Poultry Production

NTQF Level-III

Learning Guide-30

Unit of Competence: Perform Hatchery Operation

Module Title: Performing Hatchery Operation

LG Code: AGR PLP3 M08 LO1-LG-30

TTLM Code: AGR PLP3 TTLM 0120v1

LO 1: Perform Basic Incubator operation

Instruction Sheet	Learning Guide #30

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Understanding principles of incubation of hatching eggs
- Identifying Basic Incubators and accessory equipment requirements
- Maintaining air flows, construction standards
- Replace fan motors
- Fix alarms and investigate causes
- Calibrating temperature and humidity probes
- Evaluating alternative options to Incubator and accessory equipment for applicability.
- Identifying and address Storage and housing requirements for Incubator and accessory equipment
- Locating the incubator in a well-ventilate room
- Maintaining water reservoirs and electricity at the appropriate level, in order to keep the proper level of humidity

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Understand principles of incubation of hatching eggs
- Identify basic Incubators and accessory equipment requirements
- Maintain air flows, construction standards
- Replace fan motors
- Fix alarms and investigate causes
- calibrate temperature and humidity probes

- Evaluate alternative options to Incubator and accessory equipment for applicability.
- Identify and address Storage and housing requirements for Incubator and accessory equipment
- Locate the incubator in a well-ventilate room
- Maintain water reservoirs and electricity at the appropriate level, in order to keep the proper level of humidity

Learning Instructions

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below in page 3.
3. Read the information written in the information “Sheet 1 and Sheet 2.
4. Accomplish the “Self-check 1 and Self-check 2” in page -5 and 14 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” in page -15.
6. Do the “LAP test” in page – 15 (if you are ready).

Information Sheet-1	Understanding principles of incubation of hatching eggs

1.1 Introduction

Eggs can be hatched in two ways: by natural method using a broody hen and by the artificial method using an incubator. Artificial incubation was developed with the main objectives to create the temperature and relative humidity close to the natural conditions. Artificial incubation has greatly contributed to the rapid expansion of poultry industry by allowing mass production of chicks. The operation of a chick hatchery involves the production of the largest number of quality chicks possible from the hatching eggs received at the hatchery.

1.2 Incubation and Hatchery management

Incubation is the act of bringing an egg to hatching. Two methods of Incubation's are usually practiced the natural and the artificial method. The incubation period for chicken egg is 21 days.

1. **Incubation**

In the natural method eggs are incubated with the help of broody hens. It is by natural incubation that most chicks of indigenous breeds are produced in the villages. The results of natural incubation are usually poor.

Sitting hen needs

- Supply of clean drinking water and feed
- Protection against insects and vermin.
- The nest should be placed in quite, shaded cool place.

2. Artificial incubation

Artificial incubation is carried out in incubators heated with fuels, butane gas or electricity

1.3 Incubator

- An incubator is an *artificial method for the hatching of eggs*. In essence, an incubator allows you to hatch eggs without having hens.
- Incubators mimic the conditions and experiences of a b*rooding hen for fertilized eggs,* including appropriate temperature, humidity, and ventilation levels.
- To successfully hatch eggs in an incubator, you need to *properly calibrate the incubator* and *keep the settings stable throughout the incubation period.*
- *Popular incubator models often include automatic turners, humidifiers, and temperature controllers.*

1.4 Clean the incubator

- Two to three days before incubation sanitize the incubator
- Carefully wipe or vacuum off any visible dust or debris from all the surfaces of the incubator.
- Then wipe down all surfaces with a clean cloth or sponge dipped in a diluted bleach solution (mix 20 drops of household bleach in 1 quart of water.)
- Use gloves to protect your hands from the bleach and wring the cloth or sponge out before wiping down the incubator.
- Allow the incubator to air dry thoroughly before plugging it in for use

- To ensure the incubator, adjusting the temperature and humidity before the eggs are set for several days.
- The temperature and humidity of the incubation room should be correct and stable when you set the eggs.
- If you are using an automatic turner, test it completely before setting the eggs.
- In incubation the eggs are set for 18 days in the setter and for the last 3 days in the hatchery

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write types of Incubation? .(5 points)
2. Define incubation period.(5 points)

Note: **Satisfactory rating - 10 and 10 points** **Unsatisfactory - below 10 and 10 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

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Information Sheet- 2	**Identifying basic Incubators and accessory equipment requirements**

2.1 Identifying Basic Incubators and accessory equipment requirements

The tolerance of the embryo to different ranges of humidity are greater than temperature, but there are negative consequences observed with humidity below 40% and above 90%.

Good hatchability is achieved when relative humidity is maintained at approximately 50-65% until 18 days of incubation, at the last 3 days it should be increased to between 70-90%.

Measure the humidity level in the incubator. Using a wet bulb thermometer or hygrometer, take a reading of the humidity level. Be sure as well to record the temperature in the incubator using a dry bulb thermometer**.**

2.2 Types of Incubators

Incubators are machines, types of which artificially provide the egg with the correct, controlled environment for the developing chick. Depending on complexity, an incubator will give varying degrees of control over temperature, humidity, egg turning, fresh air flow and hygiene, while providing a secure place for the eggs. The basic types of incubators may be classed as still air incubators, forced draft incubators and contact incubator types according to how air is circulated

1. Still Air (Flat Type) Incubators

Still air incubators also called flat type incubators are the most basic form of incubator. A still air incubator is basically small size insulated box with capacity of 50 to

500 eggs at a time. Still-air incubators have no fans, so the air is allowed to stratify. The air inside a still air incubator is circulated by convection. As the air is heated it expands and rises to the top of the incubator. The amount of airflow achieved in a still air machine is therefore determined by the ratio of air temperature inside the box to outside, that is the lower the air temperature outside the box; the greater the airflow inside. To achieve good air circulation, air inlets are usually positioned in the base and top of the incubator. Inside a still air incubator, the warm air moves towards the top so different temperatures will be recorded at different levels. Basic parts of still air incubators to be studied along with their functions are:

- ✓ Heating element: is a device that provides heat.
- ✓ Electric bulb: light source inside the machine.
- ✓ Thermostat : is a device that control the incubator temperature
- ✓ Egg setting tray: to set eggs which is used during the first 18 days
- ✓ Egg hatching tray: used to hatch eggs which is used during the last 3 days. Hatching eggs are set in the flats or bug-eye type trays.
- ✓ Thermometer: an instrument used to measure the air temperature
- ✓ Water tray (pan): for holding water used as humidifier.
- ✓ Air Vent: the air vent is a circular opening with shutter on the top front (air out let) and on the bottom (air inlet). This allows you to manipulate how much fresh air enters the machine and CO_2 exits.
- ✓ Hygrometer: Some machines may have a hygrometer for humidity measurement
- ✓ Turning mechanism: Some machines may have turning mechanism for automatic turning of eggs

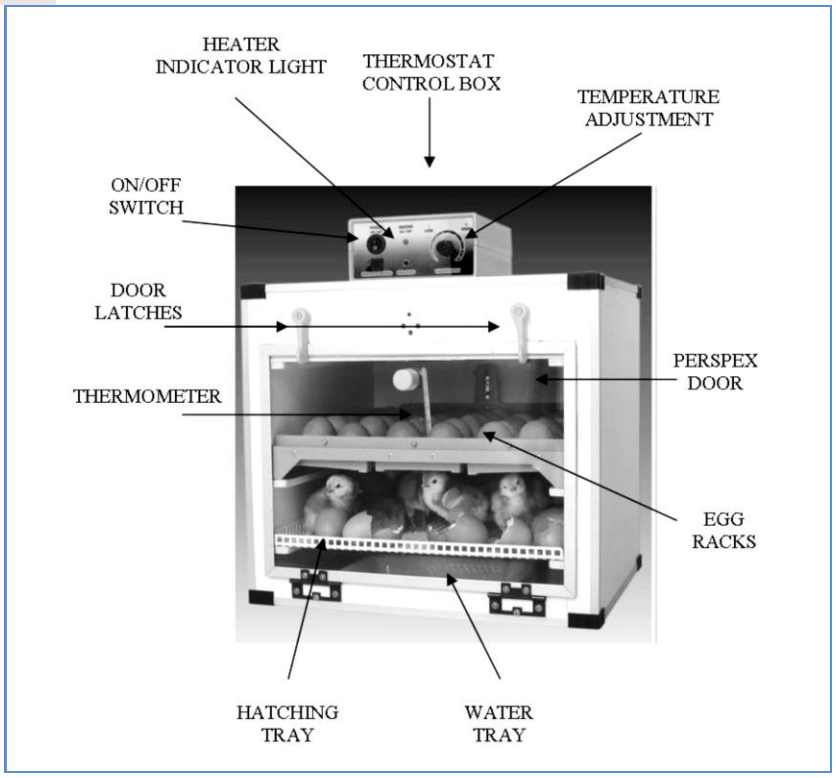

Figure 1, Still air incubator

2. Forced Draft (Cabinet Type) Incubators

The forced draft or cabinet type incubators were developed to overcome temperature gradient problems throughout the incubator. In a forced draft incubator a fan is used to circulate the air, which gives a uniform temperature throughout the machine. The air temperature surrounding the egg is therefore constant and positioning of the thermometer and temperature sensor is less critical. Eggs, too, can be of differing size and set in trays at different levels. Using a forced draft incubator also allows the use of a Wet Bulb Thermometer, which can be used for the accurate reading of humidity. Eggs are placed in stacks of trays. Most units have automatic equipment for turning the eggs and spray mist nozzles for holding proper humidity levels. It is of more importance to control humidity in a forced air machine to prevent the higher airflow

drying the eggs. In addition to the basic parts of still air incubators, the forced air (cabinet type) incubators have the following parts as shown also on.

- ✓ *Ventilating Fan*: is a device that circulate and distribute air and heat in the incubator.
- ✓ *Wet-bulb Thermometer*: a thermometer with the bulb or sensor covered with a water moistened wick in a moving air stream.
- ✓ *Turning or tilting mechanism*: forced air incubators have turning mechanism for automatic turning of eggs.

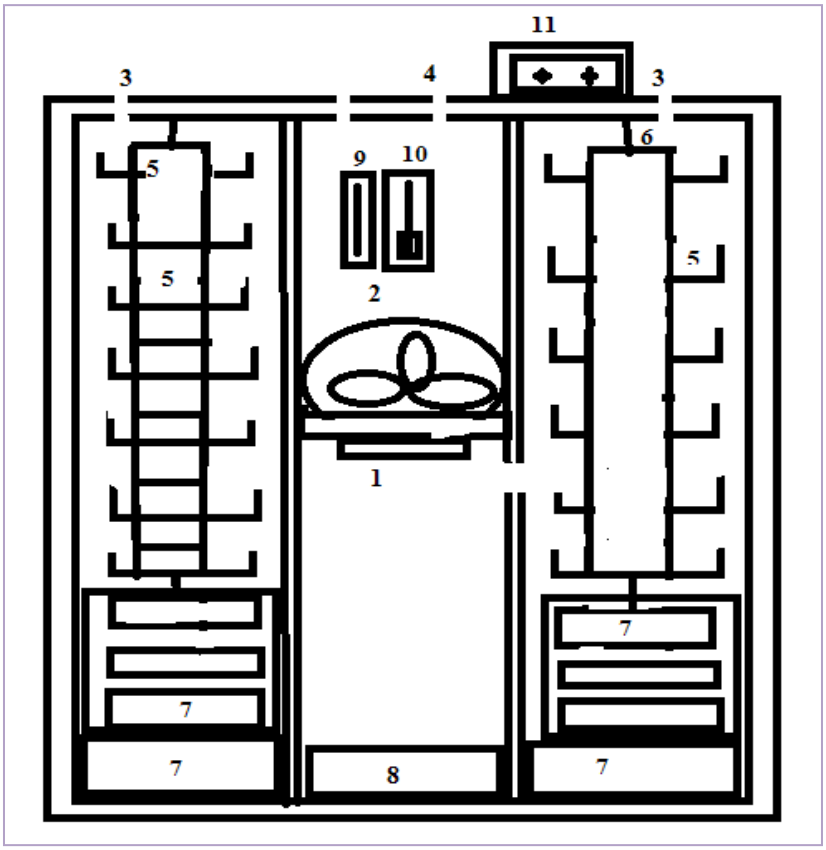

Figure 2 .Basic parts of Forced air

Key:

