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Reproductive Performance of Broiler Breeders Maintained on a Photo Schedule of Only Morning and Evening Artificial Light in Open-Type Houses

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Abstract: One thousand five hundred twenty female and 152 male Arbor Acres feather-sexed broiler breeders were reared together in a litter-floored house under natural daylight. Groups were housed 40 females and 4 males per pen, in 38 pens, of an open-sided litter-floored layer house. They were subjected to artificial light treatment beginning at 20 weeks of age and given 14.5 hrs of light per day, with a weekly increase of 15 min until 16 hrs of artificial light was received at 26 weeks. At 26 weeks of age, half of the pens were given only two hours of artificial light per day at 0400 to 0500 and 1900 to 2000 while the other half of the pens continued to receive 16 hrs of artificial light per day (0400-2000). Egg production, egg weight, egg specific gravity, body weight, fertility and hatchability were recorded throughout the laying period until the birds were 60 weeks of age. The results of this experiment showed that egg production, egg weight, egg specific gravity, fertility and hatchability were not significantly affected by only giving artificial light for 1 hr early in the morning and 1 hr in the evening in conjunction with natural daylight in open-type houses.

Key words: Broiler breeder, artificial light, egg production

Introduction

As electricity costs have continued to rise, producers have searched for ways to reduce electricity consumption and maintain breeder productivity. In addition, broiler breeders are produced in areas of the world where electricity is only available in limited supply. Since many producers routinely turn off lights at sunrise and on again at dusk, this experiment was conducted to determine the effects of adding constant short-period morning and evening lights to natural day length on the productivity of broiler breeders.

Most studies on the use of artificial light in poultry have dealt with light/dark ratios, no matter when the light was given to the birds. Lanson and Sturkie (1961) studied the effects of four intermittent lighting regimes on egg production, feed consumption and body weight of Plymouth Rock chickens. They found no significant effects from any of the lighting treatments. Hawes *et al.* (1991) also found no significant effects on egg weight in brown-egg laying hens when ahemeral light/dark schedules were applied. However, they did find that the number of eggs produced was significantly reduced when the birds were placed on an ahemeral schedule. Ahemeral lighting has been found to decrease egg production, fertility and hatchability while increasing egg size and improving shell strength (Proudfoot, 1980). The same study showed that a 24-hr intermittent treatment had no detrimental effects on fertility and hatchability while still yielding larger eggs and improving the strength of the eggshell.

In a study that was not limited to light/dark ratios, Douglas *et al.* (1986) investigated the influence of

evening and morning lights on egg size by increasing the morning and total photoperiod and by shifting artificial light from morning to evening while maintaining constant photoperiod length. They concluded that morning lights could be used to increase egg weights during hot weather and evening lights used to eliminate extra large eggs. Mather (1982) demonstrated in laying hens that supplementing natural day length by one hour of artificial light which was given early in the morning and one additional hour given in the evening resulted in equivalent egg production as that of a conventional lighting program. Initiation of the morning and evening lighting program can be at the normal time or age for maturing pullets (Mather and Wilson, 1988). Additional information on lighting programs for commercial layers has been reviewed by Rowland (1985), Ernst *et al.* (1987) and Shanawany (1993).

This study was conducted to determine the effects of adding short-period morning and evening lights to the natural day length on the egg production, egg weight, egg specific gravity, fertility and hatchability in broiler breeders.

Materials and Methods

One thousand eight hundred female and 300 male Arbor Acres feather sexed broiler breeders hatched at the end of June, were reared together in a litter-floored house and subjected to natural daylight until they were moved to the layer house. Natural day length varied from 14.0 hrs at 1 wk of age to 10.5 hrs at 20 wk of age. Birds were vaccinated against Marek's disease, Newcastle disease, avian encephalomyelitis and fowl pox.

