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Efficiency And Ultilization Of Argis Electro Charge Incubator In Hatching Mallard Duck (Anas Platrhynchos) Eggs In Niger Delta, Nigeria

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ABSTRACT

Incubator is a device enclosure where environmental conditions such as temperature and humidity, can be controlled at optimal levels for growth, reproduction of hatching of fertilized eggs. Argis electrocharge incubator was experimented at the Duck Unit of Animal Production Teaching and Research Farm (APTRF), Faculty of Agriculture, DSUST, Ozoro, to examine the efficiency and utilization in hatching mallard duck eggs. Experimental birds used for this research work were Mallard ducks belonging to the family of Anatidae, with a sex ratio of 1:5 and laying ranged 8 to 12 eggs per clutch. Eggs laid by ducks were stored for 7 days at a room temperature between 15^{o}C and 18^{o}C and 70 to 80 % RH before being placed in the incubator. Eggs are turned manually alongside with automatic temperature regulator between 37.5^{o}C to 38.5 ^{o}C. Eggs were candled twice (at 7th day after egg set and at 25th day before hatch stage) to examine fertile and infertile eggs. Percentages of hatchability, fertility, hatch percent and efficiency was determined. Results obtained for the incubation period (29 days) shows 53.57% hatch percent, 82.1% fertility, 78.95% hatchability and 53.57% incubator efficiency. The efficiency of Argis electrocharge incubator had proven capable of hatching mallard duck eggs. In conclusion, the result revealed that for the incubation period (29 days) of using the Argis electrocharge incubator, the incubator has an average efficiency and capability in hatching mallard ducks eggs.

Keywords: Argis electro-charge, incubator, fertility, hatchability, Mallard duck, eggs.

INTRODUCTION

Incubator is a device enclosure where environmental conditions such as temperature and humidity, can be controlled at optimal levels for growth, reproduction of hatching of fertilized eggs (Aakanksha, 2021). Incubation of eggs is a modern technology process used to provide opportunity for farmers to produce ducklings from fertilized eggs without mother hen, an easiest ways of hatching eggs (Benjamin and Oye, 2012). Incubation of a fertilized egg and hatching can be obtained either naturally; where the duck provides the required conditions or by the use of an incubator (electric egg incubator) which is an automatic in nature and powered by electric power supply, also providing and controlling the environmental conditions for successful hatching (Ekarius, 2007).

However, the use of an artificial incubator was not in use until recently when the Egyptians were brought to Europe to build and operate an Egyptian type of hatchery, but was unsuccessful as a result of adverse climatic condition. Nevertheless, in 19th century, the advancement of thermostats to regulate temperature accurately gives opportunity for the development of more efficient incubators. At this juncture, several models of incubators were developed (Paniago, 2005).

Electric egg incubators used in egg hatching are of two (2) types: still-air and forced-air incubators. Though still and forced air incubator have the capacity of maintaining constant temperature, the forced-air incubators are capable of maintaining more even temperature, RH and oxygen level (Lourens, 2005). For optimum performance of electrical incubator for high hatchability of eggs, an

average temperature and RH of 36.5^{0}C and 30% are required (Lourens, 2005).

The incubation period last from 21days to 31days, an average of 28 days (Marissa, 2020), with an average number of fertile eggs hatched by the duck between 8 and 14 (Ramli., et al, 2017). However, eggs set at the incubator, should be stored at temperature of 13^{0}C and 80% RH to minimize deterioration of egg (Kelly, 2019).

The natural method of incubation (when the duck provides necessary conditions for the hatching of the eggs) cannot be relied upon to produce large amount of eggs due to reduced dead embryo and low hatchability, and as such cannot be used for commercial purpose. Hence the introduction and usage of Argis electro-charge incubator is encouraged. Therefore, the objective of this study was to examine the efficiency and utilization of Argis electro-charge incubator in hatching mallard duck eggs.

MATERIALS AND METHODS

Experimental Site

The research was carried out at the Duck Unit of APTRF, Faculty of Agriculture, DSUST, Ozoro. The unit falls within the rainforest zone of mid-western Nigeria on Latitude 5^0 32^I N and Longitude 6^0 15^I E of Greenwich meridian. The climatic condition is humid with annual mean rainfall ranged from 2500-3000mm. The mean temperature and RH are 27.4^{o}C and 85% respectively (DSUST Meteorological Station, Ozoro, 2021).

Experimental Birds

A total of 10 mallard ducks were used for the research work. Males (drakes) have a glossy green head and a green on their wings and belly. But the females (hens or ducks) have mainly bow- speckled plumage. Both possess white – bordered black or blue feathers called a speculum on their wings; males especially tend to have blue speculum feathers. Mallard duck is 50-65cm long, of which the body length makes up around two – thirds.