1= Heating element

2= Fan

3= Air outlet (vent)

4= Air inlet (vent)

5= Setting (incubating)

Egg trays

6 = Tray racks (supports)

7 = Hatching egg trays

8 = Water tray

9 = Dry bulb thermometer

10 = Wet bulb thermometer

11 = Thermostat

3. Contact Incubators

Contact incubation mimics the natural incubation process that occurs in the nest. The most striking difference between natural and artificial incubation is the fact that the natural parent provides warmth by contact rather than surrounding the egg with warm air. This may not at first sight seem significant but important research studies have revealed major unsuspected differences in thermal behaviour of eggs incubated by contact rather than convection. Crucially, eggs in a forced draft incubator have near uniform temperature throughout incubation; there will be some increase in embryonic temperature towards the end of incubation as a result of increased metabolism but otherwise the whole egg will remain near incubator air temperature. By contrast, eggs incubated naturally or by contact, have significant temperature differences. Heat is entering the egg over a relatively small brood patch, which is therefore warmer than

other regions of the egg and is being lost from most of the remaining shell area, which is cooler

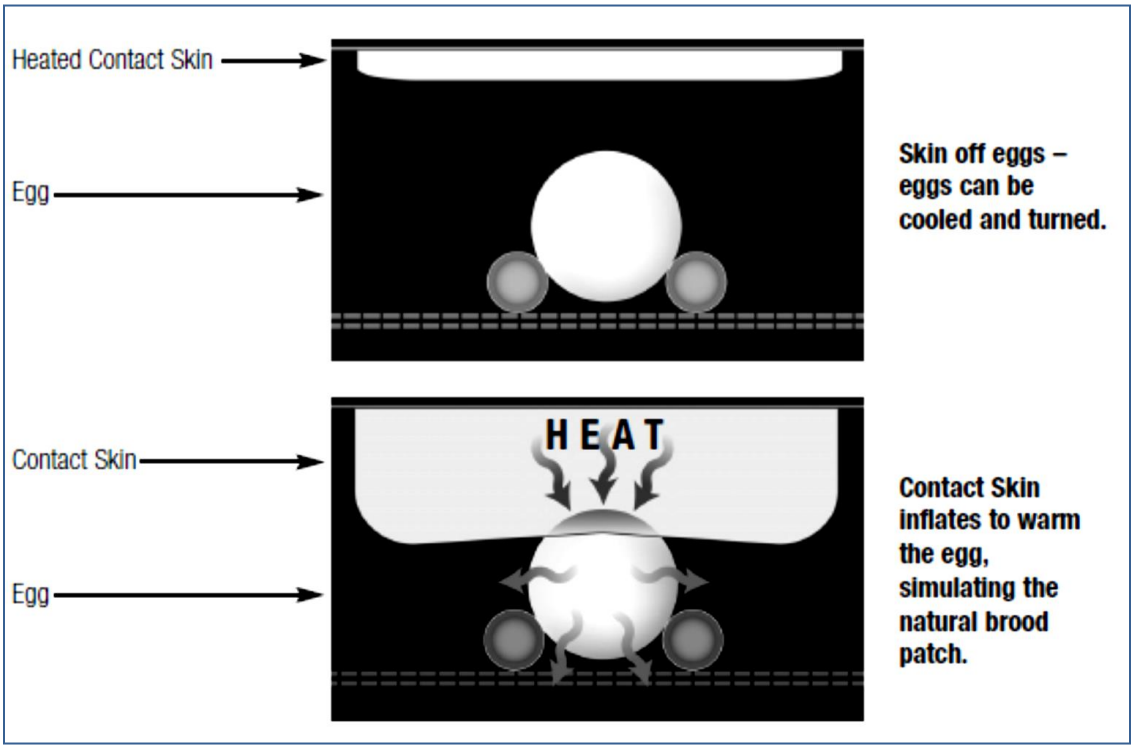

Figure 3 Parts of Contact incubator

1. Maintaining air flows, construction standards

In addition to the setters and hatchers it is also important to maintain and check the other equipment in the Hatchery properly. Manufacturer's recommended maintenance programs should be adhered to. The following are common problem areas in hatcheries. Air handling systems: Filters need be cleaned or replaced regularly as blocked filters will reduce the oxygen supply to the eggs Air handling system filters that are not regularly cleaned or replaced become blocked and will prevent oxygen entering the hatchery. The operation of a chick hatchery involves the production of the largest number of quality chicks possible from the hatching eggs received at the hatchery. In addition, chicks must be produced economically. The following steps should be followed properly for successful hatchery operation. The sequences of hatchery operations and routine incubator management activities followed in commercial hatcheries are described below:

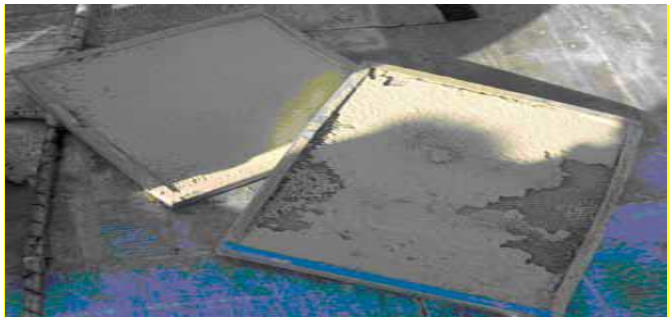

Figure 4 maintaining air flows

2.1.1 Clean, Disinfect and Fumigate Incubator

. The following procedures should be followed during cleaning, disinfection and fumigation of incubator

- Loose fittings of the machine should be removed first, and then washed and disinfected separately, and then fitted at their respective places.

- The interior of the machine should be washed with 4% solution of washing soda followed by disinfection with phenyl or lysol.
- The incubator should be fumigated with formaldehyde (40% Formalin) and potassium permanganate ($KMnO_4$).
- Before fumigation thermometers should be removed as during fumigation excessive heat generation may damage these sensitive parts of the incubator. Air inlet and outlet should be closed properly to conserve the fumigated gas inside the incubator.
- Quantity required for fumigation: 20 g of $KMnO_4$ crystals and 40 ml formalin for each 3 m^3 of space inside the incubator or hatchery for a period of 3 to 4 hours is adequate. Place $KMnO_4$ crystals in enamel bowl (porcelain basin) and kept at the bottom of the incubator; then formalin is poured over it to liberate formaldehyde gas. The enamel bowl should have sufficient volumetric capacity to avoid overflowing during reaction. After fumigation the incubator should be opened and ventilated properly before setting of eggs to remove traces of poisonous gas.

2.2 Replace fan motors

Ventilation fans should be checked to ensure that they turn at the correct rpm (revolutions per minute) as recommended by the manufacturer Where fan belts are used they and the pulleys should be routinely checked for wear and adjustment

Figure 5 using a strobe light to check fan speeds

Ventilation inlet and outlet dampers should be checked to make sure they operate correctly and that air flow through the setter at the same damper opening is the same in all machines of the same design. Uneven air flows between machines will indicate that the hatchery ventilation system is unbalanced. Where wet bulb thermometers are used to control or measure humidity, ensure that the wicks are turned daily and replaced regularly (or after every hatch in a hatchery) and that distilled water is used.

Multistage incubators are operated continuously and this can make it difficult to properly maintain, clean and disinfect the machines. It is good practice to plan for each setter to be emptied of eggs at least once per year so that a full maintenance and a thorough cleaning and disinfection can be carried out.

2.3 fix alarms and investigate causes

2.3.1Set up and Test the Incubator

Prepare and adjust the incubator 2 to 3 days for still air incubator and one week for forced air incubators before the actual setting of the eggs.

The following steps should be followed in the preparation and setting up of the incubator

- Mount thermometer either inside the unit or in the mounting brackets at the front of the unit.
- Fill the water pan in the bottom of the unit with lukewarm water.
- In units with plastic egg trays ensure they are correctly fitted in the racks.
- If using wet bulb thermometer fill bulb with lukewarm water and place inside the unit.
- Plug in and switch unit on at the control box.
- The red light at the front of the unit will come on to indicate the heating element is on. Set the optimum temperature on the control knob.

- The fan inside the unit will also come on and continues to run even when the element indicator light goes off, this is to give a more even and constant temperature throughout the incubator cavity.

2.4calibrating temperature and humidity probes

- Once the element indicator light goes out, check the temperature on the thermometer. If the temperature is too low then turn the control knob on the front of the unit clockwise. The red light will come on again to indicate the unit is continuing to heat up. If the temperature is too high then turn the control knob anti-clockwise, wait and check the temperature.
- Check the relative humidity of the incubator by comparing dry and wet bulb thermometer reading.

Figure 6 Calibrating by locating the calibration probe next to the machine temperature sensor

- Evaluating alternative options to Incubator and accessory equipment for applicability.
- Identifying and address Storage and housing requirements for Incubator and accessory equipment
- Locate the incubator in a well-ventilate room
- Maintaining water reservoirs and electricity at the appropriate level, in order to keep the proper level of humidity.

- Locate the incubator in a well-ventilate room
- Maintain water reservoirs and electricity at the appropriate level, in order to keep the proper level of humidity.

Figure 7 calibrating temperature and humidity

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write at list five calibrating temperature and humidity? (5 points)
2. Write types of incubator? (5 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

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Information Sheet- 3	**Evaluating alternative options to Incubator and accessory equipment for applicability.**

3.1 Hatchery Equipment and Machines

In addition to incubators and its accessories other hatchery equipment's, tools and machineries are described below.

- Egg handling equipment includes- hatchery carts, egg cases, egg flats, egg grader, egg candles, vacuum egg lifts (egg transfer machines), egg washer, fumigation cabinets, , In vaccination equipment Generator ,Heater, Electric lamps, Incubator
  Chick handling equipment includes - chick boxes, chick box racks, service tables, de-beaker, vaccination equipment, and incinerators.

- Emergency standby electric generator: When there is a failure in the local electrical supply, the incubators must have a secondary source of electricity. Therefore, a standby electrical generator located on site, generally within, or next to the hatchery building is imperative. The standby electrical generator should have the capacity to support the all essential services of the hatchery

3.2 Checking Incubators and Hatchers

There are several useful techniques for identifying problems in setters and hatchers in addition to the normal maintenance checks. The eyes and ears of the hatchery staff are important tools in identifying potential problems. For example:

• Heaters and coolers operating at the same time or staying on for long periods of time can indicate: Sensor calibration problem or sensor failure. Localized cooling from a water leak, the cooling solenoid is stuck open or cold air entering the machine. Heater bar stuck on. Damper stuck (open or closed). Condensation on cooling pipes while setters are warming eggs can indicate: The cooling solenoid is stuck open.

• The hissing sound of water passing through the solenoid when the cooling is off can indicate: The cooling solenoid is stuck open. Water on eggs or floor can indicate: Atwater leak. Too low water pressure to humidity nozzles. Blocked or partially blocked humidity nozzles. Eggs stay turned in the same direction for more than one hour indicates: Turning mechanism failure. Eggs turned at different angles indicates: Turning mechanism failure. Turning mechanism not connected correctly. If the setter goes through a cycle of heating, cooling and humidifying, possibly with a change in ventilation Damper opening it can indicate: Too much air is passing through the machine. The temperature control system has cooling and heating set points too close together. Noisy fans or fan belts can indicate: Fan bearings starting to fail. Worn fan belts.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write at list five Checking Incubators and Hatchers? (5 points)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

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Information Sheet- 4	**Identifying and address Storage and housing requirements for Incubator and accessory equipment**

4.1 Incubation Reminders

Keeping good records of maintenance checks and equipment failures is a good tool for helping determine the Frequency of future checks and to help manage the spare part inventory Simple records can be an aide to managing the maintenance program.