Table 1: Body weight, egg production and egg weight of broiler breeders as influenced by a laying period light program consisting of natural light plus artificial light from either 0400-2000 (Control) or from 0400-0500 and 1900-2000 (morning and evening, M and E)

Period ¹	Body Weight ² (kg)		Egg Production (%HD)		Egg Weight ³ (g)	
	Control	M and E	Control	M and E	Control	M and E
1	3.07±0.04	3.08±0.03	37.4±0.8	39.1±0.9	55.5±0.5	55.0±0.5
2	3.43±0.04	3.40±0.04	74.1±0.5	75.3±0.6	61.1±0.6	60.4±0.6
3	3.51±0.05	3.53±0.03	76.0±0.6	76.2±0.5	62.3±0.6	62.4±0.6
4	3.55±0.04	3.58±0.04	75.6±0.7	76.4±0.6	64.4±0.7	65.0±0.6
5	3.60±0.06	3.62±0.05	72.8±0.9	71.0±0.9	65.3±0.6	65.3±0.6
6	3.62±0.05	3.63±0.06	66.5±0.9	67.4±0.9	67.2±0.5	66.8±0.6
7	3.67±0.04	3.67±0.05	61.4±0.8	62.2±0.7	68.0±0.6	67.4±0.7
8	3.70±0.05	3.71±0.05	57.3±0.7	57.5±0.7	68.4±0.5	68.2±0.6
9	3.75±0.06	3.74±0.05	51.4±0.9	50.5±0.9	69.1±0.7	68.4±0.6

¹Each Period was 4 weeks beginning at 25 weeks of age and ending at 61 weeks of age, ²Body weight was measured at 25 weeks of age and every 4 weeks thereafter, ³Egg weight was measured at 28 weeks and every 4 weeks thereafter

Table 2: Egg specific gravity, fertility and hatchability of fertile eggs from broiler breeders as influenced by a laying period light program consisting of natural light plus artificial light from either 0400-2000 (Control) or from 0400-0500 and 1900-2000 (morning and evening, M and E)

Period ¹	Egg Specific Gravity ²		Fertility ³ (%)		Hatchability ³ (%)	
	Control	M and E	Control	M and E	Control	M and E
1	1.0897±4	1.0891±5	93.0±0.8	94.1±1.0	88.9±1.0	90.1±1.3
2	1.0867±2	1.0862±3	95.3±1.1	95.0±1.0	85.4±1.4	85.0±1.5
3	1.0857±4	1.0855±4	93.2±0.9	93.5±0.8	90.1±1.7	88.9±1.8
4	1.0838±6	1.0833±4	91.6±1.2	90.3±1.0	93.2±1.8	91.3±1.6
5	1.0845±3	1.0841±5	91.4±1.3	92.0±1.1	92.0±1.5	94.0±1.8
6	1.0784±4	1.0780±5	89.2±1.0	90.3±1.0	89.1±1.7	87.6±1.9
7	1.0782±5	1.0780±4	88.7±1.3	87.8±1.2	88.4±1.5	87.3±1.4
8	1.0758±6	1.0759±4	86.3±1.5	87.0±1.6	89.3±1.2	89.0±1.0
9	1.0736±5	1.0735±4	84.9±1.8	83.9±1.9	85.6±1.6	87.2±1.5

¹Each Period was 4 weeks beginning at 25 weeks of age and ending at 61 weeks of age, ²Egg specific gravity was measured at 25 weeks of age and every 4 weeks thereafter, ³Fertility and Hatchability were measured at 27 weeks and every 4 weeks thereafter

At 16 weeks of age, 1520 females and 152 males were selected and transferred to an open-sided litter floored layer house where 40 females were housed with 4 males per pen, in 38 pens measuring 6 X 2.75 m. Each pen was equipped with two 75-watt light bulbs placed 2.15 m from the floor to provide 2 ftc of light at the floor level. The pen divisions were covered with black plastic from floor to ceiling.

