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Full Length Research Paper

Hatchability of chicken eggs as influenced by turning frequency in hurricane lantern incubator

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An experiment was conducted to determine the influence of turning frequency of chicken eggs on hatchability in hurricane lantern incubator. There were four treatments in which eggs were not turned in treatment one (control), those in treatment two were turned once daily (morning), treatment three turned twice daily (morning and afternoon) while treatment four were turned thrice daily (morning, afternoon and evening). A range of 9.86 - 11.51% egg weight loss was obtained with the lowest value of 9.86% recorded in the control experiment. Egg turning three times daily produced highest hatchability of 72.90%. Embryonic mortality occurred in all the treatments. Early embryonic mortality (DIG) was highest (70.85%) in treatment two while late embryonic mortality (DIS) was highest (66.65%) in treatment three. Hatching occurred in the three zones of the egg. Most of the chicks hatched from the equatorial region while few ones hatched from the narrow end of the egg. Manual turning of eggs three times a day is recommended for hurricane lantern incubator in order to enhance minimal egg weight loss and higher hatchability of chicks. Such incubator could be used for hatching eggs of domestic fowls, turkeys, ducks, etc thereby taking hatchery operations to the door- steps of small-scale poultry farmers.

Key words: hatchability, chicken eggs, hurricane lantern incubator.

INTRODUCTION

Several factors are known to affect hatchability of eggs in the incubator. These include temperature and humidity control, conditions of the egg, turning frequency, etc. The importance of egg turning has been documented in several studies. Tona et al. (2003) indicated that turning in the first week of incubation enables proper formation of extra-embryonic membrane while in the last week avoids embryonic malpositioning. In a related study, Elibol and Brake (2004) confirmed that absence of turning resulted in presentation of the head in the small end of the egg. Egg turning facilitated the transfer of yolk nutrients to the embryo via the sub-embryonic fluid (Deeming, 1989a).

With modern incubators, automatic turning devices allow the eggs to be turned on hourly basis. However, for table-top incubators, manual turning of eggs is very crucial to the developing embryos. Abiola (1999) observed that manual turning of eggs once a day is suitable for electric table-type incubator to ensure minimal egg weight loss. Different types of poultry egg incubators have been recommended for small-scale hatchery operations. Irtwange (2003) designed and constructed a passive solar powdered poultry eggs incubator to provide free energy from the sun. Because of the high cost of imported electric incubator, high cost of electricity tariff coupled with epileptic power supply particularly in some developing countries, fabricated table-type kerosene incubators will be acceptable for small-scale hatchery operations. The operation of such incubator for hatching eggs of domestic fowls, turkeys, ducks, quails etc will greatly expand and enrich the poultry industry. The aim of this study is to determine the influence of egg turning in hurricane lantern incubator on hatchability of eggs with a view to taking hatchery operations to the door-steps of small scale poultry farmers.

MATERIALS AND METHODS

The incubator used for the study (Figures 1 and 2) was designed in

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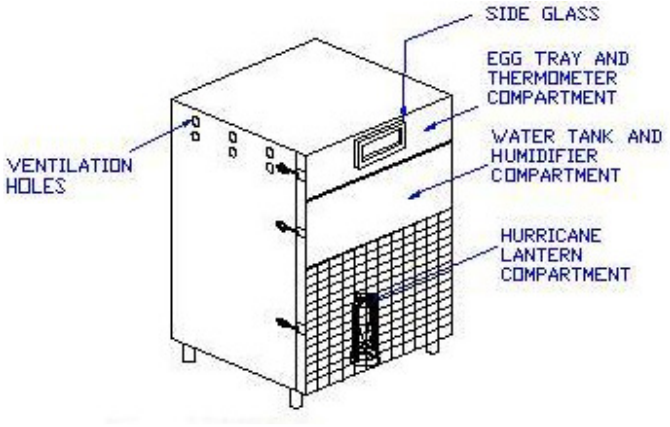

Figure 1. Hurricane lantern incubator (Isometric view in cm).

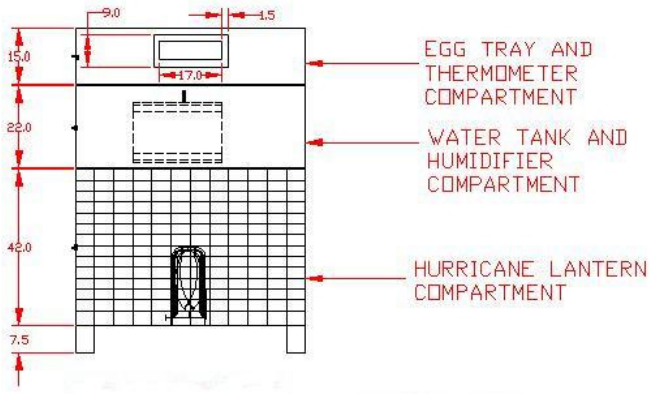

Figure 2. Hurricane lantern incubator (front view in cm).

the Department of Animal Production and Health, University of Agriculture, Abeokuta, Ogun State, Nigeria. It has three compartments. Compartment one (Topmost) which serves as the setter and hatcher contains egg tray and thermometer, compartment two (middle) contains the water tank and humidifier while compartment three (bottom) contains the hurricane lantern.

A total of sixty four hatchable broiler eggs obtained from a commercial hatchery were used for the study. The eggs were numbered, weighed individually and later fumigated with potassium permanganate and formalin at ratio of 1:1 for 15 min. The incubator was also fumigated and test run for twenty four hours before egg setting. The eggs were later arranged horizontally in four treatments with each treatment containing sixteen eggs. The experiment was replicated twice with eight eggs per replicate. Temperature of the incubator was maintained at 37^{o}C while a plastic basin with water was placed under the egg tray as humidifier.

