

INVESTIGATION OF CONSTANT TEMPERATURE KEEPING PROCESS TO HATCH HEN EGG IN AN INCUBATOR UNIT: A REVIEW

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ABSTRACT

Incubation process of any egg needs lots of care and proper temperature management. This is done by temperature control unit which works on either solar, electric or LPG etc. Normally 98 to 100 °F (37 to 38 °C) temperature is maintained in incubator unit. Still the hatchability of eggs can be achieved in between 78 to 85 % only. There are several suggestions are given to improve the hatchability of incubator unit. Moisture content is also a key factor which must be mentioned in between 60 to 80 %. There are also several other factors needs to be understood while hatching the eggs in incubator unit. But the most important factor is to maintain the temperature range in proper range. Several research studies are also available in this regard. Out of them few studies are explored in this paper. There methodologies are explained well to support further incubator development. Some of the methods and studies are adopted to support the fabrication of cheaper incubators.

Keywords: Incubator, Temperature controller, Moisture content

1. Introduction to Hatching

Eggs have the best hatch rate when stored for no more than 7 days before beginning to incubate. Allow cool eggs to warm slowly to room temperature before placing in the incubator. Abrupt warming from 55 degrees to 100 degrees can cause moisture condensation on the egg shell which can lead to disease and reduced hatches.

1.1 Humidity Control

Humidity is controlled in order to prevent unnecessary loss of egg moisture. The ideal humidity level for hatching eggs is still being debated among experts, but many agree that it should not fall below 25% or above 60% between setting and three days prior to hatching. During the last three days (the "lock-down" period), the humidity level should be increased to between 70-80%. Keeping an adequate humidity range inside the incubator is quite simple. The humidity will have an impact on how much water need in the incubator to keep it within the correct humidity range. Check the water level periodically to ensure they don't dry out. Many experts agree that a common cause of poor hatch rates is too much humidity during the first part of incubating and not enough during the last three days (the "lock-down" period).

1.2 Turning the Eggs

Eggs must be turned at least 2-3 times daily during the incubation period. Many experts say if we can turn them 4-5 times a day it is even better. Do not turn eggs during the last three days before hatching. The embryos are moving into hatching position and need no turning. Keep the incubator closed during hatching to maintain proper temperature and humidity. If we are using an automatic egg turner, then that will take care of the turning. Just be sure to remove them from the turner and lay them on the floor of the incubator (most come with a wire floor) three days before hatch. When the eggs are turned by hand, it may be helpful to place an "X" on one side of each egg and an "O" on the other side, using a pencil. This serves as an aide to determine whether all eggs are turned. When turning, be sure that hands are free of all greasy or dusty substances. Eggs soiled with oils suffer from reduced hatchability. Take extra precautions when turning eggs during the first week of incubation. The developing embryos have delicate blood vessels that rupture easily when severely jarred or shaken, so take care to handle the eggs carefully. Turn the eggs until three days before they are due to hatch.

2. Hatching Incubators

In brief, an egg incubator artificially performs the role that a broody Hen does in nature. It is a

mechanical device which regulates temperature and humidity at perfect levels therefore creating the ideal conditions which allows the chick to grow inside the fertilized egg, without the hen needing to be present. In fact, incubators are a lot more successful at hatching eggs than hens. For example, one hen could hatch approximately 20-30 eggs each year but if you use an incubator to hatch the eggs laid by that same hen, you could possibly hatch 200-300 eggs. The reason for this is that a broody hen will stop laying until she has hatched her eggs and reared her young. Plus, a lot of external factors can interrupt the hatching cycle, such as the hen herself getting distracted and allowing the eggs to get

2.1 How it works

Incubators are built to include a motor and a fan which work at keeping the temperature inside at the required level. As the inside temperature of the incubator must be kept at a constant level, ideally the incubator should be kept inside and in a room where the temperature will not drop too low. The eggs are placed on a tray inside the incubator and they need to be turned at least 3 times a day. The smaller the egg the more will fit on the tray and the larger the egg the lesser will fit. Water needs be added to the incubator each day to keep the humidity at the correct levels and this level will increase on the last few days of incubation. There is usually a hole at the base of the incubator which allows the water to be added without the need for the incubator to be opened. Both manual and automatic incubators are available. As the eggs need to be turned a couple of times a day the mechanism of the incubator will dictate whether this will be done manually by you or automatically by the incubator itself.

