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Short communication

Photostimulated changes in egg production and reproductive performance of the Guinea fowl in a sub-humid tropical environment.

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Abstract

The effect of photo-induced changes on egg production and reproductive performance of female guinea fowl was studied by exposing the birds to three photo-regimens, namely natural daylight all day for 12 weeks (NDL), 8 hours of light per day for 8 weeks (8L–16D) plus supplementary light for 16 hours per day for 4 weeks (16L–8D) (RSL) , and provided natural daylight all day for 8 weeks plus supplementary light at 16 hours per day for 4 weeks (SL). Weight gain during the pre-laying period was similar (P>0.05) in all the treatment groups between 20-36 weeks of age. The reverse was the case during the laying period between 36-52 weeks, which coincided with the age at sexual maturity. Feed intake was similar (P>0.05) for the NDL and SL groups during the pre-laying period but the RSL group had significantly lower (P<0.05) feed intake than the others. Overall laying mortality was lowest in the RSL birds. There was no significant difference (P>0.05) in body weight for all the groups. Age at first egg was significantly lower (P<0.05) in the RSL (207 d) than in the NDL (249 d) and SL (235 d) birds which were similar (P>0.05). The guinea fowls which received 8 weeks of restricted light (RSL) responded more rapidly in terms of day-to-first-egg after exposure to 16 hours of light and achieved significantly higher (P<0.05) level of egg production than the other two groups. The overall economy of production, in terms of cost, revealed that RSL birds performed better than the NDL and SL, in that it cost ₦36.58 and ₦27.05 more to produce each NDL and SL guinea fowl at point of lay respectively. The results indicate that different light regimes altered the time during which egg production response took place and apparently affected the genetic potentials of the groups with regard to egg mass and total number of eggs laid during the period covered by this trial.

Keywords: Photo-stimulation, egg production, guinea fowl.

Introduction

Seasonal changes in day length provide initial prediction information allowing the development of physiological condition in which breeding can occur (Kannoth and Sharp, 1998). In photo-stimulatory birds exposed to short days from

hatch, increased day length induces premature gonadal development associated with increased luteinizing hormone secretion (Follet and Robinson, 1980). Generally, egg production (number) is the major index of performance of commercial layers. Uniform onset of egg production and high rate of lay from point of lay is desirous in all laying flocks.

Guinea fowls are monogamous and seasonal breeders. These monogamous and seasonal breeding behaviours will surely be counter-productive in domestication programme. Photostimulation during rearing greatly influences laying performance as it affects age at sexual maturity. Gonzalez (1979) reported an improvement in age at the beginning of lay, duration of lay, egg production, fertility and hatchability in the guinea fowl on exposure to 12 to 20 hours of light regime for 10 weeks.

Management systems designed to induce continuous breeding in the guinea fowl and to remove seasonal breeding behaviour should be investigated. Understanding of the avian photoperiodic response has advanced to the point where it is possible to generate a unifying model to account for long or short day breeding in birds and mammals (Nichols *et al.*, 1988; Sharp, 1993; Cockrem, 1995). However, the functional significance of photoperiod in the sub-humid tropical guinea fowl is poorly understood.

The purpose of the research was therefore to investigate the influence of photo-stimulation on egg production and reproductive performance of the local guinea fowl.

Materials and Methods

The effect of photo-stimulation on 360, 20-week old female guinea fowls obtained from hatches of eggs collected from the Teaching and Research Farm, University of Ilorin, Ilorin, Nigeria, were investigated by exposing the fowls to three light regimes: (a) given natural daylight all day for 12 weeks (NDL); (b) provided 8 hours of light per day for 8 weeks (8L–16D) plus supplementary light for 16 hours per day for 4 weeks (16L–8D) (RSL); and (c) provided natural day light all day for 8 weeks plus supplementary light at 16 hours per day for 4 weeks (SL). Prior to the experiment the birds were brooded for the first six weeks of life under continuous illumination in a brooder house. Thereafter they were raised on deep litter under natural daylight until they attained 20 weeks of age when they were used for the study. The actual study period was 32 weeks.

The birds were divided into three treatment groups with 120 birds each. The groups were further divided into 3 replicates of 40 birds each and were randomly allocated to pens in a completely randomized design. The rooms for the RSL birds were light- proof using dark polyethylene sheets and well insulated. Housing was not environmentally controlled beyond photoperiod. Artificial illumination was provided by one sixty-watt incandescent light bulb in 34cm reflector attached directly to the ceiling. The experimental light schedule was started at the 20th week of age (start of experiment) and discontinued at 32 weeks of age from when all the birds were kept under natural daylight.

The birds had been raised on a starter ration containing 23.89% CP and 2994.74 kcal/kg ME during the first 8 weeks, followed by a grower's diet containing 20.01% CP and 2750 kcal/kg ME between 8 and 20 weeks of age when they were introduced into the experiment. Throughout the study, they were fed a layer's diet containing 17.50% and 2650 kcal/kg ME.

Data Collection and Statistical Analysis

Body weight and feed intake were measured fortnightly throughout the experimental period

and the mean weights calculated. Age and body weight at first egg were taken for each group and age when 50% rate of lay was first attained was used as an estimate of age at sexual maturity. Weekly hen-housed and average hen-day rates of lay were determined from the egg production records of each group. Weights of all eggs laid in the first 3 days of each week were taken throughout the duration of the study. The average egg mass was calculated by multiplying the weekly egg weight by the hen housed average. The cost of raising the pullet guinea fowl to point of lay was obtained by adding the cost of the day old keets, medication, feed intake and compensating for mortality. The economy of egg production was taken as the cost of feed required to produce a dozen eggs. Data collected were subjected to one-way analysis of variance using the computerized statistical analysis system (SAS) (Barr *et al.* 1976).