- ✓ Place the incubator in a room with a constant temperature, no drafts or direct sunlight.
- ✓ Sanitize the incubator.
- ✓ Wash hands before touching eggs.
- ✓ Keep germs, dirt and oil away from incubating eggs.
- ✓ Only incubate eggs together from species with similar incubation periods
- ✓ Keep the small end of the egg lower than the large end.
- ✓ Record of incubator data daily.
- ✓ Ensure that the humidifier is working or that the water pan is filled.
- ✓ Verify humidity levels are between 55 to 65%.
- ✓ Check temperature daily and keep it at 99.5°F to 100°F.
- ✓ Turn eggs at least 5 times a day until 3 days before hatch.
- ✓ Increase ventilation during the last third of incubation.
- ✓ Do not turn for the final 3 days.
- ✓ Provide a cloth or rough paper for the chicks to walk on.
- ✓ Increase humidity 70%-90% at hatch stage

4.2 The following rooms are necessary

1. The egg-receiving – grading – and storage rooms

- ✓ If the hatching eggs need to be stored for several days keep the temperature at 18^{O}C (64^{O}F) with a relative humidity of 70 – 80%.
- ✓ Clean the grading/setting room after every setting and the egg receiving area and storage room at least once a week.

2. Disinfection room

- ✓ After the eggs are strayed (for incubation) they need to be fumigated. This is best done in a special designed room between the egg receiving-grading- and storage room, and the incubator room.

2. Incubator room

Optimum temperature:

- ✓ ± 22^{O}C (72^{O}F) and
- ✓ Relative humidity: 50%.

For easy handling of trolleys and trays minimum working space of 3 meters should be allowed in front of the incubator.

Depending on the type of incubator used, a distance of 60 cm should exist between the incubators and between the back of the incubator and the wall.

For cleaning purpose it is desirable to have 1.5 meter space above the incubator. The fan capacity depends on the type and capacity of the incubator. Generally speaking a standard of 57 m3 air per hour for each 10,000 incubated eggs is recommended. For the ventilation of the incubator a separate incubator-

ventilation-system is preferable In this room the eggs are incubated for 18th day and transferred on the hatching trays through a shutter to the hatching room

Figure 8 Incubator room

4. Hatching room

- ✓ For hygiene reasons it is preferable to have two or more hatching compartments;
- ✓ Especially if chicks pip more than twice a week. The optimum temperature in the hatching room is 22^{O}C and the relative humidity 60%.
- ✓ If possible apply the separate- hatchery- ventilation-system.
- ✓ The ventilation capacity depends on the type of incubator.
- ✓ As a general standard 370m3 air per hour for 10,000 eggs is recommended.
- ✓ Use for the room exhaust fans (under-pressure-ventilation).

5. Sexing room

- ✓ Temperature should be 22^{O}C and relative humidity 60%.

6. Chick room / packing dispatch

- ✓ In this room the chicks are vaccinated, counted and put in boxes.

7. Chick storage room

- ✓ The storing is done on racks or trolleys. Keep enough space between the boxes. Prevent direct sunlight. Optimum temperature should be 24^{O}C and relative humidity 60%.

8. Washing room

- ✓ Good facilities are required for soaking, washing and scrubbing of trays etc. it may be very convenient to have two compartments: one for cleaning and one for disinfection.

9. Disposal room

- ✓ This room is used for temporary storage of the disposal bins with dead chickens and egg shell

10. Loading room

- ✓ This part of the hatchery is used for loading the chicks van (control of rain, sunshine and temperature). A raised platform for loading the lorries is very convenient.

11. Hygiene room

- ✓ The necessity of a strictly applied complete hatchery sanitation-program is generally admitted for sanitary reasons. A hatchery should have only two entrances (doors) viz.: one for the workers and one for the garbage removal.

4.3 Sanitation of Incubator and Equipment

No matter what type of incubation you use, it is important that you thoroughly clean and disinfect the incubator before and after you use it. It is just as important that the incubation room and egg storage area are kept equally clean. The lack of sanitation will decrease hatchability.

Immediately after each hatch, thoroughly clean and disinfect all hatching trays, water pans and the floor of the hatcher. Scrape off all egg shells and adhering dirt. Wipe clean surfaces thoroughly with a cloth dampened in quaternary ammonium, chlorox or other disinfectant solution.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write at list five Incubation Reminders? (5 points)
2. Write at list five rooms are necessary and functions? (5 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

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Information Sheet- 5	Locate the incubator in a well-ventilate room

5.1 Locate the incubator in a well-ventilate room

While most incubators operate using electricity, there are some that run on paraffin lamps When using this type of incubator it is important to Ventilate the exhaust gasses out of the building If not properly ventilated, the gasses can build up and kill the developing embryos and lower the Number of chicks hatched It can also cause health problems for the people living and working there.

Example of a paraffin heated incubators

Provide a safe place for them that prevents predators from eating them Keep food and water close by Provide adequate ventilation When chicks are small provide a safe place

for them Keep a fence around the area to keep them safe during the day from predators At night, lock them in a safe house with their mothers to keep protect them

Figure, Using Hens to Hatch Eggs

5.2 Ventilation and Carbon Dioxide/Oxygen Concentration

- ✓ Embryonic growth is optimised at an air concentration of carbon dioxide of 0.4%
- ✓ Embryonic growth is depressed and mortality increased with carbon dioxide concentrations above 1%. The normal atmosphere contains 21% oxygen and 0.04% carbon dioxide.
- ✓ For every % increase of oxygen, the hatchability is decreased by 1%, and for every % decrease of oxygen ,the hatchability is decreased by 5%
- ✓ The hatched chick is most susceptible to oxygen deviation (compared to the pipped chick and the embryo in the intact egg), which implies that ventilation rate and carbon dioxide concentration is most critical in the late phase of incubation.

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write at list five advantages of Locate the incubator in a well-ventilate room? (5 points)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

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Information Sheet- 6	Maintaining water reservoirs and electricity at the appropriate level

6.1 **Incubation Relative Humidity**

It takes 21 days for eggs to hatch, hens that set on eggs and care for young do not lay eggs during that time Incubating eggs in an incubator allows hens to continue to lay eggs Requirements for incubation (embryo growth) are Correct temperature ~ (99.5, 98– 100^{o} F) Do not place incubators in direct sunlight as it can cause them to overheat during the day Make sure the incubator is located in a well ventilated room that protected from the environment Correct humidity ~ 55%, or 28.5^{o}C (83^{o}F) wet bulb Make sure water reservoirs are maintained at the appropriate level, in order to maintain the proper level of humidity Regular turning of eggs ~ 4-8 x per day

- The tolerance of the embryo to different ranges of humidity are greater than temperature, but there are negative consequences observed with humidity below 40% and above 90%.
- Good hatchability is achieved when relative humidity is maintained at approximately *50-65%* until 18 days of incubation, at the last 3 days it should be increased to between 70-90%.
- Measure the humidity level in the incubator. Using a *wet bulb thermometer or hygrometer,* take a reading of the *humidity* level. Be sure as well to record the *temperature* in the incubator using a *dry bulb thermometer*.

6.2 Ventilation and Carbon Dioxide/Oxygen Concentration

- Embryonic growth is optimism at an air concentration of carbon dioxide of 0.4%
- Embryonic growth is depressed and mortality increased with carbon dioxide concentrations above 1%. The normal atmosphere contains 21% oxygen and 0.04% carbon dioxide.
- For every % increase of oxygen, the hatchability is decreased by 1%, and for every % decrease of oxygen ,the hatchability is decreased by 5%

The hatched chick is most susceptible to oxygen deviation (compared to the pipped chick and the embryo in the intact egg), which implies that ventilation rate and carbon dioxide concentration is most critical in the late phase of incubation**.**

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define Good hatchability? (5 points)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

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Operation sheet-1	Set Up and Test the Incubator Techniques

Steps /procedures

- Wear PPE
- Mount thermometer either inside the unit or in the mounting brackets at the front of the unit.
- Fill the water pan in the bottom of the unit with lukewarm water.
- In units with plastic egg trays ensure they are correctly fitted in the racks.
- If using wet bulb thermometer fill bulb with lukewarm water and place inside the unit.
- Plug in and switch unit on at the control box.
- Once the element indicator light goes out, check the temperature on the thermometer
- Check the relative humidity of the incubator
- Make sure the turner functions properly at the required angle and rate or frequency.
- The incubator about 24 hrs. to settle down in temperature
- Do not set the eggs until temperature and humidity are correct and stable

Operation sheet-2	egg candling operation Techniques for hatchability

Steps /procedures

- Wear PPE
- Remove all eggs from the incubator and place in egg trays
- Dim the lights
- Hold each egg, one at a time, against a Candling Torch
- Discard non-fertile eggs (“clears”) or those that have stopped developing (“quitters”)
- Return viable eggs to the incubator

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 10 hours.

Task 1. Wear PPE

Task 2. Clean, Disinfect and Fumigate Incubator

Task 3. Set Up and Test the Incubator

Task 4. Warm Eggs prior to Setting

Task 5. Load Eggs in the Setter Incubator

Task 6. Operate Setter Incubator

Task7 Candle and Transfer Eggs to Hatcher

List of Reference Materials

1. Agromisa (2003). Chicken farming in the tropics 1: basics. Educational material no. 32. ISBN 90-5285-006-2.

2. Agromisa (2003). Chicken farming in the tropics 2: lecture notes. (ed. E.H. Ketelaars) Educational material no. 33. ISBN 90-5285-060-7.

3. Chinombo, D., Jere, J., Kapelemer-Phiri, G. & Schleiss, K. (2001). The Malawi smallholder poultry production model (MSPPM): A Poverty reduction strategy. Livestock, Community and Environment. *Proceedings 10th Conference of the Association of Institutions for Tropical Veterinary Medicine*, 2001, Copenhagen, Denmark.

4. C.V. McAinsh and J.C. Riise, 2005. Farmer Field Schools Facilitator's manual on small-scale village poultry production. Network for Smallholder Poultry Development. ISBN 87-990401-2-3.

5. Dawit Alemu, Tamirat Degefe and Setotaw Tefera. Overview and background paper on Ethiopia's poultry sector: Relevance for HPAI research in Ethiopia. Ethiopian Institute of Agricultural Research. Devesh Roy International Food Policy Research Institute.

6. FAO, (2009). Good practices in small scale poultry production: A manual for trainers and producers in East Africa. FAO ECTAD Regional Unit Eastern Africa, Nairobi, Kenya

7. Production. FAO Animal Production and Health no. 1. ISBN 92-5-105082-1. Also via : http://www.fao.org/docrep/008/y5169e/y5169e00.htm

https://www.youtube.com/watch?v=M4UhRXLriXA

Poultry Production

Level-III

Learning Guide -31

Unit of Competence: Perform Hatchery Operation

Module Title: Performing Hatchery Operation

LG Code: AGR PLP3 Mo8 LO2-LG-31

TTLM Code: AGR PLP3 TTLM 1219v1

LO 2: Select and store Hatching egg

Instruction Sheet	Learning Guide # 31

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Noting egg collection times, frequency and safety required by the enterprise.
- Operating equipment's according to manufacturer's instructions.
- Completing records of all collections to monitor production levels.
- Maintaining proper handling of eggs following collection
- Maintaining check right ratio of cock: hens, uniform size and shape of egg
- Storing fertile eggs according to standards condition for incubation purpose

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- ☞ Note egg collection times, frequency and safety required by the enterprise.
- ☞ Operate equipment's according to manufacturer's instructions.
- ☞ Complete records of all collections to monitor production levels.
- ☞ maintain proper handling of eggs following collection
- ☞ Maintain check right ratio of cock: hens, uniform size and shape of egg
- ☞ Store fertile eggs according to standards condition for incubation purpose

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below in page 18.
3. Read the information written in the information “Sheet 1- 6”.
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3, Self-check 4, Self-check 5 and Self-check 6” in page -26, 31, 33, 36, 39 and 43 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3” in page -44.
6. Do the “LAP test” in page – 45 (if you are ready).

