; vit. D, 1111 I.C.U.; riboflavin, 3.3 mg.; d-pantothenic acid, 5.51 mg.; niacin, 22 mg.; choline, 191 mg.; vit. B_{12}, 5.51 mcg.; vit. E, 1.1 I.U.; vit. K, .55 mg.; folacin, .22 mg.

[3]Provided gratuitously by Salsbury Laboratories, Charles City, Iowa.

[4]Provided gratuitously by International Minerals Co., Terra Haute, Indiana. Suggested at a level of 0.05 percent.

experiment was 30 cents. In Experiment 3, feed costs were 13 and 12 cents for the starter and finisher feeds, respectively, and 27 cents per pound live weight for bird revenue.

Chapter III

RESULTS AND DISCUSSION

Mean body weights, feed conversion, and feed consumption data for seven weeks of age for Experiment 1 are presented in Table 2. The data showed no significant differences among treatments for mean male, female, and combined sex body weights, feed conversion, and feed consumption. Mortality was not affected by the light treatment during the experiment.

Insert Table 2. about here

There were also no significant differences in mean male, female, and combined sex body weights, feed conversion, and feed consumption among any of the treatments at seven weeks of age for Experiment 2 (Table 3). However, feed consumption was numerically lower, ranging from 0.20 to 0.23 kilograms per bird for the intermittent lighting treatments compared to continuous lighting. Light treatment did not affect mortality.

Insert Table 3. about here

The economic comparisons (Table 4) shows electrical savings from 0.38 to 0.43 cents per bird and feed savings of 6.0 cents per bird for Treatments 2, 3, and 4, compared to Treatment 1. The overall savings

Table 2. Effect of Eight Hours of Natural Light (NL) With Three Intermittent Light Programs During the Night on Broiler Performance at Seven Weeks of Age, (Experiment 1)[1]

Treat. No.	Light Program Light(L):Dark(D)	Mean Body Weight			Feed/ Gain	Feed Consumed	Mortality
		Male	Female	M + F			
	(Hours)	(G)	(G)	(G)		(Kg/Bird)	(%)
1	24L:0D	2003[a]	1637[a]	1819[a]	2.21[a]	4.03[a]	3.2[a]
2	8NL + [1¾ D:¾ L recycled during the night]	2008[a]	1658[a]	1833[a]	2.23[a]	4.09[a]	3.2[a]
3	8NL + [1½D:½L recycled during the night]	1973[a]	1556[a]	1764[a]	2.22[a]	3.88[a]	1.8[a]
4	8NL + [¾ D:¼L recycled during the night]	1987[a]	1587[a]	1783[a]	2.18[a]	3.85[a]	1.8[a]

[1]Means with different superscripts within a column were significantly different, ($P \leq 0.05$).

Table 3. Effect of 14½ Hours Light Followed by Two Intermittent Light Programs During the Night on Broiler Performance at Seven Weeks of Age, (Experiment 2) [1]

Treat. No.	Light Program Light(L):Dark(D)	Mean Body Weight			Feed/ Gain	Feed Consumed	Mortality
		Male	Female	M + F			
	(Hours)	(G)	(G)	(G)		(Kg/Bird)	(%)
1	24L:OD	2061[a]	1635[a]	1845[a]	2.11[a]	3.88[a]	8.7[a]
2	14½L:9½D	2008[a]	1592[a]	1790[a]	2.05[a]	3.65[a]	12.1[a]
3.	14½L + [2½D:1L recycled during the night]	2018[a]	1633[a]	1816[a]	2.08[a]	3.68[a]	5.5[a]
4	14½ + [¾ D:¼L recycled during the night]	2004[a]	1620[a]	1807[a]	2.05[a]	3.66[a]	7.8[a]

[1]Means with different superscripts within a column were significantly different, ($P \leq 0.05$).

were 2.43, 4.39, and 3.38 cents per bird for Treatments 2, 3, and 4, respectively, when compared to Treatment 1, which was the continuous lighting.

Insert Table 4. about here

No significant differences between treatments at seven weeks for mean body weight, feed conversion, and feed consumption were observed in Experiment 3 (Table 5). Because of relatively warm daytime temperatures (32° to 37°C) during the fifth to the seventh week, mean body weights were lower overall than in the first two experiments. Mortality was not affected by light treatments.

Insert Table 5. about here

All three intermittent lighting programs in Experiment 3 produced savings per broiler, ranging from 0.25 to 1.36 cents (Table 6). The greatest advantage was obtained from Treatment 2 (¼L:¾D, recycled) with 1.36 cents savings per bird. The cost differences between treatments were small compared to Experiment 2 and may be attributed to the hot weather during the experiment.