2.2 Manual v Automatic incubators

One of the major advantages of an automatic egg incubator is that it turns the eggs for you, so you don't have to remember to do so each day. The eggs sit in compartments on a specially designed tray. This tray is moved automatically by a motor which cause the eggs to rotate. If you want to be more involved in the incubation process, then a manual incubator is for you because with a manual egg

incubator, you are required to turn the eggs by hand at least 3 times a day. It is best that you mark one side of the egg so that you can track when they were last turned. It is important that eggs are turned regularly as the chick can stick to the inside of the shell.

3. Literature Survey

Mohd Badli Ramlib, Hooi Peng Limb, "Egg hatching incubator using conveyor rotation system". This study aimed to design and develop a force air system of eggs incubator to incubate various types of eggs through a conveyor rotating system. [1] Diduo Liua, Zhaoqi Liub, "Research on the Energy Load during Incubation and the Energy-Saving Potential of the Traditional Incubator". In their paper the energy-saving potential of traditional incubator is analyzed and the possibility of using other high efficiency methods is also discussed to substitute the electric heater in the poultry incubation equipment and achieve the goal of energy conservation. [2] Anthony J. Taplah1*, Delfin C. Suministrado2, "Development of hot spring fed incubator for duck eggs". Their study addressed issues such as replacing conventional source of energy with geothermal energy in Los Baños, Laguna, Philippines for incubation of eggs (ducklings, *ballot* and *penoy*). [3] K. Radhakrishnan1, Noble Jose2, "Design and Implementation of a Fully Automated Egg Incubator". The purpose of their paper is to explain the design of an ATmega16[1] microcontroller based egg incubator system which is able to automatically maintain the environment which is optimum for embryo growth. [4]

Muhammad J. A. Khan, Sohail H. Khan*, "The effect of storage time on egg quality and hatchability characteristics of Rhode Island Red (RIR) hens". In this research study, hatchability results and some internal egg quality characteristics of 0, 2, 3, 5, 7 and 9 d stored eggs in RIR were examined. It was determined that the effect of storage time on hatchability, hatchability of fertile eggs, embryonic mortality, chick weight, albumen weight, yolk weight, albumen index, yolk index and Haugh unit was significant ($P < 0.05$). [6]

Pallavi Bhosale1, Jagriti Tripathi2, "Development of Smart Egg Incubator System

Using Arduino”. The purpose of their paper is to design and develop the system of an egg incubator that is able to incubate various types of egg, named as Development of Smart Egg Incubator System using Arduino (SEIS). [7], Ogunwande, G. A., Akinola, “Development of a Biogas-Powered Poultry Egg Incubator”. This study advances the utilization of biogas energy for chick production. A wooden frame still-air incubator was developed, which uses biogas as a fuel to supply heat through a burner installed at the base. A no-load test was carried out during which incubator temperatures were calibrated against ambient temperatures when heat was supplied at various burner regulator knob positions. The results were used to develop a chart for incubator o temperature control. Incubator temperature range (36-39.4 C) was successfully achieved at prevailing ambient temperatures by adjusting the knob position according to the chart. The temperature variation inside the incubator was not significant ($p > 0.05$). [8]

4. Constructional Details of Incubator

Incubation is the act Forced draft incubators

I. Based on heating source:

- Hot air incubator
- Hot water incubator

II. Based on fuel used

- Gas operated incubator
- Oil operated incubator

Location

The chick hatcheries are modern buildings that provide separate rooms for each hatchery operations, but each room has its individual requirements. The hatchery area should be a separate unit with its own entrance and exit, unassociated with those of the poultry farm. The hatchery should be situated at least 1000 ft from poultry houses to prevent horizontal transmission of disease-producing organisms from the chicken houses to the hatchery.