Information Sheet-1	**Noting egg collection times, frequency and safety required by the enterprise**

1.1 Noting egg collection times, frequency and safety required by the enterprise

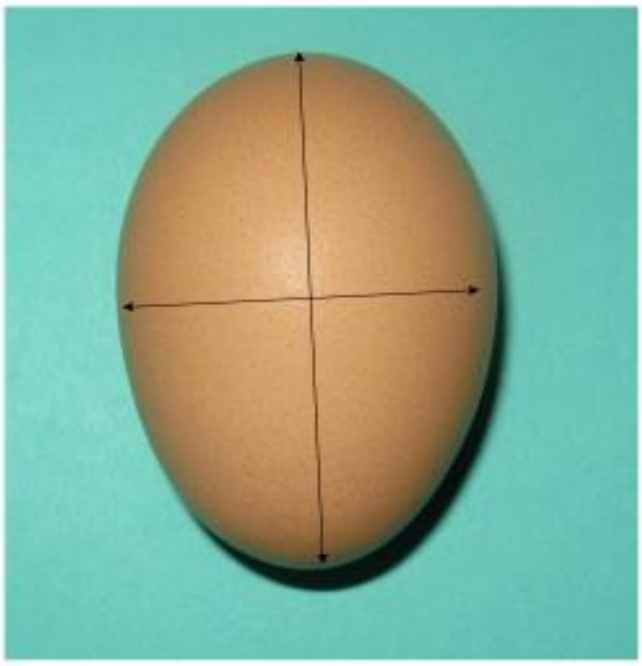
Collect eggs 2-3 times a day Store them with the big end up Store eggs for hatching in a cool part of the house Not too dry or too wet19-21 C is best temperature Avoid temperature fluctuations, keep constant temp Do not place in direct sunlight Only store eggs for 7 days or less before placing them under a hen Eggs from multiple hens can be placed under the same hen This allows you to place eggs that were lay date the same time.

Figure, egg collection

2.2 ideal hatching egg should

- ✓ Have a dimension length to width of 1.4/1.0.
- ✓ Have a weight and size within the average of the flock.
- ✓ Be laid in a nest that is dry, clean and protected from dust.
- ✓ Come from a flock that is free of disease.
- ✓ Be free of faeces, or nest litter.

- ✓ Be clean & not soiled by albumen or yolk from other broken eggs
- ✓ Be of uniform colour with a smooth shell exempt from roughness and calcium deposits.
- ✓ Have no solid shell, not broken, perforated or fragile and porous



Figure, best egg shape

2.3 Why some eggs don’t hatch

They were not fertile, They were stored too long or improperly, They were dirty, if an egg breaks and covers the other eggs it can prevent the egg from breathing, They get broken, Eggs were stored in direct sunlight, If eggs don’t hatch wait a couple of days and see, if they are fertile To see if they are fertile carefully open one end of the egg and look for an embryo

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the Why some eggs don't hatch?(6 points)
2. List out the ideal hatching egg should?(6 points)

Note: **Satisfactory rating - 12 points** **Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

- _____
- _____
- _____

_____

2.

- _____
- _____
- _____

Information Sheet-2	Operating equipment's according to manufacturer's instructions

2.1 Operating equipment's according to manufacturer's instructions

Once eggs are in the incubator, the machine should not be opened frequently avoid interference in maintaining temperature and humidity in it. Do not adjust the temperature or humidity for a few hours unless the temperature exceeds 38.9 ^{o}C(102 ^{o}F). After 4 hours, make proper adjustments. The final temperature should vary only 1/2 degree above or below 37.5 ^{o}C (99.5 ^{o}F). It is important the forced draft incubator temperature is recorded four times per day. The forced draft incubator has a fully automated system of turning the eggs which is activated via a 24 hour timer on the top of the incubator itself. This is set to turn the eggs at regular intervals throughout the day and night. Check there is sufficient water in the trays at the bottom of the incubator and in the wet bulbs to maintain humidity levels before replacing the egg.

2.2 calibrating temperature and humidity probes

2.2.1 Calibration

All sensors used to control temperature and humidity should be regularly calibrated against a calibration probe to ensure that they do not lose accuracy. The key points to successful calibration are: Manufacturers may provide guidelines on how to carry out calibration and these should be followed. The calibration probe needs to be of sufficient accuracy, stability and be routinely calibrated against a certificated sensor. Set acceptable deviation tolerances for the sensor being calibrated that is appropriate for the sensor type. The machine being calibrated should be operating in a stable situation, for example setters and hatchers should not be calibrated straight after an egg set or transfer. In single-stage incubators, it is better to calibrate the setter between 2 – 5 days

of incubation. Calibration should be carried out in a consistent fashion. That is, the calibration probe should be located in the same location, the eggs at the same stage of incubation, eggs turned in the same direction and ventilation fans turning in the same direction. The calibration probe should be positioned as close as possible to the machine sensor

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List out the calibrating temperature and humidity probes? (10 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

- _____
- _____
- _____

_____

information Sheet-3	Completing records of all collections to monitor production levels

3.1 Completing records of all collections to monitor production levels

To keep records is simply to collect relevant information that can help you to take good decisions and to keep track of activities, production and important events on a farm.

3.1.1 Records can be about

- Any performance of the chickens
- Economic development, or
- Any activity of the farmer or veterinarian.

It is important to keep record keeping simple, and to keep records systematic. If records should be of use for the farmer, than they must be complete (none missing), they should be true (collected carefully). When record can't be trusted because they are not complete or true, time should not be spent on it at all.

3.1.2The records can:

- Be used in determining profitability of various techniques used at the farm
- Be used to keep your memory on what you did and/or what happened
- Be used in decision making, especially on a strategic level
- Be used to compare the efficiency of use of inputs, such as land, lab our and capital, for example when implementing a new / alternative systems
- Help the farmer / investor in improving the efficiency of farm's operations

The real value is to support the farmer and the advisors to keep track and take decisions. Too often, records are only kept for the purpose of official reporting, e.g. to the Ministry headquarters for the parasitical and not used as a tool on the farm/ranch for making the decision in time.

The records should be simple, easy and quick to interpret, and then they can be supplemented with remarks which can explain some unusual events or findings.

3.1.3 What can records are used for?

If a farmer wants to build a financially successful livestock enterprise, record keeping is a must. The records can be used to further develop the farm and the herd, and thereby the sector in the country. For many farmers, it helps to think of their farm as a business, and to see that good care and good management actually also influences the production and profitability of the farm.

1. Production Records

These records are useful in measuring the performance of the animals and the herd. It contributes greatly to the economic appraisal of the enterprise. It can help farmers take decisions on investments, based on how many animals produce how much on the farm, so how much surplus can the family expects. The records can also be used by the whole sector to improve the genetics of the animals in the country, with specific focus on the production.

Figure, for record keeping

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention at list six advantages of records? (12 points)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

- _____
- _____
- _____

_____

Information Sheet-4	Maintaining proper handling of eggs following collection

4.1 proper handling of eggs collection

- ✓ Hatching eggs should be collected at least 4 times a day
- ✓ At the moment an egg is laid it has a temperature of 40-41^{O}C (104-105^{O}F). That means the body temperature of the hen.
- ✓ After an egg has been laid, this temperature should decrease gradually till 27^{O}C (80^{O}F) within approximately 6 hours.
- ✓ At this temperature the embryonic development slows almost to a standstill.
- ✓ If hatching eggs are kept at temperature above 27^{O}C the blastodisc development continues and when cooled down this over development blastoderm may later on die.
- ✓ Cooling down the egg too quickly is not good. In this case the blastodisc development is delayed which may result in a week blastoderm, which may die too.
- ✓ Those hatching eggs having a chance of gradual cooling-down get strong blastodisc which may well stand storage and transport.
- ✓ Always collect eggs into egg tray and keep cracks and dirties apart. It is not preferable to collect eggs into wire baskets or buckets.
- ✓ Pack all eggs small end down. Use key-tray-carriers. Keep egg boxes clean and use new key-trays
- ✓ Remember: Any Dirty or Cracked Egg is Lost as a Hatching Egg

4.2 Egg Storage

Eggs should be allowed to cool down gradually to the farm egg store temperature (refer to the Following Optimum Temperature Range for Egg Storage chart) before putting them into the egg Store. Store the eggs in a separate room that can be maintained at all

times according to the chart. A Relative Humidity of 75% should be maintained at all times. For long-term egg storage, refer to Cobb Hatchery Management Guide. Keep a record of the maximum and minimum temperatures and the relative humidity in the egg store. Read the thermometers three times a day, in the morning, mid-day and in the evening, at the same times every day. Condensation will form when cold eggs are taken into a warmer environment. This is often overlooked when eggs are being transported from the farm to the hatchery and can be prevented by using temperature controlled egg vehicles to transport eggs from farm to hatchery.

Figure, d/t egg color

The color of the egg shell does not affect the egg Eggs shells can be many colors including: white, brown, blue, green and olive Novice poultry producers usually become interested in artificial incubation of their own chicks. The success of this type project depends on proper care and incubation of the hatching eggs so healthy, vigorous chicks are produced. The following topics discussed in this publication will help improve the producer's success.

4.3 Selection of Hatching Eggs

Most producers set as many eggs as their breeders produce. If incubator space is the limiting factor, it is more profitable to select the better quality eggs for incubating. A few tips to follow when selecting hatching eggs are: Select eggs from breeders that are

1. well developed, mature and healthy
2. compatible with their mates and produce a high percentage of fertile eggs
3. are not disturbed much during the mating season; (4) fed a complete breeder diet; and
4. Not directly related [brother, sister, mother, father, etc.
5. Avoid excessively large or small eggs. Large eggs hatch poorly and small eggs produce small chicks.
6. Avoid eggs with cracked or thin shells. These eggs have difficulty retaining moisture
7. Needed for proper chick development. Penetration of disease organisms increase in cracked eggs.
8. Do not incubate eggs that are excessively misshapen.
9. Keep only clean eggs for hatching. Do not wash dirty eggs or wipe eggs clean with a damp cloth. This removes the egg's protective coating and exposes it to entry of disease organisms. The washing and rubbing action also serves to force disease organisms through the pores of the shell**.**

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write proper handling of eggs collection? (5 points)

2. Write criteria's of Selection of Hatching Eggs? (5points

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.
   - _____
   - _____
   - _____

   _____

2.
   - _____
   - _____
   - _____

   _____

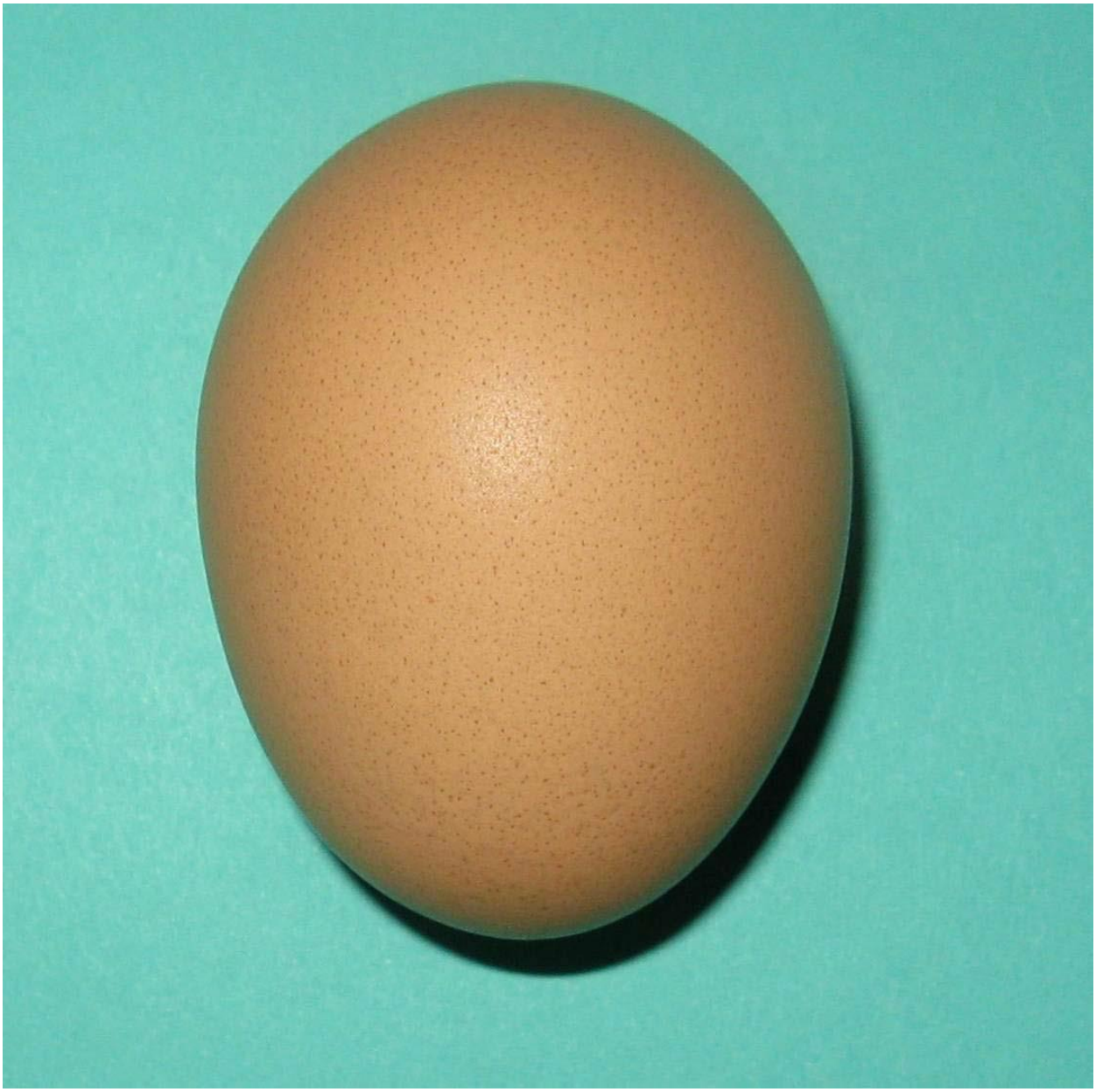
Information Sheet-5	Maintaining check right ratio of cock: hens, uniform size and shape of egg