Insert Table 6. about here

These three experiments show that intermittent lighting regimes under both conventional and light-tight housing are workable systems.

Table 4. Economic Comparisons for Broilers Exposed to 14½ Hours Continuous Light Followed By Either No Light or Intermittent Light During the Night Hours, (Experiment 2)

Treat.[1] No.	Electrical[2] Savings/Loss	Feed Savings/Loss	Revenue Savings/Loss	Total[3] Loss or Gain
	(¢/bird)	(¢/bird)	(¢/bird)	(¢/bird)
1	-	-	-	-
2	+0.43	+6.0	-4.0	+2.43
3	+0.39	+6.0	-2.0	+4.39
4	+0.39	+6.0	-3.0	+3.39

[1]See Table 3 and text for lighting programs.

[2]Savings or loss in each category column (electrical, feed, and revenue) are calculated by comparison to the cost values for the control group (Treatment 1, 24 hour lighting) in this experiment.

[3]Values in this column were calculated by adding all the pluses and subtracting all the minuses for each row.

Table 5. Effect of Three Intermittent Light Programs in Light-tight House on Broiler Performance at Seven Weeks of Age, (Experiment 3)[1]

Treat. No.	Light Program Light(L):Dark(D)	Mean Body Weight			Feed/ Gain	Feed Consumed	Mortality
		Male	Female	M + F			
	(Hours)	(G)	(G)	(G)		(Kg/Bird)	(%)
1	24L:0D	1889[a]	1543[a]	1716[a]	1.97[a]	3.38[a]	3.6[a]
2	¼L:¾ D recycled	1893[a]	1541[a]	1717[a]	1.94[a]	3.34[a]	3.6[a]
3	1L:3D recycled	1929[a]	1558[a]	1744[a]	1.95[a]	3.42[a]	2.1[a]
4	10L:2D:¼L:2D: ¼L:2D:¼L:2D:¼L: 2D:¼L:2D:¼L:½D	1899[a]	1577[a]	1738[a]	1.96[a]	3.42[a]	3.6[a]

[1]Means with different superscripts within a column were significantly different, ($P \leq 0.05$).

Table 6. Economic Comparisons of Broilers Exposed to Continuous Light and Intermittent Light in Light-tight House, (Experiment 3)

Treat.[1] No.	Electrical[2] Savings/Loss	Feed Savings/Loss	Revenue Savings/Loss	Total[3] Loss or Gain
	(¢/bird)	(¢/bird)	(¢/bird)	(¢/bird)
1	-	-	-	-
2	+0.36	+1.0	-	+1.36
3	+0.36	-1.0	+1.6	+0.96
4	+0.25	-1.0	+1.0	+0.25

[1]See Table 5 and text for lighting programs.

[2]Savings or loss in each category column (electrical, feed, and revenue) are calculated by comparison to the cost values for the control group (Treatment 1, 24 hour lighting) in this experiment.

[3]Values in this column were calculated by adding all the pluses and subtracting all the minuses for each row.

In these studies, electrical costs for lighting were reduced as much as 0.4 cents per bird and the feed costs by 6.0 cents per bird. Overall savings in the experiments ranged from 0.25 to 4.39 cents per bird when compared to continuous lighting. An intermittent system of 0.5 to 1 hour of light and 2 hours of dark would seem to be the best to use with continuous natural light during the day. A system of one hour light and three hours dark would be a good system in a light-tight house.

Nitrogen, fat, and phosphorus retention data (Table 7) for Experiment 2, may indicate differences between treatments for nitrogen and phosphorus retention. Treatments 2 (14½L:9½D) and 3 (14½L + 2½D:1L) with the longest total dark period during 24 hours had the higher nitrogen retention and the lowest phosphorus retention. Conversely, Treatments 1 (24L:0D) and 4 (14½L + ¾D:¼L), with either none or shorter dark periods had lower nitrogen retention and the higher phosphorus retention. Differences for percent retention for fat were small between treatments.

Insert Table 7. about here

Nitrogen, phosphorus, and fat retention data for Experiment 3 are listed in Tables 8 and 9. Average retentions of nitrogen, fat, and phosphorus generally increased with age in all treatments. Males retained these three nutrients more efficiently than females during both growth periods that were sampled. During the 2½–3½ week growth period, both males and females in Treatment 4 (10L + ¼L:2D) retained nitrogen considerably less than males and females of Treatments 1, 2,

Table 7. Nitrogen, Fat, and Phosphorus Retention Values for 5½ - 6½ Week Old Broilers With Four Light Treatments, (Experiment 2)