Feeding Management

Mallard ducks of (24-30 weeks of age) were fed commercial (hybrid) layers mash twice a day with water ad libitum. The precentage composition of commercial (hybrid) layers mash supplied 16.8% CP (min), 3.6%, fat (min), 4.2% CF (max), 4.2% calcium (min), 0.50% phosphorus (min), 0.45% methionine, 0.85% lysine (min) and 2860 kcal/kg ME.

Housing Management

The Mallard ducks were under intensive system of housing in which pens were built with low fenced (4 feet from the ground) and a wire mesh in a rectangular form with measurements 30ft x 40ft with floor space of 91.5ft. Bath tub sink at the centre of the house with water which the ducks bath with and swims on.

Health Management

Appropriate prophylactic medication were given to the birds, when due or when necessary and feed and water were provided to the birds to ensure optimal health condition of the birds.

Management of Hatching Eggs

To attain desired results during this experiment proper management procedure were carried out, such as disinfection, sanitation, fumigation etc. Mallard ducks eggs were stored and incubated carefully for successful hatching. Environmental conditions, handling, sanitation, and record keeping are all important factors considered during incubation period and hatching of eggs.

Collection and storage of eggs

Fertile eggs were collected and stored properly. Eggs kept under storage temperature are to prevent embryonic mortality. Eggs were collected frequently and properly stored for incubator. Eggs stored less than 7 days with temperature and RH maintained at 65°F and 75% delay embryonic development. Eggs were stored small end down and large end up.

Cleaning and culling

Cracked, misshapen, soiled, or unusually small or large eggs were discarded as they rarely hatch and could potentially contaminate the good eggs. Eggs were not washed or wiped with a wet cloth, as doing so could remove egg's cuticles and can allow micro-organism to penetrate it. Such eggs are contaminated. The best way to prevent soiled eggs is to gently sand paper it as was done during this experiment.

Hygiene/General care

During collection of eggs and setting egg in the incubator, sanitization and frequent washing of hands were done to evade damaging or contamination of eggs in the incubator.

Storage time

Eggs were stored for 3 days before preparing them for incubation. However fresh and stored eggs were not set together. Eggs are incubated within 5 to 6 days after laid.

Temperature and RH during storage

Fertile eggs are stored between 15°C and 18°C in room temperature which is generally warm. Fertile eggs were stored at 70 to 80 % RH, as high humidity may cause condensation on eggshell. This may clog the pores of eggshell and cause contamination by the same way washing does. Clogging the pores may suffocate the embryo.

Positioning and turning eggs during storage.

Eggs stored within the week were not turned because it is less than 7 days. Eggs were covered with clean material to keep them hygienic.

2 to 3 days before incubation

Before eggs were set, incubator was sanitized and switched on for 2 - 3 days. This was done to maintain proper temperature and RH. Temperature and RH were controlled automatically and egg turner was tested manually. The stable and equal state of the incubation room depends on the temperature and RH.

Cleaning and fumigation

Microbes found in an incubator may significantly increased poor hatchability. Disinfecting of equipment was properly carried out. Incubators, hatchers and racks were disinfected with quaternary ammonia.

Day eggs are set

Eggs were set on the 1st day in the incubator. However eggs were stored for 4 - 8 hours at room temperature before they were being set in the incubator. Cold eggs were not placed in a warm or humid incubator as condensation could form on the surface and possibly contaminate or suffocate the eggs.

Immediately eggs were set in the incubator, temperature or RH was not adjusted for 3 to 4 hours unless the temperature exceeds 102° F. But it wasn't called for since the incubator possesses a thermostat for an automatic regulator. However, the incubator's temperature was monitored including the circulating fan to make sure it works properly in order not to harm hatching process.

Set Stage

Set stage was prepared for hatching on the 25th day after eggs were set in the incubator. Incubator period of ducks usually takes 28 - 29 days. During the preparation eggs were turned at least 3 - 5 times per day to avoid embryo death and unhealthy ducklings.

Prior to expected day of hatching (2 day's) eggs were no longer turned and are to be transferred to the hatcher at a temperature of 98.5°F and RH of 66 - 75%.

Temperature, RH, and ventilation of incubator

During the set stage, temperature in the incubator was monitored to be 99.5°F to 100°F for duck eggs. Temperature was checked at least twice a day as the temperature deviates more than 1/2 degree from 100°F, a poor hatch may likely appear. Since incubator uses a passive humidity control system, water was added to the pan or trough daily to maintain correct humidity levels because if incubator humidity is too low or too high the hatch may likely fail.

