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Production Performance of White Leghorn Hens Under Different Lighting Regimes

Fawwad Ahmad, Ahsan-ul-Haq, M. Ashraf, Jibran Hussain and M. Zubair Siddiqui

Department of Poultry Science, University of Agriculture, Faisalabad, Pakistan

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ABSTRACT

A study was conducted for eight weeks to determine the effect of different light sources on the production performance of egg laying birds. For this purpose, 384 single comb White Leghorn layers 40-weeks of age, in their first laying cycle, were obtained from the Poultry Research Centre, University of Agriculture, Faisalabad, Pakistan. The layers were randomly divided into 12 basic experimental units comprising 32 laying hens each, to be designated as replicate. These 12 replicates were further divided into three treatment groups viz; A (fluorescent), B (compact fluorescent), and C (incandescent), each comprising 128 layers. Production performance of birds under different treatments was compared in terms of body weight, feed consumption, egg production, feed conversion ratio, mortality and economics. Hen-day egg production (%) was significantly higher ($P<0.05$) in groups B and C compared to group A. Analysis of data on feed conversion ratio showed that layers in group A and B were significantly less efficient in feed conversion compared to those of group C; difference between the former two groups was non-significant. However, light sources showed non-significant effect on feed consumption, body weight and mortality of the birds. Birds of group B fetched more profit than those of groups A and C.

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INTRODUCTION

Poultry production is one of the best available sources for the production of high biological value animal protein in terms of eggs and meat. Commercial hybrids, both broilers and layers, are being propagated for meat and egg production throughout the world (Yasmeen *et al.*, 2008). Although poultry industry has developed tremendously during the last three decades due to the import of high egg producing strains, but there are many managemental factors which are still needed to be explored to gain optimum performance, especially in open sided houses. Among various managemental tools, light management is very important, especially in case of egg laying birds. The egg number, livability and profitability can be favorably influenced by a proper lighting programme, as egg production is directly related to changes in day length to which the pullets are exposed. In Pakistan, per capita availability of eggs in the year 2008-09 was 70 which is far lower than that in the developed countries (Anonymous, 2008-09). Light intensity influences bird activity, immune response and growth rate and has been used to alleviate mortality issues related to metabolic diseases (Brown *et al.*, 2007). In the context of egg production, light intensity, wavelength, duration and source are important (Renema *et al.*, 2001). Morris (1981) reported the optimum light intensity for egg production between 5 and 10 lux.

Siopes (1984) observed that the use of fluorescent light delayed the onset of egg production in turkey hens, total egg production was significantly lower in hens kept under the fluorescent light than those under incandescent light. On the other hand, Felts *et al.* (1992) observed that hen-house egg production was significantly higher for female turkeys exposed to sodium vapors and fluorescent lights versus incandescent light during the first 10-wk production period. Lewis and Morris (1998) reviewed the responses of domestic fowl, turkeys and geese to various sources of illumination. They concluded that there is no evidence that fluorescent or high pressure sodium lighting, irrespective of intensity or spectral distribution, has any consistent detrimental effect on growth, food utilization, reproductive performance, mortality, behavior or live bird quality in either domestic fowl or turkeys, nor in the egg production of geese.

However, very less work has been done on the light supplementation source in open sided houses. Therefore, the present study was planned to compare the effect of different light supplementation sources on the production performance and economics of egg laying hens maintained in open-sided houses.

MATERIALS AND METHODS

Three hundred and eighty four, single comb White Leghorn layers 40-weeks of age, in their first laying year cycle, were obtained from the Poultry Research Centre, University of Agriculture, Faisalabad, Pakistan. The layers were randomly divided into 12 basic experimental units, comprising 32 laying hens each, to be designated as replicates. These 12 replicates were further divided into three light treatment groups viz; A (fluorescent, tube light), B (compact fluorescent, energy saver), and C (incandescent, bulb lights) of the same intensity, each comprising of 128 layers. Automatic light supplementation system was used to maintain 17 hours light duration during the experimental period of eight weeks in February to April, 2007. Light intensity of various light supplementation sources was kept at 10.76 Lux.

The observations on body weight, feed intake, feed conversion ratio and economics of the study were recorded for each experimental unit during the experimental period of eight weeks. The body weight of the birds was recorded at the start and end of the experiment. For this purpose, four birds from each replicate were randomly selected and weighed with the help of an electrical balance. Birds were offered feed daily (100 gm/bird) and refusal was recorded after a week. Record of weekly feed intake was kept separately for each experimental unit. Weekly feed intake per experimental unit thus recorded was used to compute feed intake per bird per day using the following formula:

$$\text{Feed intake /bird/ day} = \frac{\text{Weekly feed consumption by a replicate}}{\text{No. of birds in a replicate during that week}} \times \frac{1}{7}$$

The daily egg production was recorded for each experimental unit by using following formula:

$$\text{Egg production (\%)} = \frac{\text{Number of egg produced on each day}}{\text{No. of hens alive on each day}} \times 100$$

Feed conversion ratio was calculated for per dozen of eggs on weekly basis for each experimental unit, by using the following formula:

$$\text{FCR/dozen eggs} = \frac{\text{Weekly feed consumption/replicate}}{\text{Weekly number of egg produced/replicate}} \times \frac{1}{12}$$

The economics of the study was also calculated on the basis of production cost and cost of electricity by the use of various light sources. The data thus collected were subjected to statistical analysis according to completely randomized design and differences among means were compare by Duncan's multiple range tests (Steel *et al.*, 1997).