Treatment Number[1]	5½ - 6½ Week Sample Period Nutrient Retention		
	Nitrogen	Fat	Phosphorus
	%	%	%
1	31.3	81.1	25.1
2	45.3	80.4	15.9
3	38.7	75.9	20.9
4	30.7	77.3	29.7

[1]See Table 3 and text for lighting programs.

and 3. The differences for nitrogen between Treatment 1 (24L:0D) and Treatment 4 for the males, females and combined sex ranged from 23.9, 15.2, 19.4 percent respectively. During this same period, there were small differences in phosphorus for the males but the females in Treatment 4 retained phosphorus at 15.4 percent less than females for Treatment 1. No large differences between treatments were found in fat during this period. This similar trend of lower retention for nitrogen and phosphorus with Treatment 4 was also observed during the 5½-6½ week interval (Table 9). This would indicate that disrupting an intermittent lighting cycle with a long period of continuous light may cause lower retention of such nutrients as nitrogen and phosphorus. The differences for retention values for nitrogen and phosphorus between Treatment 1 (24L:0D) and the intermittent treatments 2 (¼L:¾D) and 3 (1L:3D) which had no long interruption in the intermittent cycle were much smaller than found for Treatment 4 (10L + ¼L:2D). Buckland et. al. (1973, 1976) reported lower weight gains in an intermittent lighting program interrupted by 13 hours of continuous lighting. Poorer feed utilization could have contributed to these lower body weight gains. However, in this experiment, body weight gains and feed conversion were comparable for all treatments (Table 5).

Insert Tables 8. and 9. about here

Rates of feed passage were compared between Treatments 1 (24L:0D) and 3 (1L:3D, recycled) in a light-tight house during the 2½-3½ week growth period (Table 10) for Experiment 3.

Table 8. Nitrogen, Fat and Phosphorus Retention Values for 2½ - 3½ Week Old Broilers With Four Lighting Treatments (Experiment 3)

Treatment[1] Number	2½ - 3½ Week Sample Period Nutrient Retention								
	Nitrogen			Fat			Phosphorus		
	M[2] %	F[3] %	M+F %	M %	F %	M+F %	M %	F %	M+F %
1	66.7	50.0	58.2	83.6	84.0	83.2	52.7	52.8	52.7
2	62.5	51.0	56.7	87.0	86.8	86.9	58.4	42.5	50.4
3	57.6	55.2	56.4	87.7	89.2	88.4	53.4	52.0	52.7
4	42.8	34.8	38.8	84.3	85.0	84.7	54.0	37.4	45.7

[1]See Table 5 and text for lighting programs.

[2]Males

[3]Females

Table 9. Nitrogen, Fat and Phosphorus Retention Values for 5½ - 6½ Week Old Broilers With Four Lighting Treatments (Experiment 3)

Treatment[1] Number	5½ - 6½ Week Sample Period Nutrient Retention								
	Nitrogen			Fat			Phosphorus		
	M[2] %	F[3] %	M+F %	M %	F %	M+F %	M %	F %	M+F %
1	79.5	39.5	59.5	92.1	91.4	91.8	57.6	54.2	55.9
2	69.0	53.3	61.1	88.2	89.0	88.5	55.0	53.0	54.0
3	74.2	53.7	64.0	87.9	87.3	87.6	51.5	41.0	46.3
4	53.8	42.2	48.0	88.8	86.4	87.6	46.3	40.7	43.3

[1]See Table 5 and text for lighting programs.

[2]Males

[3]Females

Insert Table 10. about here

Samples were also taken for the 5½-6½ week growth period but analysis failed to show any measurable chromium in any of these samples. The appearance of chromium in the feces served as the rate of feed passage through the gastrointestinal tract. Feed passages for both males and females with light regimes of 1L:3D, recycled, were faster than both sexes for Treatment 1 (24L:0D). First appearance of chromium in the feces for the intermittent light groups was at two hours after feeding started whereas no chromium was found in the feces for Treatment 1 (24L:0D) until after three hours of feeding the feed with the marker. However, if passage time was based on the rate at which maximum concentration of chromium was found in the feces, Treatment 1 would have the overall faster rate of feed passage. The maximum level of chromium in the feces from broilers exposed to continuous light was 0.233 percent after five hours of initial feeding of the marked feed whereas with the broilers exposed to the intermittent light the level was 0.197 percent. Jensen et. al. (1962) reported a feed passage time in four week old N.H. and W.L. chicks of four to six hours under continuous lighting. On the other hand, Tuckey (1958) reported a feed passage rate of 2-2½ hours. In these experiments, differences in nutrient retention and feed passage data between lighting treatments caused no dramatic effect on broiler growth or feed conversion. In Experiment 3, the trend of lower retention for nitrogen and phosphorus seen in Treatment 4 (10L + ½L:2D) had little detrimental effect on body weight gain and

