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Comprehensive Management of Poultry Hatcheries: Ensuring Biosecurity, Chicks Quality, and Economic Sustainability, A Mini Review

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ABSTRACT

A poultry hatchery is an installation or building in which the hatching of poultry eggs is artificially controlled for commercial purposes. It serves various purposes, including the conservation of rare species and meeting economic needs for food production. The hatchery process involves careful egg handling, maintaining specific temperatures and humidity levels, and ensuring biosecurity measures to prevent diseases. From egg receiving to incubation and chick grading, each step is crucial for producing healthy and uniform chicks. The overall success of the hatchery depends on effective management, contributing to the quality of chicks supplied to the poultry industry.

Keywords: Hatchery, Chicks, Embryological Development and Poultry.

Introduction:

A hatchery is a facility where eggs are hatched under artificial conditions, especially those of poultry. Certainly! Poultry hatcheries may be used for ex-situ conservation purposes, i.e., safeguarding rare or endangered species by breeding them in controlled environments, and the other is for economic reasons, such as enhancing food supplies [1]. In developed countries, most of the chickens and turkeys we eat come from these hatcheries. Larger poultry hatcheries are usually connected to large-scale poultry meat or egg production. [2]. This is a multibillion-dollar industry, with highly well-organized production systems used to maximize bird size or egg production versus feed consumed. Generally, large numbers are produced at one time so the resulting birds are uniform in size and can be harvested [for meat] or brought into production [for eggs] at the same time [3]. A large hatchery produces 15 million chicks annually. Poultry generally starts with naturally or artificially inseminated hens that lay eggs; the eggs are cleaned and shells are checked for soundness before being put into the incubators [4]. Incubators play a crucial role in hatching eggs by managing temperature and humidity while gently turning the eggs until shortly before hatching. About three days before the expected hatch date, the eggs are shifted to a hatcher unit. In the hatcher, the eggs remain stationary, allowing the embryos to position themselves properly for hatching. The temperature and humidity conditions are carefully optimized for this stage. After the eggs hatch and the chicks are a few days old, they are commonly given vaccinations. [1].

Overview of Hatchery Management:

Hatchery consists of two portions as setter side/clean area and the hatcher side/ dirty area.

Setter side: It consists of an entrance, eggs classifying room, fumigation room, and pre-warming room, setter halls, transfer room [5].

Entrance: All the vehicles either entering or exiting from the hatchery must pass through a wheel dip. The wheel dip has a 2% solution of disinfectant to disinfect the wheels. The dimension of the wheel dip is [20x12] ft², with a depth of 1 foot.

Biosecurity:

The word biosecurity informed common sense that "do not" bring germs into the hatchery. Biosecurity is defined as the sum of the management practice in the hatchery to reduce the risk of infectious disease and ensure the absolute health of newly grown chick [6].

Workers Biosecurity:

Step 1: In each unit the foot dip is present at the doorstep. 2% solution of disinfectant used in foot dip. Dimension of foot dip is [3x2] ft, with 4-inch height. The purpose is to disinfect the shoes while entering the unit to reduce the chances of contamination. **Step 2:** Un-wear the clothes and shoes. **Step 3:** Take a bath. **Step 4:** Wear the hatchery uniform and shoes. **Step 5:** The last step is to Sanitize your hand and then make an entrance into the production house [6].

Eggs Receiving Room:

Check the farm-out voucher for farm-out time, hatchery entrance time, the number of eggs, received eggs temperature (18 to 19ºC), count patties according to the received voucher, check condensation on eggs, and check the data logger for humidity and temperature recorded during transportation. After that unload the vehicle. During unloading gently place egg boxes on the floor to prevent breakage. Makes proper record of received eggs. Eggs are set in the tray each tray contain 30 egg and placed in the boxes, each box contains 12 trays. Total eggs in one box. 30×12= 360eggs [1].

Maintenance of the Egg Room:

Before the arrival of the egg room should be maintained at the desired level as shown in Table 1. Relative humidity and temperature are automatically controlled through a humidity state and thermometer [1].

Effect of Egg Storage: The main effects of egg storage are prolonged incubation time (on average one day of storage adds one hour to incubation time), depressed hatchability, and low chick quality. The temperature and humidity should be maintained as shown in Table 1.

Table No.1: Temperature and Humidity Management During Egg Storage.