5.1 Male to female ratio

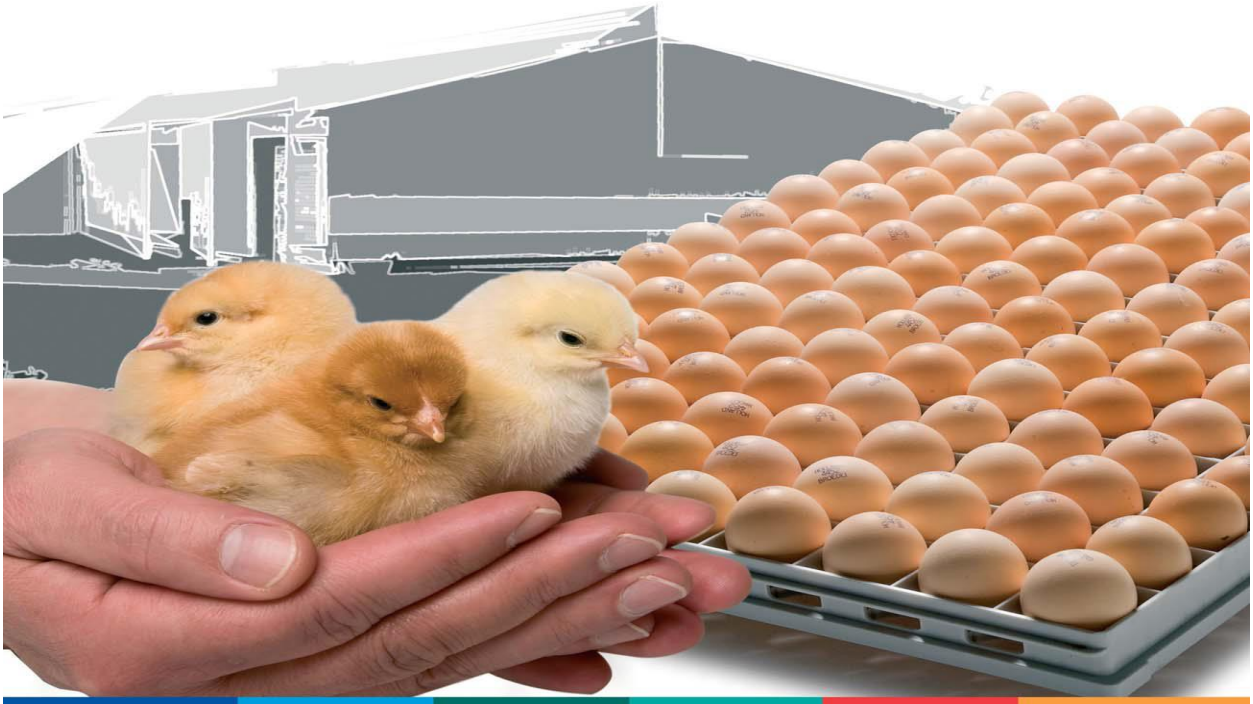
1. As production starts at least 8-10 males per 100 hens should be present for layers.
2. 10-12 males per 100 for meat type breeders.
3. An excess as well as a shortage of males will cause fertility problems in the flock.

5.2 Sex ratio and fertility

- The fertility in poultry to large extent depends on genetics and selection of bird as an inherent character, but it is equally affected by better management than in-heritance.
- The most important management point for it is sex ratio for mating.
- 8-10 males per 100 hens should be present for layers.
- 10-12 males per 100 hens for meat type breeders



Figure, uniform size and shape of egg



Figure, uniform size and shape of egg

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the Recommended Male to female ratio? (6 points)

2. Write the Recommended Sex ratio and fertility? (6 points)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

- _____
- _____
- _____
- _____

2.

- _____
- _____
- _____
- _____

Information Sheet-6	**Storing fertile eggs according to standards condition for incubation purpose**

1.1 Egg Care and Storage

Many times a producer carefully attends to the incubation process but disregards the care of the eggs before they are placed in the incubator. Even before incubation starts the embryo is developing and needs proper care. Hatching eggs suffer from reduced hatchability if the eggs are not cared for properly. Listed below are tips to help maintain hatching egg quality. Collect eggs at least three times daily. When daily high temperatures exceed 85 degrees F. increase egg collection to five times daily. Collect two or three times in the morning and one or two times in the afternoon. Slightly soiled eggs can be used for hatching purposes without causing hatching problems, but dirty eggs should not be saved. Do not wash dirty eggs. Store eggs in a cool-humid storage area. Ideal storage conditions include a 55 degree F. temperature and 75% relative humidity. Store the eggs with the small end pointed downward. Alter egg position periodically if not incubating within 4-6 days. Turn the eggs to a new position once daily until placing in the incubator. Hatchability holds reasonably well up to seven days, but declines rapidly afterward. Therefore, do not store eggs more than 7 days before incubating. After 3 weeks of storage, hatchability drops to almost zero. Plan ahead and have a regular hatching schedule to avoid storage problems and reduced hatches.

Allow cool eggs to warm slowly to room temperature before placing in the incubator. Abrupt warming from 55 degrees to 100 degrees causes moisture condensation on the egg shell that leads to disease and reduced hatches.

In normal hatchery operations, eggs cannot be set immediately after they are laid. Many hatcheries set eggs once or twice in a week. For the storage of hatching eggs

one needs a good egg storage room with controlled environment. The storage room should be fitted with a cooling and heating system and well insulated to maintain a constant temperature and humidity.

1.2 Hatching eggs storage management includes

1. **Egg storage duration**- hatching eggs should not be stored for more than 7 days; otherwise, prolonged storage can have a dramatic impact on percent hatchability. Storage prolongs incubation time
2. **Egg storage position**- eggs should be stored with small end down, if the storage duration is less than 7 days. If it is known that eggs are to be held for more than 7 days prior to setting, it is recommended to store eggs with the small end up to improve hatchability.
3. **Ventilation**- there should be air circulation in the storage room. However, the ventilation needs to be restricted to a minimum to reduce water loss from eggs
4. **Temperature-** ideal storage temperature is between 12-19ºC. If storage temperature is high then development of embryo can commence but at the wrong rate.
5. **Humidity-** The best humidity level at which to store eggs is between 70 to 90% RH to avoid significant drying out of the egg before incubation. The lower the relative humidity the higher the water evaporation,
6. **Turning During Storage-** if eggs are to be stored for more than 7 days, then eggs should be turned once a day at 45^{o} each way, back and forth through 90º during the storage period. Insufficient turning can cause the yolk to float and touch membranes near the shell. If the embryo touches then it may stick and prevent growth once inside the incubator

6.3 Principles of Artificial Incubation of Fertile Eggs

The four main essentials of incubation of good quality fertile eggs are:

1. Correct and even temperature controlled by a thermometer
2. Correct humidity controlled by ventilation rate and water application
3. Correct oxygen and carbon dioxide concentrations controlled by ventilation
4. Turning of the fertile eggs by approximately 90 degrees several times per day by manual or automatic means.
5. For the storage of hatching eggs one needs a good egg storage room. This room should have two compartments. One cleaning and grading eggs and storage of packing material, and the other for the storage of hatching eggs.
6. The storage of hatching eggs to be fitted with a cooling and heating system and well insulated to maintain a constant temperature and humidity. The K-value (heat loss kilo joule(kj) / hour) must be 0.4 – 0.5
7. For each square meter one may store 22 boxes (each of 360 eggs = 7920 eggs). If practicable, place the boxes on wood-slat platforms
8. Turning of eggs during storage allows the embryo to be exposed to new sources of nutrients and that this helps it to resist longer storage periods.
9. eggs stored at an angle of 50° and turned daily 180°, showed better hatch than non-turned eggs
10. When storing eggs less than 10 days, store them with the large end up. If eggs are held for 10 days or more, hatchability will be improved if stored with small end up.

	Period of egg storage in days						
	1-2	3-4	5-6	7-8	9-12	13-16	17-20
Temperature	19.0°C	17.0°C	15.5°C	14.0°C	12.5°C	12.0°C	11.5°C
Relative Humidity (%)	70.0	80.0	85.0	90.0	90.0	90.0	90.0
Turning	No	No	No	No	Yes	Yes	Yes
Small end up	No	No	No	No	No	Yes	Yes

11. Optimal hatchability is achieved in fresh eggs <10 days old, but reasonable hatchability can be obtained in eggs up to 14 days of age.
12. During storage loss of moisture from the egg takes place due to water evaporation.
13. Storing conditions however must never reach the dew-point when condensation on the shell surface would provide favourable conditions for microbial growth.
14. During the transportation of hatching eggs avoid shocks in order to prevent cracks. Exercise special care in loading and unloading.
15. At least twice a week (better daily) the eggs need to be taken from the egg supply farms and transported to the hatchery if an egg storage room is not available on the farm

Figure, checking egg store environment using a temperature and humidity sensor

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write at List six Hatching eggs storage management? (6 points)

2. Write at List six Principles of Artificial Incubation of Fertile Eggs? (6 points)

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

- _____
- _____
- _____

_____

2.

- _____
- _____

Operation sheet-1	Egg selection

Procedures/steps

- Wear PPE
- Collect/ buy/ eggs
- Select hatching eggs by using egg selection criteria (size, shape, smoothness, shell thickness, etc.)
- Take sample egg and break it to know whether it is fertile or not.
- Observe the broken egg and if there is spot (sperm) the egg is fertile.
- Finally, incubate only the selected eggs.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1. Egg selection?

List of Reference Materials

Agromisa (2003). Chicken farming in the tropics 1: basics. Educational material no. 32. ISBN 90-5285-006-2.

2. Agromisa (2003). Chicken farming in the tropics 2: lecture notes. (ed. E.H. Ketelaars) Educational material no. 33. ISBN 90-5285-060-7.

3. Chinombo, D., Jere, J., Kapelemer-Phiri, G. & Schleiss, K. (2001). The Malawi smallholder poultry production model (MSPPM): A Poverty reduction strategy. Livestock, Community and Environment. *Proceedings 10th Conference of the Association of Institutions for Tropical Veterinary Medicine*, 2001, Copenhagen, Denmark.

4. C.V. McAinsh and J.C. Riise, 2005. Farmer Field Schools Facilitator's manual on small-scale village poultry production. Network for Smallholder Poultry Development. ISBN 87-990401-2-3.

5. Dawit Alemu, Tamirat Degefe and Setotaw Tefera. Overview and background paper on Ethiopia's poultry sector: Relevance for HPAI research in Ethiopia. Ethiopian Institute of Agricultural Research. Devesh Roy International Food Policy Research Institute.