Table 10. Feed Passage of 2½ - 3½ Week Old Broilers on Two Lighting Regimes in a Light-tight House, (Experiment 3)

Time (Hours)[1]	Chromium in Feces, %							
	Light Program							
	24L:0D				1L:3D, Recycled			
	M	F	M+F	%[2]	M	F	M+F	%[2]
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.017	0.037	0.027	9.00
3	0.138	0.160	0.149	49.70	0.105	0.140	0.123	41.0
4	0.164	0.253	0.209	69.7	0.188	0.197	0.193	64.3
5	0.222	0.243	0.233	77.7	0.180	0.214	0.197	65.7

[1]The hourly collection of fecal samples after birds were fed the 0.3 percent chromic oxide feed.

[2]Percent of chromium appearing in the feces compared to original amount in feed.

feed conversion. Likewise, the possible slower feed passage rate for Treatment 3 compared to Treatment 1 showed no corresponding improvement in feed conversion. These results would suggest that the rations used in these experiments were well-balanced and able to support good growth even when used less efficiently under some light treatments. However, as feed costs increase and nutrient requirements are reduced to minimum levels in broiler rations, management techniques that cause less efficient use of feed nutrients may become more obvious.

Chapter IV

SUMMARY AND CONCLUSIONS

Under the conditions of these experiments, the following conclusions may be drawn:

1. There were no significant differences in body weight, feed consumption, feed conversion, or mortality between continuous or intermittent lighting treatment.

2. There were favorable economic savings for intermittent lighting treatments compared to continuous lighting.

3. A long light period (10 hours) interrupting an intermittent lighting system lowers nitrogen andphosphorus retention values for broilers.

4. There is a range of retention values for nitrogen and phosphorus that will provide good growth and feed conversion for broilers.

5. The intermittent lighting program of 1L:3D showed a slower feed passage time than continuous (24L:0D) light.

BIBLIOGRAPHY

Association of Official Analytical Chemist, 1975. Official Methods of Analysis. 12th ed., Washington, D.C.

Buckland, R. B., H. C. Gasperdone, and D. B. Bragg, 1971. Interaction of Strain, Density, and Ration with Two Light Systems on Broiler Performance. Can. J. Anim. Sci. 51: 613-619.

Buckland, R. B., A. T. Hill, and D. E. Bernon, 1973. Effects of Four Lighting Regimes on the Performance of Broilers and Roasters. Can. J. Anim. Sci. 53: 21-24.

Buckland, R. B., D. E. Bernon, and A. Goldrosen, 1976. Effects of Four Lighting Regimes on Broiler Performance, Leg Abnormalities, and Plasma Corticoid Levels. Poultry Sci. 55: 1072-1076.

Cherry, J. A., W. L. Beane, and W. D. Weaver, Jr., 1978. The Influence of Dietary Energy on the Performance of Broilers Reared Under Different Lighting Regimes. Poultry Sci. 57: 998-1001.

Dorminey, R. W. and H. S. Nakaue, 1977. Intermittent Light and Light Intensity Effects on Broilers in Light-proof Pens. Poultry Sci. 56: 1868-1875.

Edwards, H. M. and M. B. Gillis, 1959. A Chromic Oxide Balance Method for Determining Phosphate Availability. Poultry Sci. 38: 569-574.

Koenig, R. A. and C. R. Johnson, 1942. Colorimetric Determination of Phosphorus in Biological Materials. Industrial and Engineering Chemistry Analytical Edition 14: 155-156.

Jensen, L. S., L. H. Merrill, C. V. Reddy, and J. McGinnis, 1962. Observations of Eating Patterns and Rate of Food Passage of Birds Fed Pelleted and Unpelleted Diets. Poultry Sci. 41: 1414-1419.

Malone, G. W., G. W. Chaloupka, E. W. Walpole, and L. H. Littlefield, 1980. The Effect of Dietary Energy and Light Treatment on Broiler Performance. Poultry Sci. 59: 576-581.

McDaniel, G. R., J. L. Koon, and C. A. Flood, 1977. The Effect of Intermittent Light on Broiler Performance, Dust Production, and Litter Moisture. Poultry Sci. 56: 1381-1383.

Quarles, C. L. and H. F. Kling, 1974. The Effect of Three Lighting Regimes on Broiler Performance. Poultry Sci. 53: 1435-1438.

Steel, R. G. D. and J. H. Torrie, 1960. Principles and Procedures of Statistics. McGraw-Hill Book Co., New York, New York.

Tuckey, R., B. E. March, and J. Biely, 1958. Diet and Rate of Food Passage in the Growing Chick. Poultry Sci. 37: 786-792.