Eggs in Treatment one (control) were not turned, those in Treatment two were turned manually with sterile gloves once daily (morning), Treatment three were turned twice daily (morning and afternoon) while treatment four were turned thrice daily (morning, afternoon and evening). Egg turning was between second and eighteenth day of incubation. Egg weight loss and fertility test were determined on the eighteenth day of incubation. Infertile eggs were eliminated from the incubator. Chicks that hatched on the twenty first day of incubation were weighed using a sensitive scale while the un-hatched eggs were opened up to determine the type and cause of mortality.

Data obtained were subjected to analysis of variance while means were compared using the Duncan's New Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Table 1 shows the effect of turning frequency on egg weight loss. Results obtained were statistically significant ($P < 0.05$). Egg weight loss ranged between 9.86 - 11.51%. The lowest value of 9.86% egg weight loss recorded in the control experiment is due to the death of many embryos, hence no respiration and metabolism was taking place. In a similar study, Abiola (1999) recorded a range of 10.88 - 12.8% egg weight loss in electric table type incubator. Ar and Rahn (1980) in an earlier study observed that 15% (±5%) of the egg mass was the average value for water loss for most bird eggs. Water loss early during incubation is more harmful than later on (Snyder and Birchard, 1982). Losses in egg weight during incubation were attributed to outward diffusion of moisture and gases from the egg shell (Ikeme, 1987). In the study of oviposition time and its influence on pore area and pore diameter, Oguike (1995) indicated that moisture loss from egg was positively correlated with pore area. The author observed that eggs laid in the morning had smaller pore area and pore diameter than those laid in the afternoon. Consequently, there would be greater weight loss from the later.

Turning frequency of egg had effect on hatchability of chicks (Table 2). Best result of 72.90% hatchability was recorded in treatment four where the eggs were turned thrice daily. The lowest value of 23.80% hatchability was however obtained in treatment one (control). The relationship between egg turning and hatchability of chicks has been documented in several studies. Wilson and Wilmering (1988) indicated that egg turning is required to prevent premature adhesion of the chorion to the inner shell membrane. There was no correlation between egg and chick weight and values obtained were not statistically different from one another. This is contrary to the report of Burke (1992) that chick weight was strongly influenced by the egg weight from where the chick hatched.

Although DIG (early embryonic mortality) and DIS (late embryonic mortality) were observed in all the treatments when un-hatched incubator eggs were opened up, the values recorded for DIG in treatments one and two were higher than those obtained in other treatments. Mal-positioning of embryos was the major cause of the DIS particularly in treatment one where most of the dead embryos faced the small end. Elibol and Brake (2004) reported that absence of turning resulted in high embryonic mortality and presentation of the head in the small end of the egg. Deeming (1989a) considered mal-positioning of embryos in the later part of incubation to be related with membrane adhesion, brought about by insufficient or lack of egg turning. Effect of turning frequency of eggs on hatching site is shown in Table 3.

Table 1. Effect of turning frequency on egg weight loss.

Parameters	Frequency of egg turning/day			
	0	1	2	3
Initial egg weight (g)	50.75±0.56	47.43±0.02	47.43±0.16	49.18±0.62
Final egg weight (g)	45.81±0.48^{a}	41.89±0.13^{c}	42.16±0.19^{c}	43.84±0.48^{b}
Egg weight loss (g)	4.05±0.09^{b}	5.54±0.15^{a}	5.28±0.03^{ab}	5.34±0.14^{a}
Egg weight loss (%)	9.86±0.03^{c}	11.51±0.15^{a}	11.06±0.03^{b}	10.89±0.16^{b}

Means in the same row with different superscripts are significantly different (P < 0.05).

Table 2. Effect of turning frequency on hatchability.

Parameters	Frequency of egg turning/day			
	0	1	2	3
No of eggs set	16	16	16	16
Fertility (%)	81.25±6.25	87.50±0.00	93.75±6.25	87.50±12.50
Hatchability (%)	23.80±9.50^{c}	50.00±7.10^{b}	48.20±23.20^{b}	72.90±10.40^{a}
Average egg wt.(g)	50.75±0.56	47.43±0.01	47.43±0.16	49.18±0.55
Chick hatching wt.(g)	34.54±0.75	33.33±0.01	34.87±1.18	34.14±0.04
Mortality (%):				
Dead-in-Germ	54.15±20.85	70.85±4.15	33.35±33.35	50.00±50.00
Dead-in-Shell	45.85±20.85	29.15±4.15	66.65±33.35	50.00±50.00

Means in the same row with different superscripts are significantly different (P < 0.05).

Table 3. Effect of turning frequency on hatching site.

Parameters	Frequency of egg turning/day			
	0	1	2	3
Narrow end (%) -	12.50±12.50	10.00±10.00	-	
Equatorial region (%)	75.00±25.00	54.15±20.85	45.00±5.00	50.00±10.00
Broad end (%)	25.00±25.00	33.35±33.35	45.00±5.00	50.00±10.00

Although hatching occurred in the three zones of the egg, most of the chicks hatched from the equatorial region while few ones hatched from the narrow end of the egg.

Conclusion

In conclusion, eggs should be turned manually three times a day in hurricane lantern incubator for minimal egg weight loss and higher hatchability of chicks. Consistency in the turning of the eggs will facilitate position of developing embryos and ensure that nutrients are evenly distributed for embryonic development. Such incubator could be used conveniently for small-scale hatchery operations to improve the living standard of the farmers.

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