The air cell may become larger as incubation progresses due to balance of temperature and RH. During the incubation duck eggs loss 12 to 14 % weights to evaporation, therefore the racks were weighed to detect problems with humidity and evaporative loss before hatch is destroyed. The duckling embryo uses oxygen and produces Carbon IV oxide.

This gaseous exchange was significant during the early stage since the full egg tray was fully complete. Towards the end of the incubation period, shell were filled with the embryo and since a full incubator requires large amounts of energy, adequate ventilation and RH and temperature are these were carefully observed during the last third days.

Precautions and reminders in the incubation process are as follows;

- Sanitization.
- Washing of hands before touching eggs so as to keep germs, dirt and oil away from incubating eggs.
- Keeping the small end up lower than the large end.
- Routine checking of temperature maintaining at 99.5ºF to 100ºF.
- Maintaining RH levels between 55 to 60 %.
- Turning eggs at least 5 times daily until 3days before hatch.
- Increasing ventilation at the last third day of incubation.
- Providing cloth or rough paper for ducklings to walk on and not turning eggs for the final 3 days.
- Increasing RH to 65 to 70 % at hatch stage.

Candling

This was done in a dark room by holding egg in a light by observing egg content. It was observed that fertile eggs are like spider-like structure. The blood vessel appeared firm and distinct. Candling was done twice; one 7 days into incubation and the other was carried at 25th day. In comparison, an infertile or un-incubated egg transmits light brightly, although, dead embryo likely appear as a ring or a smear of blood in the egg or a dark spot dried inside the shell.

Candling on the first day (7 days after eggs were set) shows that 36 out 56 eggs were fertile and 28 out of the 36 were fertile on the 25th day. Since 10-20% or more of the incubated eggs were infertile, they were identified and removed to avoid contamination to other eggs.

28 Days of Incubation

Duck eggs were incubated at a temperature ranged from 99.3^{0}C to 99.6^{0}C for 28 days. Humidity levels were 45-55% for the first 25 days and then increased to 65% for three consecutive days. Eggs were turned a minimum of five times a day - turning 180 degrees each time - so the egg spends every other night on the opposite side. This prevents developing embryo from sticking to the shell.

Five days into the incubation, veins were observed and other development. Candled eggs at day seven of incubation show significant expansion of the air sac in the blunt end and a developing embryo. But some reddish ring were seen inside some eggs, that 'blood ring' indicates bacteria had gotten inside and was immediately discarded, as contaminated eggs may explode and contaminate other eggs.

Once a day, incubator lid was removed and left opens for 30 minutes. After then each egg were mist with lukewarm water and the lid was replaced. The practices of mother duck leaving the nest each day to scavenge for food and maybe take a short swim, and return wet to her nest. Studies have proven that this practice has greatly improved hatching rates. This was done until day 25.

At this juncture, candling was done and those infertile eggs were discarded so only fertile eggs remained. Eggs were given one last turning, cooling and misting and RH was increased in the incubator. The ducklings were moved into 'hatch position'. On day 28 'pip's (small holes) began to appear on the eggshells.

The duckling then made its way out of the shell and eventually a brand new baby duckling emerges. This whole process took 48 hours or longer. The ducklings were not fed or given water for the first few days because they survive on the nutrients in the egg yolk being absorbed just prior to hatching. Immediately they had dried off, they were moved to a brooder house. A few sips of sugar water were provided to add energy before the ducklings were brought in.

When ducklings hatch

Hatching requires great effort; therefore the ducklings that hatched and is very active then takes long rests. The entire process takes 20 hours to 30 hours.

Eggs not hatched at day one after the predicted incubation period was discarded. However some ducklings were not helped to free from the shell as such ducklings which were given assistance during incubation could not survive. Immediately duckling had successfully leaved their shell, the ventilation was increased and left them in till 24 hours or until their feathers were dry.

When more than 90 % ducklings had dried, they were transferred to the hatcher. They were given water and feed, as leaving ducklings in the incubator too long could dehydrate them.

Embryo death

Eggs that failed to hatch were observed to be infertile or caused by death of embryo. After proper examination, causes of failure to hatch were traced to storage time position and turning of egg during

storage and incubation, and inconsistence temperature and RH.

