BIBLIOGRAPHY

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ABSTRACT

This study was conducted to determine the effect of intermittent lighting program on the growth performance of broilers. Specifically, the study aimed to find out the effect of intermittent lighting program on the growth rate, feed intake, feed conversion ratio, percent abdominal fat and dressing percentage, as well as morbidity and mortality. Finally, this study aimed to determine the feed cost and return on investment (ROI).

Ninety-six 21 day old Cobb broilers were randomly distributed into three treatments following the completely randomized design (CRD) with four replications four times with eight birds per replicate. The treatments were 23-hour light (T_0): 1-hour darkness; 1-hour light: 2-hour darkness at night with normal light during the day (T_1) and 1-hour light: 3-hour darkness at night with normal light during the day (T_2).

Highly significant differences were observed in the gain in weight, feed intake, feed conversion ratio, feed cost per kilogram gain in weight, and dressing percentage of birds exposed to intermittent lighting of 1-hour light: 3-hour darkness. Birds exposed to 1-hour light: 3-hour darkness at night with normal light during the day had significantly higher average daily gain in weight of 0.051 kg with a significantly lower FCR of 2.35 as

compared to the birds exposed to 1-hour light: 2-hour darkness with normal light during the day having an average daily gain of 0.047 with an FCR of 2.82. Birds exposed to continuous light had the lowest average daily gain in weight of 0.046 with the highest FCR of 3.46.

Result showed that used of intermittent lighting did not affect the percent abdominal fat. The average percent abdominal fat obtained in this study was 1.98 %.

Result of the study shows that the return on investment (ROI) of birds exposed to intermittent lighting of 1-hour light: 3 hour darkness during the night with normal light during the day resulted to better profit of 2.41% than those birds exposed to 1-hour light: 2 hour darkness during the night with normal light during the day and birds subjected to continuous light, though it is minimal.

It is concluded that birds subjected to intermittent lighting of 1-hour light and 3-hour darkness during the night is recommended.

INTRODUCTION

As the broiler industry is expanding, the factors hindering the growth are also taken in to account by the farmers as well as the scientists. Numerous studies conducted have shown that among the other managemental practices, different regimens of light to which the broilers are subjected have significant effect on the weight gain and disease control. Many light patterns have been applied so far, such as twenty four hours continuous light, light and dark periods, intermittent lighting programs and different colors of light to rear broilers. For many years, broiler chickens have usually been reared under continuous or near continuous (23L: 1D) photoperiods to maximize feed consumption and growth rate. However, several investigations showed that using continuous light programs induces sleep deprivation and causes severe physiological stress responses (Campo and Davila, 2002; Kliger *et al*., 2000).

Dozier (2002) stated that melatonin hormone production in the brain of chicks is inhibited by light. Melatonin enhances the chick's immune systems and serves as an antioxidant, which helps to maintain healthy cells. There were other advantages in applying lighting program as revealed by previous studies such as reduced leg problems, lesser incidence of ascites and lesser respiratory lesion and better immunity to respiratory disease. As a result, mortality is reduced which increases profit for broiler growers.

Most of the recent researches have focused on restricting light regimes to improve productivity of broiler chickens because the physical activity is very low during darkness and energy expenditure of activity is considerable (Rahimi *et al*., 2005).

Both intermittent and non intermittent restricted light regimen improved feed conversion significantly compared to continuous light regimen. Even though the

intermittent and non intermittent restricted regimens have the same period of darkness, the intermittent light regimen would be more beneficial than non intermittent restricted light program (Abbas *et al*., 2008).

This study intended to find out the effect of intermittent lighting program on the growth performance of broilers. The result of this study will not only benefit farmers but can serve as a guide for further studies on better lighting programs.

Generally, this study aimed to determine the effect of lighting programs on the growth performance of broilers from day 21 to day 40.

Specifically, this study aimed to determine the effect of intermittent lighting program on the gain in weight, feed intake, feed conversion ratio, abdominal fat, dressing percentage of broilers; to determine morbidity and mortality rates of broilers subjected to intermittent lighting program; and to determine the return on investment (ROI).