6. FAO, (2009). Good practices in small scale poultry production: A manual for trainers and producers in East Africa. FAO ECTAD Regional Unit Eastern Africa, Nairobi, Kenya

7. Production. FAO Animal Production and Health no. 1. ISBN 92-5-105082-1. Also via : http://www.fao.org/docrep/008/y5169e/y5169e00.htm

https://www.youtube.com/watch?v=M4UhRXLriXA

Poultry production

NTQF Level III

Learning Guide # 32

Unit of Competence: perform hatchery operation

Module Title: performing hatchery operation

LG Code: AGR PLP2 M0 LO1 LG-32

TTLM Code: AGR PLP 2 TTLM 0120v1

LO3. Operate setter

Instruction Sheet	Learning Guide # 32

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Undertaking preload check
- Taking and Recording Setter readings
- Fixing alarms and investigate causes
- Operating, repairing and maintaining setter
- Checking and calibrating temperature, humidity, ventilation and regular turning of eggs per day

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Under take preload check
- Taken and Recorded Setter readings
- Fix alarms and investigate causes
- Operate, repair and maintain setter
- Check and calibrate temperature, humidity, ventilation and regular turning of eggs per day

Learning Instructions:

1. Read the specific objectives of this Learning Guide .
2. Follow the instructions described in number 1 to 5.
3. Read the information written in the “Information Sheet (**1, 2, 3, 4 and 5**) in page 3**,6,14** and 28 respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the “Self-check 1, Self-check 2, Self-check 3, Self-check 4, and Self-check 5” in page 3, 6,14, and 28 respectively.
6. If you earned a satisfactory evaluation proceed to “the next topic”. However, if your rating is unsatisfactory, see your teacher for further instructions or read back the Learning guide information sheets 1-5. Submit your accomplished Self-check. This will form part of your training .
7. Do operations sheet and LAP test 23

Information sheet -1	**Undertaking preload check**

Preload operations

Prepare and adjust the incubator 2 to 3 days for still air incubator and one week for forced air incubators before the actual setting of the eggs.

The following steps should be followed in the preparation and setting up of the incubator :

- Mount thermometer either inside the unit or in the mounting brackets at the front of the unit.
- Fill the water pan in the bottom of the unit with lukewarm water.
- In units with plastic egg trays ensure they are correctly fitted in the racks.
- If using wet bulb thermometer fill bulb with lukewarm water and place inside the unit.
- Plug in and switch unit on at the control box.
- The red light at the front of the unit will come on to indicate the heating element is on. Set the optimum temperature on the control knob.
- The fan inside the unit will also come on and continues to run even when the element indicator light goes off, this is to give a more even and constant temperature throughout the incubator cavity.
- Once the element indicator light goes out, check the temperature on the thermometer. If the temperature is too low then turn the control knob on the front of the unit clockwise. The red light will come on again to indicate the unit is continuing to heat up. If the temperature is too high then turn the control knob anti-clockwise, wait and check the temperature.

- Check the relative humidity of the incubator by comparing dry and wet bulb thermometer reading.
- If the incubator has an automatic turner, make sure the turner functions properly at the required angle and rate or frequency.
- Give the incubator about 24 hrs to settle down in temperature, after this time you can make adjustment to the temperature.
- Do not set the eggs until temperature and humidity are correct and stable. The incubator should be on for at least 24 hours to make sure that it is all right.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the advantages of pre- heating of eggs before loading to the incubator . (5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1.

- _____
- _____
- _____
- _____
- _____

Information sheet-2	Taking and recording setter readings

Record keeping—Keep a daily record of the incubator environment. Record keeping can be used to detect malfunctions before a disaster develops. Also, records of fertility and embryo deaths alert the hatchery manager to production, storage, or incubator problems so that adjustments can be corrected before major losses occur. Proper records call attention to deviations that could destroy a producer's profits. A 5 percent loss of hatchability can go unnoticed. However, a 5 percent loss is 100 percent profit, and conditions that cause a 5 percent reduction in hatchability also contribute to health problems in successfully hatched chicks.

The above lists are important to make a perfect recording this thing in operating the incubators are :

- Once eggs are in the incubator, the machine should not be opened frequently to avoid interference in maintaining temperature and humidity in it.
- do not adjust the temperature or humidity for a few hours unless the temperature exceeds 38.9^{o}C (102^{o}F). After 4 hours, make proper adjustments.
- The final temperature should vary only *1/2* degree above or below 37.5 ^{o}C (99.5 ^{o}F).
- It is important the forced draft incubator temperature is recorded four times per day.
- The forced draft incubator has a fully automated system of turning the eggs which is activated via a 24 hour timer on the top of the incubator itself. This is set to turn the eggs at regular intervals throughout the day and night.
- Check there is sufficient water in the trays at the bottom of the incubator and in the wet bulbs to maintain humidity levels before replacing the egg.
- Maintain ventilation rate by setting air vent to the recommended level.

- Allow only trained and designated people to carry out incubation room tasks and handle eggs.
- Monitor the incubation room conditions (temperature and relative humidity). This is especially important when using still air incubators.

Record all incubator parameters

Every actives after loading of eggs on the incubators should recorded the most important thing we should record is:

- Incubators Temperature
- Relative humidity
- Storage conditions and storage length of the eggs
- Rotations of the egg
- Fertility of the egg by candling
- Hatchery %
- If any Faulty

Self-Check # 2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. what are the basic thing to be rerecorded (5 points)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1._____

_____

_____

2._____

_____

Information sheet-3	Fixing alarms and investigate causes

Incubators are machines, which artificially provide the egg with the correct, controlled environment for the developing chick.

Depending on complexity, an incubator will give varying degrees of control over temperature, humidity, egg turning, fresh air flow and hygiene, while providing a secure place for the eggs. The basic types of incubators may be classed as still air incubators, forced draft incubators and contact incubator types according to how air is circulated

This is the setup of our incubator alarm system. The incubator has a serial port on the back that sends out readings of the temperature, carbon dioxide concentration, and humidity at regular intervals. The RS-232 signal goes through our network wiring to a patch panel. A Linux server with a multiparty serial card monitors all the incubators simultaneously. The messages from the incubator look like this:

```
37.0 deg C      5.0 % CO2      81 % RH
```

These messages are logged on the server's Web page. When the CO2 drops below a certain level, it is an alarm condition and the message looks like this:

```
37.0 deg C      3.0 % CO2 LO  81 % RH
```

The Linux computer then sends out email messages and dials a modem to notify someone of the problem. Since most cell phones have caller-ID, the modem just hangs up when the scientist answers. The scientist then fixes the incubator, completing the circuit. The software remembers the previous alarm state so that only one email and one phone call are sent out to each user for each event.

Note that only the network wiring, not the network hardware, is used for the signals from the incubator. The RS232 signals never touch the computer network signals. It's a good idea to use a dedicated color for all cables carrying serial signals. We could also have used the telephone wiring system, since in our building the same type of wire is used for the telephones and network connections. But then we would have gotten in trouble with the Phone Cops.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Draw the message of the incubators looks like during co2 drops (8pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1. _____
2. _____
3. _____
4. _____
5. _____

Information sheet-4	Operating, repairing and maintaining setter

Operating, repairing and maintaining setter is a main activates that will be done in a proper manner. The operation of a chick hatchery involves the production of the largest number of quality chicks possible from the hatching eggs received at the hatchery. In addition, chicks must be produced economically.

The following steps should be followed properly for successful hatchery operation. The sequences of hatchery operations and routine incubator management activities followed in commercial hatcheries are described below:

Operate Setter Incubator

- Once eggs are in the incubator, the machine should not be opened frequently to avoid interference in maintaining temperature and humidity in it.
- Do not adjust the temperature or humidity for a few hours unless the temperature exceeds 38.9^{o}C (102^{o}F). After 4 hours, make proper adjustments.
- The final temperature should vary only *1/2* degree above or below 37.5^{o}C (99.5 ^{o}F).
- It is important the forced draft incubator temperature is recorded four times per day.
- The forced draft incubator has a fully automated system of turning the eggs which is activated via a 24 hour timer on the top of the incubator itself. This is set to turn the eggs at regular intervals throughout the day and night.

- ❖ Check there is sufficient water in the trays at the bottom of the incubator and in the wet bulbs to maintain humidity levels before replacing the egg.
- ❖ Maintain ventilation rate by setting air vent to the recommended level.
- ❖ Allow only trained and designated people to carry out incubation room tasks and handle eggs.
- ❖ Monitor the incubation room conditions (temperature and relative humidity). This is especially important when using still air incubators.
- ❖ Record all incubator parameters

Repairing and maintaining the hatchery machines basic guide line

There are several useful techniques for identifying problems in setters and hatchery in addition to the normal maintenance checks. The eyes and ears of the hatchery staff are important tools in identifying potential problems.

For example:

1. Heaters and coolers operating at the same time or staying on for long periods of time can indicate:

- Sensor calibration problem or sensor failure.
- Localized cooling from a water leak, the cooling solenoid is stuck open or cold air entering the machine
- Heater bar stuck on.
- Damper stuck (open or closed).

2. Condensation on cooling pipes while setters are warming eggs can indicate:

- ➢ The cooling solenoid is stuck open.

3. The hissing sound of water passing through the solenoid when the cooling is off can indicate:

- ❖ The cooling solenoid is stuck open.
- ❖ Water on eggs or floor can indicate:
- ❖ A water leak.
- ❖ Too low water pressure to humidity nozzles.
- ❖ Blocked or partially blocked humidity nozzles.

4. Eggs stay turned in the same direction for more than one hour indicates:

- Turning mechanism failure

5. Eggs turned at different angles indicates:

- Turning mechanism failure.
- Turning mechanism not connected correctly.
- If the setter goes through a cycle of heating, cooling and humidifying, possibly with a change in ventilation

6. Damper opening it can indicate:

- Too much air is passing through the machine
- The temperature control system has cooling and heating set points too close together

7. Noisy fans or fan belts can indicate:

- Fan bearings starting to fail.

- Worn fan belts.

APPENDIX 1: TYPICAL HATCHERY MAINTENANCE PROGRAM

Equipment	Frequency	Actions
Setters and hatchers	Several times a day	• Check temperature and humidity reading. • Check ventilation opening. • Check turning.
Egg stores	Several times a day	• Check temperature and humidity readings.
Incubator and hatcher rooms	Several times a day	• Check temperature and humidity readings. • Check static pressure reading if sensors are fitted.
Setters and hatchers	Daily	• Fill up water bottles and turn wicks for wet bulb thermometers if used.
Water chillers	Daily	• Check water temperature.
Hatchers	After every hatch	• Clean and disinfect. • Visually inspect for damage and wear. • Inspect fan belts for wear. • Check all fans and heater bars are working. • Check humidity sprays are working correctly, i.e., no droplets forming or leaks. Spray nozzles should be removed and cleaned to prevent build-up of deposits. • Check for water leaks from cooling and humidification system. • Check covers to protect sensors during washing are removed after cleaning. • Replace wet bulb wicks.
Hatcher and chick handling rooms	After every hatch	• Clean and disinfect. • Clean or replace air filters in air handling unit returns.
Standby generators	Weekly	• Test under load.
Room humidifiers	Weekly	• Clean nozzles and water reservoirs. • Disinfect water reservoirs.
Hatchery alarms	Weekly	• Test all alarms and dial-out systems.

Hatchery Maintenance

Equipment	Frequency	Actions
Setters	Single-stage - after every incubation. Multi-stage - monthly	• Clean and disinfect. • Visually inspect for damage and wear. • Inspect fan belts for wear. • Check all fans and heater bars are working. • Check humidity sprays are working correctly, i.e. no droplets forming or leaks. Spray nozzles should be removed and cleaned to prevent build-up of deposits. • Check for water leaks from cooling and humidification system. • Check covers to protect sensors during washing are removed after cleaning. • Replace wet bulb wicks. • Grease fan bearings and turning mechanism cogs. • Check turner mechanism for correct angle and smooth operation. • Inspect ventilation dampers and lubricate linkages.
Hatchery ventilation units	Monthly	• Clean or replace air filters. • Clean inside of air ducts.
Water chillers, air conditioning, air compressors, evaporative coolers	Every 3 - 6 months	• Maintenance as specified by manufacturer.
Setters	Every 6 - 12 months	• Calibrate sensors. • Check infertile egg temperatures.
Hatchers	Every 6 - 12 months	• Calibrate sensors.
Setter and hatcher rooms	Every 6 - 12 months	• Calibrate static pressure control sensors.
Calibration equipment	Annually	• Send for accredited calibration.