Storage duration	Temperature centigrade	Relative humidity %
0-3 days	18-21ºC	75%
4-7 days	15-17ºC	75%
8-10 days	10-12ºC	80-88%
More than 10 days	10-12ºC	80-88%

Working in the Egg Room: In this room, multiple tasks are performed. Hatachable eggs were selected based on shell quality, weight, and color. Only oval-shaped good quality intact eggs were selected for hatching. The substandard eggs such as cracked, misshapen, blood-stained, dirty, toe-punched, and elongated were rejected [7].

Egg Grading:

Mostly manual method is adopted for grading eggs. Double yolk eggs, cracks, dirty, and misshapen eggs are separated during grading. Eggs are graded into the following categories such as A-grade eggs (54-60g weight), small (45-52g), market eggs (also A-grade but dirty, white color, misshape), and overweight. (above 90g), weak shell, hairline. Note: Cracked and hairline-broken eggs are separated. Eggs are mainly graded for shell quality, size, and shape [8, 9].

Grading Objective: To obtain the maximum uniformity of chicks. Accurate grading decreases chick weight variation which finally influences flock performance [8, 9].

Eggshell Consideration in Terms of Hatchability: If the brown egg-laying breed has some white shell eggs due to a diseased parent flock, the light or white color comes due to less stay of egg in the oviduct. From colored eggs, the skeleton of a newly born chick is not so well developed. The normal eggshell thickness is 0.33-0.35mm.

After grading egg is set in a pilot loaded on a trolley and transferred to the fumigation room.

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Effective air circulation and correct room temperature are essential to achieve the necessary conditions [9].

Pre-warming Room: Pre-worming is a process in which the eggs are pre-heated before sitting in an incubator to avoid temperature shock to the embryo and consequent condensation on the shell. Eggs are removed from the egg store room to the pre-warming room before setting [10].

Purpose of Pre-warming Eggs: Pre-warming helps to limit the amount of condensation on eggs. To provide a more uniform start to incubation. In Multistage machines reduce the chilling effect of setting cold eggs on already-set eggs. Important to shorten the hatch window and uniform hatch [10].

Fumigation of Eggs: The purpose of fumigation is to decrease germ overload [11]. Fumigation parameters are shown in Table 2.

Table 2: Fumigation Parameters.

Temperature	Humidity	Fumigation agent	Time
24 – 25ºC	65 -70 %,	kMNO4 + formalin, for hundred cubic feet 20gm kmno4 +40ml formalin used.	20 Minutes

Procedure: Stand tall trollies in the fumigation room, close them in and outdoors, and Adjust the room temperature set point in the control panel to 25ºC, Maximum heating time is 05 minutes, Fumigation time is 15 minutes, Neutralization time is 0 minutes, Extraction time is also15 minutes [11].

Reagent: Potassium per magnate [20g/100ft³] and Formalin [40ml/100ft³]. Use according to the recommendation of the hatchery manager. After that turn, on the exhaust fan, and off the fumigation fan then open the fresh air inlet window. The water is used to produce moisture in the fumigation, which prevents the dehydration of eggs [11].

Setter Operation:

Incubation of Egg: Incubation is a process of embryonic development inside an egg resulting in the production of viable chicks from fertile eggs [12, 13].

Types of Incubation:

Natural Incubation: In natural incubation, eggs are hatched under the hen after 21 days and all the hatching requirements are completed by the hen until hatched [13].

Artificial Incubation: Artificial incubation is a process in which eggs are maintained in an incubator for chick embryonic development and is used for the commercial purpose of poultry production [12, 13].

Setter Hall Management: Temperature 24 – 25 ºC, humidity 55 %, positive air pressure [12].

Incubator or Setter: The incubator facilitates the process of embryonic development by providing all the environmental conditions required for incubation including air pressure, temperature, humidity, ventilation, and turning of eggs. It is also called Incubator in which the eggs are kept for 18.5 days in controlled temperature, humidity, and ventilation. The eggs are rotating every hour. On 18.5 days [after 444 hours] the eggs are transferred to Hatcher for the next 60 hours. The room temperature of the incubator should be 99.5 F [13]. The optimum physical conditions for an embryo to grow successfully are needed as shown in Table 3.

Table 3: Optimum Physical Conditions in Setter.