This study was conducted at Ili, Datakan, Kapangan, Benguet from March to April 2012.

REVIEW OF LITERATURE

Turning the lights off is one best thing that you can do for the young meat-type chickens. By giving your birds short days and long nights from one week to three weeks age, you can help them maintain a healthy body and rapid growth rate. Long dark periods help stimulate melatonin, vitamin D3 and other hormone levels in the blood that improves the chick's immune system and tissue development. Limiting the hour of light will slow growth slightly, allowing the birds to develop strong hearts and bones needed to support rapid growth later in flocks. Turning the lights off when birds are young produces benefits that can last in the flocks (Animal Industry Branch, Manitoba Agriculture and Food, 2007).

Classen and Riddell (1989) reported that broiler chicks subjected to intermittent light had significantly higher body weight and feed efficiency than birds under continuous illumination.

According to the study of Mahmud *et al*. 2001, the result showed that the feed consumption by the birds under intermittent light was not significantly different from continuous light regimes but the weight gain and feed conversion ratio was significantly better than the group exposed to continuous light.

Weaver *et al*. (1982) used different photoperiod regimens in raising broiler chicks and reported that changing the photoperiod length from short to long during broiler growth improves bird's health while maintaining equal or slightly superior performance characteristics compared with effect of a long constant day length.

Deaton *et al*. (1978) indicated that total light intensity control is required within the broiler house for the entire twenty-four hours period to obtain maximum feed saving when broilers are maintained reared under intermittent lighting program.

Recent research has indicated that light source may affect body weight, immune response, livability and health status. Broiler behavior is strongly affected by light sources (Ghuffar *et al*., 2009).

Dozier (2002) observed that intermittent lighting program decreased leg abnormalities and total mortality was also significantly reduced, less respiratory lesion and better immunity to respiratory diseases than in poultry that was exposed to constant light. The health of the bird was improved due to melatonin hormone produced during the dark periods. Dozier (2002) further stated that broiler growers should consider not only controlling the number of hours but as well as light intensity. He also added that lighting system and program that is best for a particular company or producer depends on the type of housing, the type of birds grown, climate and electricity.

MATERIALS AND METHODS

The materials and equipment used in the study were ninety heads of broiler, commercial feeds, antibiotics, disinfectants, feeding troughs, drinkers, weighing scale, stick broom, 100-watt bulbs, old newspapers, brooding-rearing cages, record book and marking pen.

Pre-experimental phase. A week before the arrival of the chicks, all materials used in the study were cleaned and disinfected. The brooding rearing cages were divided to accommodate the three treatments having four replicates. The floor was covered with newspaper to serve as a trap for the feeds that are being wasted, provide heat during brooding and protect the chicks from falling. The cages were provided with proper lighting.

From day old to 21 days of the birds, antibiotics were added to the drinking water following the prescribed dosage for the first one week of the chicks. Chick booster was given to the chicks for the first up to two weeks of age and then was gradually shifted to to grower ration. Shifting of feeds was done by mixing 25% of the new feed ration on the first day, 50% on the second day and 75% on the third day so that on the fourth day, the birds were fed with 100% new feed ration. Feeders and drinkers were provided inside the cages. Continuous lighting and adlibitum feeding were employed.

Experimental phase. On the 21st day of age, the chicks were randomly distributed into three treatments which were replicated four times with 10 birds per replicate, following the Completely Randomized Design (CRD). The chicks were weighed individually to obtain their initial weight. The treatments were as follows:

T_0 - Continuous lighting (23L: 1D)

T_1 – 1 hour light and 2 hours darkness with normal light during the day (cycle)

T_2 – 1 hour light and 3 hours darkness with normal light during the day (cycle)

For T_0, 23-hour light: 1-hour darkness (23hL: 1hD) was maintained. For T_1, intermittent lighting schedule of 1-hour light: 2 hrs dark was imposed at night starting when it gets dark, with normal light during the day. For T_2, intermittent lighting schedule of 1-hour light: 3 hour dark was imposed at night starting when it gets dark, with normal light during the day. This was the cycle implemented throughout the study.