Size of the hatchery

The size of the hatchery is based on the egg capacity of the setters and hatcher, number of eggs that can be set each week and number of chicks hatched each week. Also, necessary space to be allotted for future expansion.

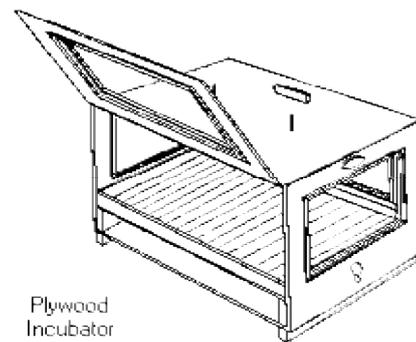


Fig. 1: Plywood Incubator Design

The following illustrations are designed to guide the reader through the construction of a small plywood and glass incubator that will accommodate about 100 chicken eggs. Basic woodworking tools are required for construction. Gather all equipment and supplies listed below together before starting construction. The diagrams shown will guide the construction of the unit. Printed diagrams are shown in MCES Publication 1150, *Avian Embryo* that is available through your local County Agent Office.

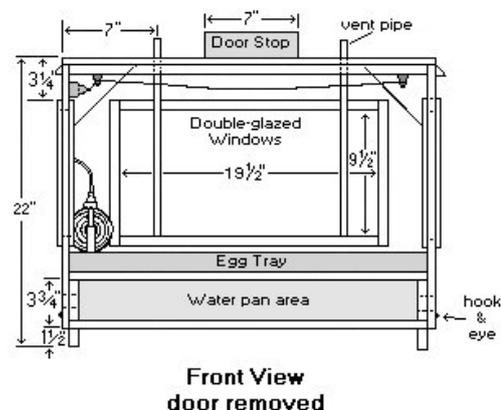


Fig. 2: Detailed Sections and their measurements

5. Incubator management

A hen on a nest of eggs provides constant body heat and moisture, and turns the eggs frequently. Good artificial incubation mimics conditions in a nest. A good incubator is an insulated box with a regulatable heat source, a thermostat and a high - quality, easy to read thermometer that shows fractions of degrees accurately. Ideally, an incubator should have a small, glass window through which to read the thermometer, and a means of measuring and controlling humidity. A tray filled with water should be provided to generate the necessary

humidity. The humidity should be measured using a wet thermometer. A wet thermometer is simply an ordinary thermometer with the lower end of the thermometer inserted in water, or a thermometer placed above a source of water with a piece of cloth wrapped around the end of the thermometer and the bulb placed in the water. The incubator should have some means of adjustable ventilation as well.

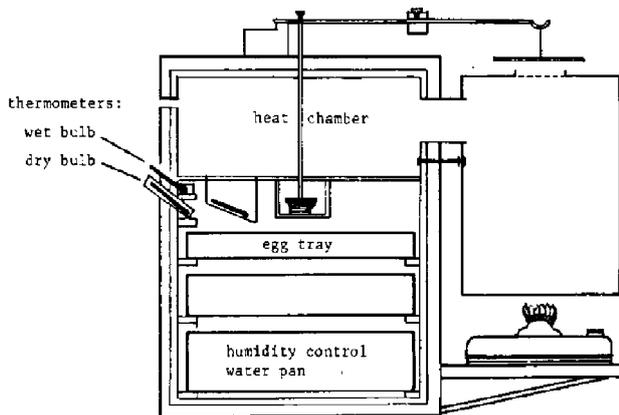


Fig. 3: Kerosene operated Egg Incubator Unit

6. Conclusion

To improve the hatching rate and the efficiency of the incubator, temperature and humidity management takes important part in hatching process. It is recommended to manage temperature and humidity in required range. Also the rotation in first few days must be done 3-4 times in a day to get maximum hatching efficiency.

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