Results and Discussion

The body weights of the birds in the three groups from 20 –36 weeks and at 52 weeks of age are presented in Tables 1 and 2 , respectively. No significant (P>0.05) differences were found in body weights between the groups of guinea fowls given different photo regimens throughout the experimental period. The effect of light on growth is through its stimulation of activity and feeding behaviour (Fostee *et al.*, 1970). Body weight was depressed (P>0.05) in birds restricted to 8 hours day length during the laying period at 36-44 weeks of age which coincided with age at sexual maturity. The depression in body weight was only temporary because all the birds were comparable in weight within the next 8 weeks. This result is an indication that as the guinea fowl gradually approached maturity the difference in body weight becomes less pronounced. The depression in body weight in the RSL birds may also probably be on account of higher laying rate at this age which calls for greater feed requirement for maintenance.

Feed intake was not significantly different (P>0.05) between the NDL and SL guinea fowls during the pre-laying period but the restricted

Table 1: Performance of indigenous Pearl guinea fowls during rearing under different treatments of light regimen

Parameter/Treatments	NDL	RSL	SL
Age at first egg (days)	249[a]	207[b]	235[a]
Body Wt. at first egg (g)	1129	1136	1130
Avg daily feed intake to first egg (g)	77.67[a]	70.90[b]	76.80[a]
Wt of first egg (g)	34.8	33.8	34.6
Pre-laying mortality (%)	6.06	0.00	3.00
Cost at 28 weeks (₦)	402.27[a]	320.26[b]	390.41[a]

[a,b,c] Means within rows with different superscripts are significantly different (P<0.05)

Table 2: Performance of indigenous Pearl guinea fowls during laying (age 36 – 52 weeks) following treatment with different light regimens

Parameter/Treatments	NDL	RSL	SL
No. of eggs/hen	32.55[a]	56.65[b]	40.83[a]
Percent Hen-day egg production	14.09[a]	24.52[b]	17.86[a]
Hen housed egg production	12.81[a]	23.76[b]	15.86[a]
Age at sexual maturity (days)	322[a]	294[b]	308[ab]
Avg daily feed intake (g)	204.77[a]	196.33[b]	201.05[a]
Mean egg weight (g)	37.93	36.82	37.05
Feed/dozen eggs (g)	1162.96[a]	640.50[b]	997.47[a]
Cost/dozen eggs (₦)	241.82[a]	133.21[b]	189.22[a]
Egg Mass (g)	485.88[a]	874.84[b]	587.61[a]
Body wt. at 52 weeks (g)	1190.5	1193.33	1191.92
Laying mortality (%)	9.09[a]	3.13[b]	7.12[a]

[a,b] Means within rows with different superscripts are significantly different ($P<0.05$)

light imposed on the local guinea fowls prior to stimulatory light (RSL group) significantly lowered ($P<0.05$) feed intake.

The overall pre-laying mortality was much reduced in the RSL guinea fowl. Breeders are especially concerned with the animal's ability to survive (Everett and Olusanya, 1985). The more the number of animals that survive, the more they are likely to provide potentials for improvement, as selection differential and consequently selection response may be greater.

Body weight at first egg was not significantly higher ($P>0.05$) in the RSL birds than those of other groups. Significant differences ($P<0.05$) were found to exist in age at first egg and age at sexual maturity between the groups of birds. In both parameters, the RSL birds were different from the other two groups which were not significantly different ($P>0.05$) between themselves. A desirable trait in poultry production is early attainment of puberty and consequently greater egg production. A factor which is responsible for the later attainment of sexual maturity in the NDL and SL birds is the slow rate at which these groups approached mature body weight in this study.

The guinea fowls which received 8 weeks of restricted light responded more rapidly in terms of age at first egg after exposure to 16 hours of light and reached significantly higher ($P<0.05$) level of egg production. This is reflected in the average number of eggs per hen of 32.55 (NDL), 56.65 (RSL) and 40.83 (SL) eggs respectively (Table 2). Of particular interest is the fact that actual weekly rate of production reached a higher level in this group than those getting only natural daylight even when the latter was supplemented with artificial light to provide for 16 hours of exposure. Thus, it seems reasonable that sexual maturity in the guinea fowl may be a function of age and rate of change of daily light rations. This agrees with the work of Sharp (1993) who proposed that the rate of maturation of pullets is directly proportional to the rate of change in day length experienced by them from hatchery. Sharp (1996) related sexual maturity to hours of constant light received by the pullets which is not in agreement with the findings in this study.

This observation is an indication that it may be the relative period of exposure to light in relation to that which the guinea fowl received previously, and not the absolute amount of light that determines the cause of action of the reproductive organs. It should be noted that although the critical day length in these birds may not be important for the timing of the onset of breeding, it may be important for the time of the termination of breeding by inducing the development of photorefractoriness. It has been noted that birds which respond most rapidly to light laid the most eggs which is in agreement with the findings in this study. The stimulus for increased gonadotrophin production may be the reason for high egg production in RSL guinea fowl.

The overall economy of production revealed that the RSL birds in terms of cost, performed better than the NDL and SL guinea fowl in that it cost ₦36.58, and ₦27.05 more to produce each NDL and SL guinea fowl at point of lay. It was also ₦121.51 and ₦50.65 cheaper respectively to produce a dozen egg from NDL and SL birds compared with RSL guinea fowl. The higher over head cost of NDL guinea fowl make their efficiency less than that of RSL birds producing eggs at the same time. On account of egg number, egg mass to 52 weeks of age was greater in RSL guinea fowl than in SL and lowest in the NDL birds. Results from this research indicate that different light regimes altered the time which egg production response took place and apparently affected the genetic potential of the group in regard to total number of eggs laid during the period covered by this trial.

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