Table 1. Hatchery machine maintenance

Self check-4	Written test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention some waste materials produced in poultry farm. (5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1. _____
2. _____
3. _____
4. _____
5. _____

Information sheet-5	**Check and calibrate temperature, humidity, ventilation and turning of eggs per day regularly**

The Basics When incubating eggs, there are five key factors to bear in mind:

1. **Temperature** – With the egg at the correct temperature (for most species this is 37.5°C), the biological process of incubation will commence and the embryo will begin to grow. The correct temperature must be sustained throughout the incubation period.

   During incubation till 18 days the temperature should be 99,7^{0}F. In the hatcher the temperature should be 99^{0}F. Make sure of a constant temperature and regularly check the thermometers of deviations. During incubation a too high as well as a too low temperature has influence on the hatching results which has been proven in several trials. In the same time they may influence the time of incubation

2. **Egg turning and positioning** – As the egg is turned, the embryo will pass through the egg white, allowing it to gain fresh nutrients. As the embryo grows, correct positioning of the egg ensures that the embryo forms in the correct position for hatching.

During the incubation period (1-18days) the hatching eggs need regular turning (90□) to prevent that the embryos getting fixed to the eggshell. It is best to turn the eggs each hour. To increase the air velocity after 15 days, it is possible to stop turning at this time.

3. **Humidity** – The shell of an egg is porous, meaning that water can pass through it. Over the egg incubation period, water passes from the egg to the air outside. Correct humidity ensures that the right amount of water is lost over time.

It is important to remember that humidity will vary, and this is not a big problem; it is the average humidity that matters more.

Inside the incubator it is necessary to maintain a relative humidity of 52-55%. Which is equals an 84-85□F reading on the wet bulb (see appendix 2). In the hatchery, too, one should maintain a relative humidity of 52- 55% bus as soon as 1/3 of the shells of the hatching eggs have been fractured, one should raise the humidity up to 70-75% (91-92□ F wet bulb reading). This increase in humidity will appear normally without adjusting the hatchery settings.

4. **Fresh Ai**r – It is important to note that during incubation the egg breathes; it takes in oxygen from the surrounding air and releases carbon dioxide. A fresh air supply is vital to egg incubation and hatching eggs.

- A correct functioning of the ventilation system is needed:
- To supply oxygen
- To discharge carbon dioxide
- To distribute the heat evenly
- The carbon dioxide content inside the hatchery should never exceed 0,5%.

5. **Clean Environment** – During incubation, eggs are susceptible to infection. The warm, egg incubator is a perfect breeding ground for bacteria. Eggs should be clean and disinfected before egg incubation begins.

Calibration

All sensors used to control temperature and humidity should be regularly calibrated against a calibration probe to ensure that they do not lose accuracy. The key points to successful calibration are:

• Manufacturers may provide guidelines on how to carry out calibration and these should be followed.

• The calibration probe needs to be of sufficient accuracy, stability and be routinely calibrated against a certificated sensor.

• Set acceptable deviation tolerances for the sensor being calibrated that is appropriate for the sensor type.

• The machine being calibrated should be operating in a stable situation, for example setters and hatchery should not be calibrated straight after an egg set or transfer. In single-stage incubators, it is better to calibrate the setter between 2 – 5 days of incubation.

• Calibration should be carried out in a consistent fashion. That is, the calibration probe should be located in the same location, the eggs at the same stage of incubation, eggs turned in the same direction and ventilation fans turning in the same direction.

• The calibration probe should be positioned as close as possible to the machine sensor

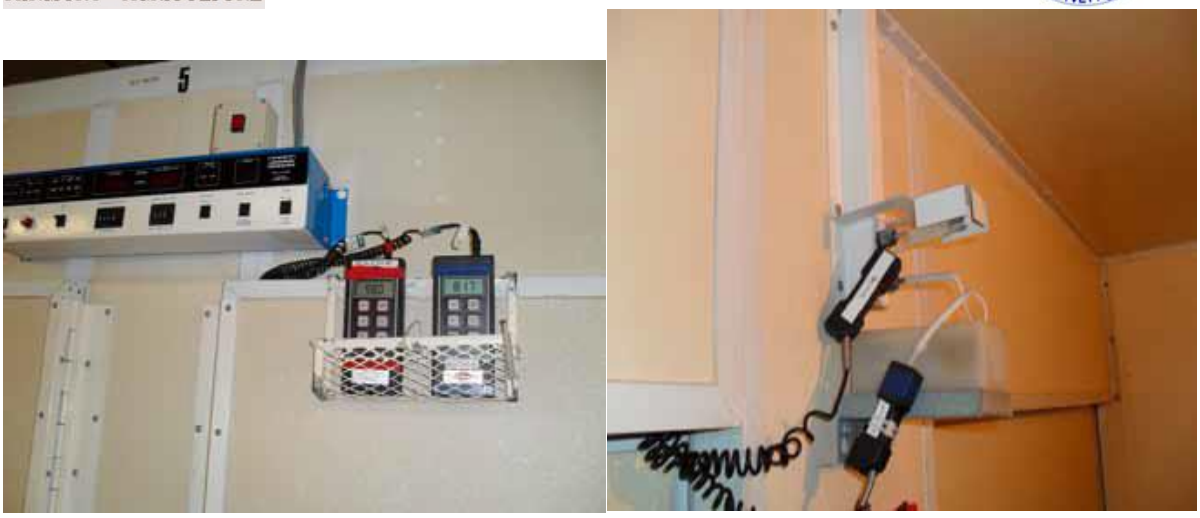


Fig.1 Calibration tools

- ✓ After positioning the calibration probe in the machine,allow sufficient time for the machine and sensors to stabilize. Typically this will take 30 minutes.
- ✓ If a sensor is found to be out of calibration, check that there are no equipment failures before adjusting the machine sensor.
- ✓ After adjusting a machine sensor, allow the machine and sensor to stabilize before recalibrating.
- ✓ Keep calibration records/checklists. These should include information on when calibration occurred, how much the machine was out of calibration and the result after adjustment

These records are useful tools for identifying problems and indicating how frequently calibration needs to be completed.

Self check-5	Written test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the Temperature ,relative humidity and turning of egg in the incubator .(5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1. _____
2. _____
3. _____
4. _____
5. _____

Operation sheet-2	Pre- check load

Objective :

- ❖ To check normal functions of the incubators
- ❖ To not to produce wastage of chickens during malfunctions

Procedures:

- ■ Wear PPE.
- Mount thermometer either inside the unit or in the mounting brackets at the front of the unit.
- Fill the water pan in the bottom of the unit with lukewarm water.
- In units with plastic egg trays ensure they are correctly fitted in the racks.
- If using wet bulb thermometer fill bulb with lukewarm water and place inside the unit.
- Plug in and switch unit on at the control box.
- The red light at the front of the unit will come on to indicate the heating element is on. Set the optimum temperature on the control knob.
- The fan inside the unit will also come on and continues to run even when the element indicator light goes off, this is to give a more even and constant temperature throughout the incubator cavity.
- Once the element indicator light goes out, check the temperature on the thermometer. If the temperature is too low then turn the control knob on the front of the unit clockwise. The red light will come on again to indicate the unit is continuing to heat up. If the temperature is too high then turn the control knob anti-clockwise, wait and check the temperature.

- Check the relative humidity of the incubator by comparing dry and wet bulb thermometer reading.
- If the incubator has an automatic turner, make sure the turner functions properly at the required angle and rate or frequency.
- Give the incubator about 24 hrs to settle down in temperature, after this time you can make adjustment to the temperature.
- Do not set the eggs until temperature and humidity are correct and stable. The incubator should be on for at least 24 hours to make sure that it is all right.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 8 hours.

Task 1. Pre- check load

References

CAB International 1987, Manual on poultry production in the tropics Wallingford, Oxon, United Kingdom

French, K.M. 1984, Practical Poultry Raising Peace Corps, Trans- Century Corporation, Washington D.C.

G.C Banerjee (2000) A text book of Animal Husbandry. 8thed Oxford & IBH publishing CO. Pvt.ltd, New Delhi / Calcutta, India

Poultry production

Level II

Learning Guide # 33

Unit of Competence: perform hatchery operation

Module Title: performing hatchery operation

LG Code: AGR PLP2 M0 LO1 LG-33

TTLM Code: AGR PLP 2 TTLM012020v1

LO4.Candling and Transfer

Instruction Sheet	Learning Guide # 33

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- ❖ Perform candling to removing eggs that can be identified as infertile or dead
- ❖ Remove possible sources of contamination from the incubator
- ❖ Safe egg handling/transfer to hatching trays
- ❖ Measure and place fumigant according to label instructions and safe work practices.
- ❖ fumigate setter and hatchery, using PPE and exclusion procedures

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- ➢ Perform candling to removing eggs that can be identified as infertile or dead
- ➢ Remove possible sources of contamination from the incubator.
- ➢ Safe egg handling/transfer to hatching trays
- ➢ Measure and place fumigant according to label instructions and safe work practices.
- ➢ Fumigate setter and hatchery, using PPE and exclusion procedures

Learning Instructions:

1. Read the specific objectives of this Learning Guide .
2. Follow the instructions described in number 1 to 6.
3. Read the information written in the “Information Sheet (**1, 2, 3, 4,5,and 6**) in page **2,4,9,12,15,19,23** and **27** respectively
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3, Self-check 4, Self-check 5” Self-check and Self-check 6n page **3, 5,11, 13,17,19,21 and 23** respectively.
5. Do the “LAP test” in page 23 (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work
6. If you earned a satisfactory evaluation proceed to “the next topic”. However, if your rating is unsatisfactory, see your teacher for further instructions or read back the Learning guide information sheets **1-6**. Submit your accomplished Self-check. This will form part of your training portfolio.

Information sheet -1	Perform candling to removing eggs that can be identified as infertile or dead

All incubated eggs will not hatch. It is probable that only 90 percent or less of incubated eggs are fertile. Removal of eggs that can be identified as infertile or dead eliminates possible sources of contamination from the incubator.

Candling is a process in which eggs are kept in front of a light source used to identify **cracked eggs, infertile eggs and dead embryo and remove them from the incubator**

There are two methods of candling; these are the

- ***Mass (table) candler*** . An entire tray of hatching eggs may be placed on the mass candler and examined with one observation
- ***Spot (individual) candler methods***. is a little slower, but it is more accurate

The eggs should be candled twice during the period of incubation,

- from the 5^{th} - 7^{th} days to remove all infertile eggs and those with dead embryos and

White-shelled eggs may be tested as early as the 5^{th} day whereas; dark brown-shelled eggs may be tested on the 7^{th} day

- From the 14^{th} to the 18^{th} day to remove embryos dying after the first test.

To test eggs by candling in dark room: hold the egg with the large end slightly above the horizontal and against a hole in the box or at the end of the light tube so that light from

the lamp passes through the egg. The Candler hole should fit tightly around the egg to prevent light leakage.

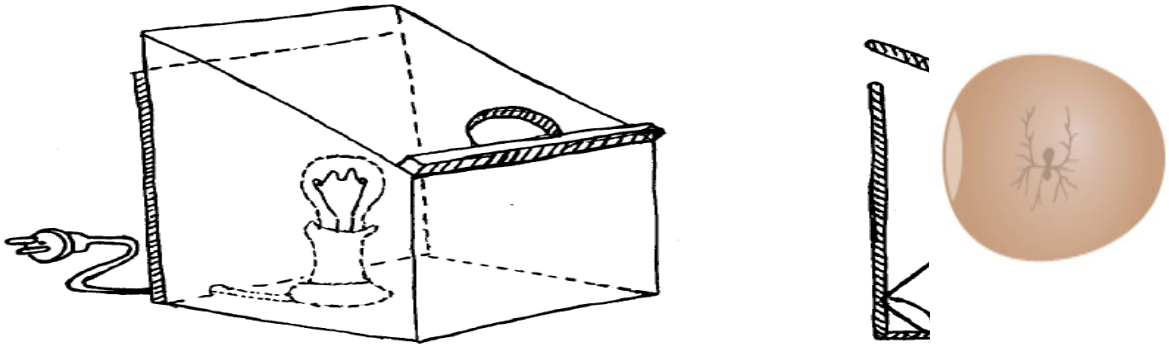


Figure 14: Two types of home-made egg viewer (
against the hole).