Temperature	Humidity	Time	Pressure	Turning	Dumper Opening
99.5 ºF	84 – 85 %,	18 days 6 hours	+ ive	1 rotation per hour with turning angle 90-degree	10%

The Egg Capacity of the Setter: In multi-stage setter 6 setting install. One set contains 15840 eggs. Total egg installs in one setter 6 * 15840 = 95040 eggs [12].

Identification of Incubation Temperature Problem: Monitor hatch time [delay hatch, early hatch], cross-check with calibration kit, observe chick yield, observe D.I.S.

Humidity: It has a major role in water loss such as high humidity in setters low water loss, low humidity in setters high water loss [13].

Turning: Eggs should be turned towards each side after every hour with an angle of 43 to 45 on both sides [13].

Importance of Egg Turning: Eggs need to be turned from day 0 to 15. Turning helps to prevent the embryo from sticking to the shell, and also allows the diffusion of gases inside the egg and between the egg and the external environment. It also facilitates nutrient movements, absorption and helps in air circulation in the setter, and prevents hot spot development [13].

Factors Important for Egg Turning: Angle: 43 – 45, time: once an hour, smoothness: no jerks (ruptures duplicated blood vessels) [13].

Signs of Improper Turning: Increased early embryonic mortality, Mall position, and Sticky chicks Reduce chick quality and Hatchability [13].

Candling of Eggs: Candling is a technique that distinguishes between fertile and infertile eggs**.** On the ninth day, the eggs are put on the candling table in which high light intensity bulbs are used which helps to distinguish between the clear (infertile) and embryonated (fertile) eggs. The clear eggs are manually picked up and fertile eggs containing embryos and transferred to the hatcher tray [13].

Hatcher Side:

It consists of hatcher halls, chicks pull room, chicks grading, packing room and washing area.

Hatcher: The hatcher is a machine where the eggs are transferred for the last 60 hours after keeping 444 hours in the setter. The Hatcher tray is called a Vertical flat piece (VFP). This contains 165 fertile eggs. The egg capacity of a hatcher is 15840 eggs installed in one hatcher

Note: The Hatcher should be powered on for 2-4 hours before eggs are set in the hatcher [15]. The optimum physical conditions for an embryo to grow successfully are needed as shown in Table 4.

Table 4: Optimum Physical Conditions in Hatcher.

Temperature	Humidity	Total time
98.5 ºF	Humidity starts at 85 % when 5% of the egg hatched then increases to 90 %	3 days

The egg remains in the hatcher for 3 days after three days chick hatched and transferred to the grading room. After 21 days chicks are hatched and transferred to chick's room for grading.

Fluctuation of Temperature and Humidity in Hatcher: Overheating of the hatcher leads to an early hatch, large navel buttons, dehydrated chicks, and unhealed navels. The chicks will be paler in color and 7th day mortality will be high [11].

Low hatcher temperature of hatcher is led to small navel buttons, increased hatch windows, and an increased number of live pips**. Low humidity in the hatcher** delays the hatch window, chicks fail to pip externally because the shell is hard. Increase last 20-day mortality [14].

Chick Yield:

The average weight of the chick at hatch as a percentage of egg setting weight, Ideal chick yield is 67-68 %. For example; we set the egg to weigh 65 grams, and the weight of the chick will be 42.2 grams [1].

Chicks Grading:

The room where chicks are graded is maintained at 24 -25 ºC temperature, and humidity 70 - 75% [11]. Chicks are graded in three categories. After the grading, the chicks are vaccinated to enhance their internal immune system against the diseases shown in Table 10. After vaccination chicks are packed in a box and delivered to the broiler farm according to head office order.

Transportation of Chicks:

Chicks are transported in thermo-control and properly disinfected vehicles. The HVAC team first inspects the vehicle. The driver maintains the temperature of the vehicle at 24–26 ºC for the plastic box and 22 – 24 ºC for the gatta boxes before loading. The humidity of vehicles is 65 – 70% and fresh air is 20 cfm/1000 chicks [14].

Conclusion:

A poultry hatchery is a crucial facility for both conservation and economic purposes, producing poultry consumed globally. Effective hatchery management is essential to ensure the health and uniformity of hatched chicks. From egg receiving to incubation and chick grading, each step demands careful attention to temperature, humidity, and hygiene. Proper egg handling, incubation conditions, and post-hatch processes contribute to the overall success of the hatchery, ultimately impacting the quality of chicks delivered to the poultry industry.

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