At 20 weeks of age, pullets were given 14.5 hours of light increased weekly by 15 minutes, until 16 hours of artificial light was reached at 26 weeks of age. From 26 weeks of age until the end of the 34-week experimental period, half of the pens were given natural day length and only two hours of artificial light per day from 400 to 500 and 1900 to 2000 (Fig. 1) while the other half of the pens continued to receive 16 hrs of natural and artificial light (0400-2000) until the end of the experimental period (Fig 2.). The treatments were arranged in a randomized block design and care was taken to ensure that the surrounding light treatments did not influence a particular pen. Extra males were maintained in separate pens on the same treatments for replacement of male mortality. Birds were fed a standard breeder diet according to the breeder's recommendation. The birds were given a daily allotment of feed at 0800 hours.

Female body weight was determined monthly. Egg production was recorded daily and summarized in 4 week periods beginning at 25 weeks. Fertility and hatchability data were collected on one week's eggs each 4 week period. Egg weight and egg specific gravity were measured on all eggs produced the following week of each 4 week period. Eggs were weighed to the nearest 0.1g and specific gravity was determined by the floatation method. All data were analyzed utilizing SAS (SAS Institute, 2001) in a randomized block design.

Results and Discussion

Body weight (Table 1) was maintained within the breeder's recommended ranges during the experiment and was not affected by treatment. Egg production was not significantly affected by type of lighting program (Table 1). Egg weight was also not affected by lighting program (Table 1). There was no significant effect of lighting treatment on egg specific gravity, fertility, or hatchability (Table 2). No treatment effect on mortality was observed in this study. These results agree with a study by Mather (1982) using White Leghorns, in which he also found no significant impact of lighting program on body weight, egg production, egg weight or egg specific gravity.

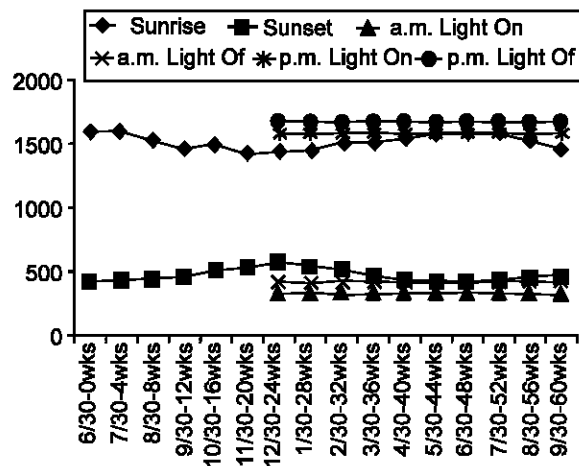


Fig. 1: Natural and Artificial Light for broiler breeders given a lighting program consisting of artificial light from 0400-0500 and 1900-2000

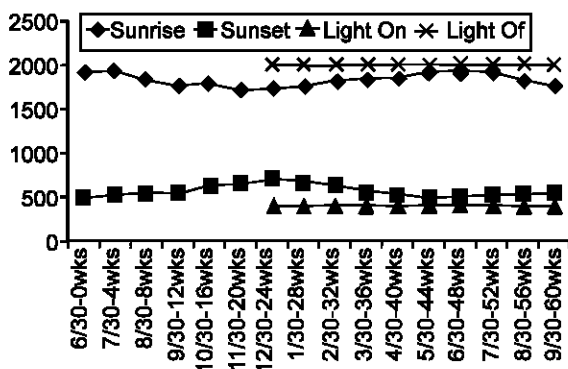


Fig. 2: Natural and artificial light for broiler breeders giving a lighting program consisting of artificial light from 0400-2000

The results from this study with broiler breeders and Mather's study with White Leghorns seem to indicate that using short period morning and evening lights in conjunction with natural daylight, rather than a continuous natural and artificial light period, is a viable lighting method which could be used with no detriment

to reproductive performance of the birds while reducing electricity costs. The birds exposed to the short period morning and evening lights apparently perceive the three periods of light and two periods of dark as one long light period. The dark periods are too short for a dark response by the bird.

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Abbreviation key: M = Morning and E = Evening