Some embryos death was recorded during the first 7 days of incubation and the 25th day immediately before hatching. Early embryo death happens when embryonic organs are forming. However, one third of fertile eggs incubated had 60 to 90 % chance of development. Death at final incubation process could occur because the ducklings: had bad/difficulty positioning for pipping, could not absorb the yolk sac, could not transit to breathing air. Examination was done on the eggs that fail to hatch by removing the top of the egg at the large end. A fully developed duckling usually had their head under the right wing and the cell large enough to position correctly for hatching.

During this process; fertile eggs, set egg, hatch eggs were obtain to calculate percentage hatchability, fertility, total eggs hatched and the efficiency. However, poor nutrition as a factor can cause fertility and hatchability problems, as recognized by the National Research Council (2010).

Data Collection

Data collected includes; Numbers of eggs set; total number of fertile eggs (fertility %); total ducklings hatched (hatch per cent); numbers of eggs hatched (hatchability %) and efficiency.

Statistical Analysis

Data obtained were hatch per cent/total eggs hatched (%), hatchability percentage, fertility percentage and the efficiency were calculated as;

$$\text{Hatch Per cent (\%)} = \frac{\text{No. of ducklings hatched}}{\text{Total eggs set}} \times 100 \quad (1)$$

$$\text{Fertility (\%)} = \frac{\text{Total fertile eggs}}{\text{Total eggs set}} \times 100 \quad (2)$$

$$\text{Hatchability (\%)} = \frac{\text{No. of ducklings hatched}}{\text{Total fertile eggs}} \times 100 \quad (3)$$

$$\text{Machine Efficiency (\%)} = \frac{\text{Output}}{\text{Input}} \times 100 \quad (4)$$

$$\text{Incubator Efficiency (\%)} = \frac{\text{No. of eggs hatch}}{\text{Total No. of eggs set}} \times 100 \quad (5)$$

RESULTS AND DISCUSSION

Table 1 showed Candling, fertility and hatchability of mallard duck. Results revealed that out of fifty six (56) eggs set, forty six (46) eggs were recorded fertile at 7th day of candling, while ten (10) eggs remained infertile. At 25th day of candling, only thirty eight (38) eggs were fertile, while eight (8) eggs remained infertile (Figure 1). Unfortunately, only thirty (30) were hatched on the 28th day.

From the above results, it reveals that fertility per cent value was 82.14% which showed high percentage of fertile eggs (46) among the eggs set. Hatchability per cent value was 78.95% for (30) fertile eggs hatched and this proved high working rate of the incubator. Hatch per cent value was 53.57% and also machine (incubator) efficiency value was 53.57% (Figure 2). The value of percentage was above average, this result can be attributed to environmental condition, production system, season, nutrition, management of parent stock, cleaning of eggs, and storage time as factors that affect the incubator efficiency. Awad, (2013) and Ramli (2017) agreed that temperature, RH, ventilation and regular turning of eggs in the incubation and hatching were environment factors that can be modifying hatchability.

Fertility and hatchability percentage value obtained were higher as a result of eggs stored were not more than 6 days in storage period. Therefore, hatchability and fertility results in this present study were increased in percentage due to decrease in storage period, since early and late embryonic death was lower.

Appropriate use of Male: Female ratio may have contributed to greater fertility. Jubrin et al., (2011) supported that for higher fertility, a ratio of one drake to five ducks should be used to enhance high fertility of duck eggs. Giri, (2014) also supported this study that mating sex ratio for production of fertile eggs under intensive system is 1:5. Brillard (2003) and Mohan (2018) opined that quality and quantity of semen deposited by the male (drake) were important to obtain good fertility.

Hatch per cent at 53.57 % and machine (incubator) efficiency also at 53.57 % proved that the “Argis Electrocharge Incubator” is reliable, working perfectly and can be recommended for hatching of other species of poultry eggs.

In conclusion, from the result it revealed that through the incubation period (29 days) of using the Argis electrocharge incubator (Figure 3); the incubator has an average efficiency and capability

in hatching mallard ducks eggs. However, the percentage efficiency of the incubator can be increased by improving hatchery management practices of obtaining fertile eggs in storage and incubation period.

Figure 1: Fertile eggs at 25th day of candling

Figure 2: Ducklings Hatched

Figure 3: Argis electrocharge incubator

Table 1: Candling, fertility and hatchability of mallard duck eggs

Days	No. of Egg set	1st candling 7th day	2nd candling 25th day	No. of Fertile eggs	No. of Infertile eggs	No. of pips	No. of Hatched eggs	Fert. (%)	Hatch-ability (%)
1	56	-	-	-	-	-	-		
7	56	✓	-	46	10	-	-		
25	56	-	✓	38	8	-	-		
28	56	-	-	0	0	30	26		
29	56	-	-	0	0	0	4	**82.14**	**78.95**

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