Adlibitum feeding was employed from the start until the end of the study. Purely commercial feeds were fed to the birds throughout the study with available fresh water all the time.

Data Gathered

1. Initial weight of the broilers (kg). This was obtained by weighing the chicks individually at 21 days of age.

2. Final weight of the broilers (kg). This was taken by weighing the chicks individually at 35 days of age.

3. Number of dead birds. This was obtained from the number of birds that died during the experimental period.

4. Number of sick birds. This was obtained from the number of sick birds during the experimental period.

5. Feed left over (kg). This was the amount of feed which is left by the birds from the feed offered each day during the experimental period.

6. Feed offered (kg). This refers to the amount of feeds given to the experimental birds per day.

7. Feed cost. This was the purchase cost of feeds incurred in the study.

8. Abdominal fat (kg). This was obtained by weighing the fat contained by the abdomen.

9. Slaughter weight (kg). This was obtained by taking the weight of the broiler prior to slaughter.

10. Carcass weight (kg). This was obtained by taking the weight of the carcass without the entrails, head and feet.

Data Computed

1. Average daily gain in weight (kg). This was obtained by dividing total gain in weight with the number of days on trial.

2. Average feed intake of broilers (kg). This was obtained by taking the difference between the feed offered and feed refuse divided by the number of days on trial.

3. Feed conversion ratio. This was obtained by dividing the total feed consumption by total gain in weight of the experimental birds.

4. Feed cost per kilogram gain in weight of broilers (Php). This was obtained by multiplying the FCR with the average feed cost per kg.

5. Percent mortality of broilers (%). This was obtained by dividing the number of experimental birds died over the total number of experimental birds multiplied by 100.

6. Percent morbidity of broilers (%). This was obtained by dividing the number of sick birds in the experiment by the total number of experimental birds multiplied by 100.

7. Dressing percentage (%). This was computed by dividing the dressed weight by the live weight multiplied by 100.

8. Percent abdominal fat (%). This was computed by dividing the weight of the abdominal fat over the carcass weight of broiler multiplied by 100.

9. Return on investment (ROI) (%). This was computed by dividing the net income by the total cost of production multiplied by 100.

10. Gross income. This was obtained by multiplying the final weight of the birds by the price per kilogram of live weight.

11. Net income. This was obtained by subtracting the gross income from the total cost of production.

Data Analysis

The data was analyzed using the analysis of variance (ANOVA) appropriate for completely randomized design (CRD).

RESULTS AND DISCUSSION

Mean Weight of Birds

Table 1 shows the initial and final weights of birds in the different treatments. Statistical analysis showed that there were no significant differences in the initial weights of birds between treatments. This implies that the birds at the start of the study were relatively uniform in terms of weight. The average initial weight of birds was 0.43 kg at 21 days of age.

Statistical analysis revealed highly significant differences in final weight of broilers at 40 days of age among treatments. The final weight of birds exposed to 1-hour light: 3-hour darkness was 1.44 kg, birds with 1-hour L: 2-hour darkness at night with normal light during the day of 1.44 kg was higher than the final weight of birds exposed to 1-hour light: 2-hour darkness at night with normal light during the day of 1.368 kg. Birds exposed to 23-hours continuous light with 1-hour darkness daily had the lowest final weight of 1.335 kg.

Table 1. Initial and final weights of birds at day 21 and 40, respectively

TREATMENT	INITIAL WEIGHT AT 21 DAYS OLD (kg)	FINAL WEIGHT AT 40 DAYS OLD (kg)
23 h L: 1h D	0.425[a]	1.335[c]
1h L: 2h D with normal light during the day	0.426[a]	1.368[b]
1h L: 3h D with normal light during the day	1.426[a]	1.440[a]

Means with common letter(s) are not significantly different at 0.05 % by DMRT

Mean Gain in Weight of Birds
from 21to 40 Days of Age

Table 2 shows the total and average gain in weight of the birds from 21 days old to 40 days in the different treatments. Statistical analysis revealed highly significant differences in the total and average daily gain (ADG) of birds. The ADG of birds subjected to intermittent lighting of 1-hour light: 3 hour darkness at night with normal light during the day was significantly higher than those birds subjected to 1-hour light:2 hours darkness at night with normal light during the day and continuous light having an average daily gain in weight of 0.047 kg and 0.046 kg, respectively.