RESULTS AND DISCUSSION

Feed intake

The average daily feed intake per bird (calculated on weekly basis) of the three treatment groups A, B and C during eight weeks experimental period is given in Table 1. The feed consumed per hen per day in groups A, B and C averaged 98.00 ± 0.10, 98.16 ± 0.33 and 97.84 ± 0.28g respectively. The statistical analysis of data showed non significant effect of different light sources on feed intake. These results are in line with those of Siopes (1984) and Felts *et al.* (1990), who observed that feed intake of male and female turkeys was unaffected by the light-source. It indicated the similar trend of feed intake in layer birds of various species kept under different light sources.

Weight gain

The average weight gain per hen during eight weeks experimental period in groups A, B and C was 27.50 ± 9.57, 29.70 ± 14.68 and 25.50 ± 5.45g, respectively, the difference was non-significant (Table 1). Ingram *et al.* (1987) also observed that the body weight of broiler breeders was not affected by incandescent or fluorescent light treatments. However, Lewis *et al.* (2007) found that pullets grown under green light had significantly lighter body weight at 6 weeks than the birds grown under white light. The contradiction may be due to the age of the birds as well as the source and duration or intensity of light being used in different studies.

Egg production

Mean hen-day egg production was 86.87 ± 0.35, 88.14 ± 0.93 and 87.55 ± 0.38 percent in groups A, B and C, respectively. Statistical analysis revealed that hen-day egg production was significantly higher ($P<0.05$) in groups B (compact fluorescent) and C (incandescent) compared to group A (fluorescent). The difference between the former two groups was non-significant (Table 1).

These results also show similar trend as the finding of Felts *et al.* (1990), who found that turkey hens under sodium vapor, day light and florescent light consistently laid more eggs than those under incandescent lights. These findings also indicate that the light sources have almost similarly impact on various species of poultry in term of egg production. Age and body weight of hens have also been shown to affect feed consumption and egg production (Malik *et al*., 2008).

Feed conversion ratio

The mean FCR values per dozen of eggs in groups A (fluorescent), B (compact fluorescent), and C (incandescent) were 1.22 ± 0.009, 1.21 ± 0.008 and 1.19 ± 0.009, respectively. Analysis of the data showed that layers in groups A and B were significantly less efficient in feed conversion compared to those of group C. Difference between groups A and B was non-significant. It shows that efficiency of feed conversion per dozen of eggs was better in group C under incandescent light source (Table 1).

However, Lewis and Morris (1998) observed non-significant difference in the FCR of egg laying birds under different light sources. This contradiction may be due to different sources and intensities of light used in these studies.

Table 1: Effect of light sources on feed intake, egg production, feed conversion ratio/dozen egg and weight gain in laying hens

Parameters	Treatment groups		
	A Fluorescent (Tube light)	**B Compact fluorescent** (Energy saver)	**C Incandescent** (Bulb light)
Feed intake (g)	98.00±0.10	98.16±0.33	97.84±0.28
Egg production (%)	86.87±0.35[b]	88.14±0.93[a]	87.55±0.38[a]
Feed conversion ratio/Dozen egg	1.22±0.009[b]	1.21±0.008[b]	1.19±0.009[a]
Weight gain (g)	27.50±9.57	29.70±14.68	25.50±5.45

Values with similar alphabet do not differ in rows significantly (P≤0.05).

Table 2: Economics of the experiment*

Description	Treatment Groups		
	A Fluorescent (Tube light 40 Watt)	**B Compact fluorescent** (Energy saver 20 Watt)	**C Incandescent** (Bulb light 60 Watt)
No. of birds	128	128	128
Feed intake/group (kg)	702.46	703.6	701.3
Total feed cost @ Rs. 13/kg	9132	9148	9117
Electricity consumed (units)	38.0	19.0	57.0
Electricity cost @ Rs. 9.00 per unit	342	171	514
Miscellaneous	200	200	200
Total expenses (Rs.)	9674	9518	9831
Total salable eggs produced in 56 days	6227	6318	6275
Total return from the sale of eggs @ Rs. 28/dozen	14532	14728	14644
Net profit per group (Rs.)	4858	5210	4813
Profit per bird (Rs.)	37.95	40.70	37.60

* This feasibility is based on the production performance of birds during eight weeks experimental period.

Mortality

No mortality was observed in any treatment group during the whole experimental period. It means that the light sources used as treatment had no detrimental effect on the bird's health and overall mortality. This indicates that any of the light source can be applied depending upon its economical performance.

Economics

This study shows that tube light and energy saver are more efficient and economical regarding converting electricity into light energy. No doubt, they have some what higher installation costs but their running cost is very low. Furthermore, their life span is also very long, making them very useful in poultry farms. On the other hand, bulb light has low installation cost but their running cost is very high. They need more electricity to work properly, so more expensive. Their overall life is also very low. So energy saver (compact florescent light) and tube light (simple florescent light) are good substitutes of the bulb light (incandescent light) in the poultry enterprises. Energy savers are more efficient and economical in term of production performance of egg laying birds (Table 2).

Conclusion

The feed conversion ratio of the birds kept under the incandescent light was significantly better than the birds kept under fluorescent and compact fluorescent light sources. However, the economics evaluation revealed that the overall production cost of the birds kept under compact fluorescent was less than the other two groups. This indicated that while studying the impact of various sources of light on the production performance of the birds, the economics of providing various sources of light may also be considered for economical poultry production.

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