This study supports the observation of Mahmud *et al*. (2011), that intermittent lighting program significantly affect gain in weight than on continuous light, and the physical activity of birds is very low during darkness and energy expenditure of activity is considerable (Rahimi *et al*., 2005). Studies have shown however, that although birds subjected to continuous light consumed more feeds; it does not necessarily mean that they would weigh more than those birds subjected on shorter light periods.

Table 2. Total and daily gain in weight of birds from 21 to 40 days of age

TREATMENT	TOTAL GAIN IN WEIGHT (kg)	AVERAGE DAILY GAIN IN WEIGHT (kg)
23 h L: 1h D	0.910[c]	0.046[c]
1h L: 2h D with normal light during the day	0.942[b]	0.047[b]
1h L: 3h D with normal light during the day	1.014[a]	0.051[a]

Means with common letter(s) are not significantly different at 0.05 % by DMRT

Mean Feed Intake of Birdss

Table 3 shows the feed consumption of birds from day 21 to day 40. Statistical analysis revealed highly significant differences in the feed intake of birds. Birds subjected to 1-hour light: 3-hour darkness at night with normal light during the day had a total feed intake of 2.39 kg with an average daily feed of 0.12 kg was significantly lower than the total and average feed intake of birds exposed to 1-hour light: 2-hour darkness at night with normal light during the day of 2.69 kg and 0.14 kg respectively. Birds exposed to 23-hour light with 1-hour darkness had the highest feed intake of 3.15 kg and average daily feed intake of 0.16 kg.

Feed Conversion Ratio (FCR) from 21 to 40 Days of Age

Statistical analysis revealed highly significant differences in the feed conversion ratio of birds. Birds subjected to 1-hour light: 3-hour darkness at night with normal light during the day of 2.35 was significantly lower than the FCR of birds exposed to 1-hour light: 2-hour darkness with normal light during the day of 2.85. Birds subjected to 23-hour light with 1-hour darkness had the highest FCR of 3.46.

Table 3. Total and average feed intake of birds from 21 to 40 days of age

TREATMENT	TOTAL FEED INTAKE (kg)	AVERAGE DAILY FEED INTAKE (kg)
23 h L: 1h D	3.15[a]	0.16[a]
1h L: 2h D with normal light during the day	2.69[b]	0.14[b]
1h L: 3h D with normal light during the day	2.39[c]	0.12[c]

Means with common letter(s) are not significantly different at 0.05 % by DMRT

Feed Cost to Produce a Kilogram of Broiler

Table 4 shows the feed cost to produce a kilogram gain in body weight of broilers. Statistical analysis revealed highly significant differences in the feed cost to produce a kilogram of broilers. Birds subjected to 1-hour light: 3-hour darkness at night with normal light during the day of Php54.76 was significantly lower than the feed cost to produce a kg gain in weight 0of broilers of birds exposed to 1-hour light: 2-hour darkness at night with normal light during the day of Php61.28. Birds subjected to continuous light had the highest feed cost to produce a kilogram gain in weight of broilers of Php70.48.

Morbidity and Mortality

Mortality and morbidity of birds were not observed from day 21 to 40. The incidence of leg abnormalities observed during the pre- experimental period from day 14 to day 18 was no longer encountered. This may be attributed to the reduced feed consumption of the birds when the lighting regimens were imposed. This may be due to their fast muscle growth but their leg bones were not growing as fast as the muscle.

Table 4. Feed conversion ratio and feed cost to produced a kg of broiler within 20 days

TREATMENT	FEED CONVERSION RATIO	FEED COST TO PRODUCED A KG OF BROILER (Php)
23 h L: 1h D	3.46[a]	70.48[a]
1h L: 2h D with normal light during the day	2.85[b]	61.28[b]
1h L: 3h D with normal light during the day	2.35[c]	54.76[c]

Means with common letter(s) are not significantly different at 0.05% by DMRT

Dressing Percentage

Table 5 shows the dressing percentage of the birds. Statistical analysis revealed a highly significant difference among the dressing percentages of broilers. Birds subjected to intermittent lighting of 1-hour light: 3-hour darkness at night with normal light during the day had the highest dressing percentage of 71% as compared to the dressing percentage of birds exposed to 1-hour light: 2-hour darkness with normal light during the day of 67.34%. Birds subjected to 23 hours continuous light with 1-hour darkness had the lowest dressing percentage of 59.67%. This implies that the differences that occur among treatments were caused by the variation of feathers and fats.

Percent Abdominal Fat

Table 6 shows the percent abdominal fat of birds in the different treatments. Statistical analysis showed that there were no significant differences among treatments. Thus, it implies that percent abdominal fat of broilers was not significantly affected by intermittent light. The average percent abdominal fat of broiler is 1.98%.

Table 5. Dressing percentage of birds at 40 days of age

TREATMENT	DRESSING PERCENTAGE (%)
23 h L: 1h D	59.67[c]
1h L: 2h D with normal light during the day	67.34[b]
1h L: 3h D with normal light during the day	71.00[a]

Means with common letter(s) are not significantly different at 0.05% by DMRT

Table 6. Percent abdominal fat of birds at 40 days of age

TREATMENT	ABDOMINAL FAT (%)
23 h L: 1h D	2.0925[a]
1h L: 2h D with normal light during the day	1.8560[a]
1h L: 3h D with normal light during the day	1.9940[a]

Means with common letter(s) are not significantly different at 0.05% by DMRT

Return on Investment

The returns on investment in the different treatments are shown in Table 7. Data shows that higher profit was obtained from the birds exposed to intermittent light of 1-hour light: 3-hour darkness during the night with normal light during the day. This implies that subjecting the birds under intermittent lighting program having 1-hour light: 3-hour darkness resulted to better profit, though it is minimal.

Table 7. Net returns and return on investment

TREATMENT	TOTAL SALES (Php)	TOTAL COST (Php)	NET INCOME (Php)	ROI (%)
Continuous light (23h L: 1h D)	5,130.00	5,721.48	-591.48	-10.34
1h L: 2h D with normal light during the day	5,244.00	6,174.60	-930.60	-15.07
1h L: 2h D with normal light during the day	5,532.00	5,401.81	130.19	2.41

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study was conducted to determine the effect of intermittent lighting program on the growth performance of broilers. Specifically, growth rate, feed conversion ratio, feed consumption and gain in weight. This was conducted at Ili, Datakan, Kapangan, Benguet from March 11, 2012 to April 20, 2012.

A total of ninety-six, 21-day-old broiler chicks were used in the study. Following the completely randomized design (CRD), the birds were randomly distributed into four treatments. Each treatment was replicated four times with eight birds per replication. The different treatments were as follows: T_0 (Control or continuous light); T_1 (1h L: 2h D at night with normal light during the day) and T_2 (1h L: 3h D at night with normal light during the day).

Highly significant differences were observed in gain in weight, feed intake, feed conversion ratio, feed cost per kilogram gain in weight and dressing percentage of birds subjected to 1-hour light: 3-hour darkness during the night with normal light during the day. The average daily gain in weight of birds was 0.05 kg with an average daily feed intake of 0.14 kg. The average FCR of birds was 2.89 with an average feed cost to produce a kg gain in weight of birds of 62.17. The average dressing percentage of birds was 66%. Results of the study revealed that intermittent light did not affect the percent abdominal fat. The average percent abdominal fat was 1.98 %.

Although the net profit returns on investment (ROI) were not subjected to statistical analysis, results showed that better ROI was obtained from the group of birds having 1-hour light: 3-hour darkness at night with normal light during the day, though it is minimal.

Conclusion

Based on the observation and result of the study, it is therefore concluded that subjecting birds on intermittent lighting having 1-hour light: 3-hour darkness at night with normal light during the day can be imposed to broilers.

Recommendation

Based on the results of the study, the researcher therefore recommends that intermittent lighting program having 1h L: 3h D can be imposed to broilers. However, further studies should be done using intermittent lighting program with longer number of hours of darkness.

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