First test (5th - 7th days):

Live embryo at 6th day Development is first recognized as

- ➔ a faint, web-like network of fine blood vessels radiating from a central focus, which is the embryo.
- ➔ The embryo will float to the uppermost position in the egg. At this stage, check to see if the embryo moves freely by gently rotating the egg;.

Fig2 . Infertile egg

Infertile eggs look clear and transparent

- **Eggs with dead embryo**- the blood settles away from the embryo toward the edges of the yolk forming in some cases an irregular circle of blood known as a blood ring

Fig.2 dead embryo

Remove and discard all infertile eggs and eggs with dead embryo.

Second test (14th - 18th days):.

Eggs with living embryo looks dark and well filled and show a distinct line of demarcation between the air cell and the growing embryo

Fig.3 fertile embryo

Eggs with dead embryo show only partial development and lack of this clear, distinct outline

Fig. 4 dead embryo

If the air space is larger than expected too much water is being lost and the humidity in the incubator should be increased to reduce the rate of water loss. If the air space is

smaller than expected then the opposite applies. Diagram below shows extent of air cell (airspace) development throughout incubation.

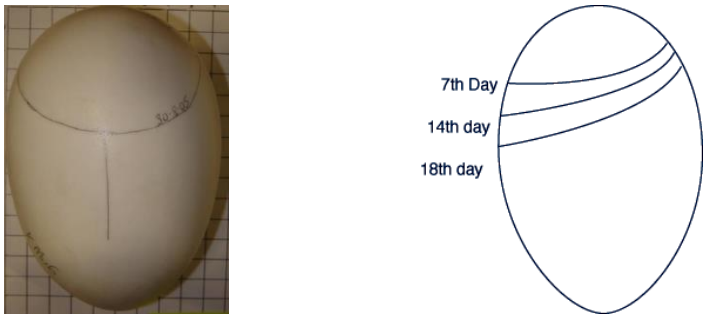


Figure 5 .Egg air cell development during incubation in days

Self-Check -1	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List dawn the difference between fertile and infertile eggs during candling(5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date _____

1. _____
2. _____

Information sheet-2	**Remove possible sources of contamination from the incubator**

An important part of hatchery maintenance is good cleaning and disinfection procedures to prevent the build up of microbiological contamination.

- Good hatchery design and control of movement between clean and dirty areas within the hatchery will greatly assist in keeping the hatchery clean. It is also easier to clean a hatchery when it is tidy and working areas are kept clear of equipment and material.
- There are a large number of detergents and disinfectants to choose from. Ideally, knowledge of the sensitivity of the hatchery's environmental and potentially pathogenic micro flora to the active compound in the disinfectant is required. No matter which detergent and disinfection chemicals are chosen, always follow manufacturer's instructions for use.
- Pay particular attention to the required contact time for the product and the in-use concentration: if the detergent or disinfectant is washed off too soon after application or it is too diluted it will not be effective.
- The use of high pressure washing systems is not recommended, as they will tend to form aerosols containing dirt and microbes, when the jet of water bounces off the surface being cleaned.
- A low pressure washing system is recommended (**Figure 1**), while the use of buckets, cloths and brushes will be appropriate for certain locations in the building. While a clean hatchery may not be free of microbiological contamination, it is certainly more likely to have a lower contamination level than a dirty hatchery.

Therefore, a simple visual inspection of areas and equipment after cleaning to look for obvious soiling is an important part of the monitoring process.

- Pay attention to hidden areas that are difficult to access during cleaning. If soiling is found the area should be cleaned and disinfected again.

Fig. 6 Hatchery sanitation's under slow water pressure

Self-Check # 2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. write some procedures during cleaning of the incubator

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date _____

1.

- _____
- _____

Information sheet-3	Safe egg handling/transfer to hatching trays

Transfer times will differ according to the different types of setters (18 to 19 days are usually the norm). Follow the following procedures during transferring

- At transfer while the eggs are on setter trays, eggs are candled to enable identify, count and remove infertile eggs, dead embryo and rots.
- After candling eggs are transferred from setter tray to Hatchery trays, which are laid on their sides to allow free movement of the chick out of the shell at hatching. It also assists hygiene; large quantities of fluff are generated during hatching and could spread this potential contamination around the hatchery.
- Ensure the Hatchery trays are properly washed and allowed to dry before eggs are transferred. Eggs in wet trays will cool down while the water is evaporating in the Hatchery. Hatchery must be dry and up to proper temperature prior to transfer.
- Take care when handling the incubator and Hatchery trays during the transfer of eggs from one to the other.
- The transfer operation should proceed smoothly and quickly to avoid cooling the eggs as this will delay hatching.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What kinds of chemicals shall we used for cleaning of lines and filters (5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date _____

1

- _____

Information sheet-4	Measure and place fumigant according to label instructions and safe work practices

Fumigation is done to prevent the contamination of egg with micro-organisms. Fumigating eggs with 3x concentration of formaldehyde (40% Formalin) and potassium permanganate ($KMnO_4$) for 20 minutes will kill about 97.5 to 99.5% of the organisms on the shells.

One 'x' concentration means 20 g of $KMnO_4$ with 40 ml of formalin for 3 m^3 area (3x means 60 g of $KMnO_4$ + 120 ml of formalin for 3 m^3 areas). After fumigation the eggs are transferred to cool room or storage area.

This disinfection should take place in a specially designed cabinet in which temperature, humidity and the period of disinfection as well as the ventilation can be controlled. Disinfect on trays, not in boxes.

The disinfection aims to kill bacteria, mould and some viruses on the eggshell to prevent these micro organisms penetrate the egg through the hundreds of tiny pores of the eggshell. As disinfectant formalin can be used either as a powder or as a solution with potassium permanganate. Per m^3 disinfection room one uses:

- 6 grams of formaldegen which is heated to 400^oF in special electrical pans. Always follow the manufactures recommendation.
- 20 grams potassium permanganate and 30 cc formalin 40% Use porcelain basins.

Formalin should be added to the potassium permanganate which is in the basin. When using damaged enamel basins oxidation of the metal might take place, whereby formic acid is liberated which may be very harmful to the hatching eggs. Disinfect for 30 minutes at a temperature of 25^oC and a relative humidity of 75%.

If required after disinfection the formalin mixture may be neutralized with ammonia 40%. (per m3 40cc ammonia). Store the potassium permanganate in dark bottles, well sealed. Keep the formalin in a cool place, but free from frost. Potassium permanganate should not be too fine otherwise there may be a danger of explosion.

- Eggs if not too dirty may be dry-cleaned with sand paper or wire wool to remove fecal or nest matter on it. Do not wash eggs unless necessary. If it is necessary to wash eggs one should have at one's disposal a well constructed egg washing machine, which should be operated in the correct way.
- Manual washing involves: always use a damp cloth with water warmer than the egg at a temperature of about 38^{o}C. this causes the egg to sweat the dirt out of the pores.
- Never use water cooler than the egg.
- Also, do not soak the eggs in water. If the egg is allowed to soak in water for a period of time, the temperature difference can equalize and bacteria have a greater chance of entering through the pores
- After Tray eggs, the eggs should be fumigated in fumigation chamber or cabinet.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Why we fumigate eggs . (5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date _____

1. _____
2. _____

Information sheet-5	Fumigate setter and hatchery, using PPE and exclusion procedures

The following procedures should be followed during cleaning, disinfection and fumigation of incubator

- Loose fittings of the machine should be removed first, and then washed and disinfected separately, and then fitted at their respective places.
- The interior of the machine should be washed with 4% solution of washing soda followed by disinfection with phenyl or lysol.
- The incubator should be fumigated with formaldehyde (40% Formalin) and potassium permanganate ($KMnO_4$).
- Before fumigation thermometers should be removed as during fumigation excessive heat generation may damage these sensitive parts of the incubator. Air inlet and outlet should be closed properly to conserve the fumigated gas inside the incubator.
- Quantity required for fumigation: 20 g of $KMnO_4$ crystals and 40 ml formalin for each 3 m^3 of space inside the incubator or Hatcher for a period of 3 to 4 hours is adequate. Place $KMnO_4$ crystals in enamel bowl (porcelain basin) and kept at the bottom of the incubator; then formalin is poured over it to liberate formaldehyde gas. The enamel bowl should have sufficient volumetric capacity to avoid overflowing during reaction.
- After fumigation the incubator should be opened and ventilated properly before setting of eggs to remove traces of poisonous gas.

Self check-5	Written test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the procedures of incubators .(5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date _____

1. _____
2. _____
3. _____

Operation sheet-1	Egg candling

Objectives :

- To identify fertile egg
- To avoid bad smells of infertile eggs
- To produce healthy chicken

Procedures

Step 1- Wear PPE.

Step 2 Remove all eggs from the incubator and place in egg trays.

Step 3 Dim the lights.

Step 4- Hold each egg, one at a time, against a Candling Torch.

Step 5-. Discard non-fertile eggs (“clears”) or those that have stopped developing (“quitters”).

Step 6- Return viable eggs to the incubator

Operation sheet-2	Set Up and Test the Incubator Technique

Objective :

- ❖ To check normal functions of the incubators
- ❖ To not to produce wastage of chickens during malfunctions

Procedures:

Step 1- Wear PPE.

Step 2 Mount thermometer either inside the unit or in the mounting brackets at the front of the unit.

Step 3 Fill the water pan in the bottom of the unit with lukewarm water.

Step 4 In units with plastic egg trays ensure they are correctly fitted in the racks.

Step 5 If using wet bulb thermometer fill bulb with lukewarm water and place inside the unit.

Step 6 Plug in and switch unit on at the control box.

Step 7 Once the element indicator light goes out, check the temperature on the thermometer

Step 8 Check the relative humidity of the incubator

Step 9 make sure the turner functions properly at the required angle and rate or frequency.

Step 10 the incubator about 24 hrs to settle down in temperature

Step 11 Do not set the eggs until temperature and humidity are correct and stable

Operation sheet-3	Fumigating incubators

Objectives :

- To avoid contaminators
- To produce healthy chickens
- To produce clean and safe environment

Procedures

- Loose fittings of the machine should be removed first, and then washed and disinfected separately, and then fitted at their respective places.
- The interior of the machine should be washed with 4% solution of washing soda followed by disinfection with phenyl or lysol.
- The incubator should be fumigated with formaldehyde (40% Formalin) and potassium permanganate ($KMnO_4$).
- Before fumigation thermometers should be removed as during fumigation excessive heat generation may damage these sensitive parts of the incubator. Air inlet and outlet should be closed properly to conserve the fumigated gas inside the incubator.
- Quantity required for fumigation: 20 g of $KMnO_4$ crystals and 40 ml formalin for each 3 m^3 of space inside the incubator or Hatchery for a period of 3 to 4 hours is adequate. Place $KMnO_4$ crystals in enamel bowl (porcelain basin) and kept at the bottom of the incubator; then formalin is poured over it to liberate formaldehyde gas. The enamel bowl should have sufficient volumetric capacity to avoid overflowing during reaction.
- After fumigation the incubator should be opened and ventilated properly before setting of eggs to remove traces of poisonous gas.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 8 hours.

Task 1. Clean and disinfect of poultry Shed

Task 2: Cleaning of tankers

Task 3: Fumigating incubators

:

References

A simplified method for assessing bacterial populations on surfaces within hatcheries. Poult. Sci., 43,1558-1566.

CAB International 1987, Manual on poultry production in the tropics Walling ford, Oxon, United Kingdom

French, K.M. 1984, Practical Poultry Raising Peace Corps, Trans- Century Corporation, Washington D.C.

G.C Banerjee (2000) A text book of Animal Husbandry. 8th ed Oxford & IBH publishing CO. Pvt.ltd, New Delhi / Calcutta, India

Poult. Sci., 43,1567-1572. 16. MAGWOOD S.E & MARR H. (1964). - Studies in hatchery sanitation.The effect of airborne bacterial populations on contamination of eggs and embryo surfaces

POULTRY PRODUCTION

Level - III

Learning Guide -34

Unit of Competence: - Perform Hatchery Operation

Module Title: - Performing Hatchery Operation

LG Code: AGR PLP3 M08 LO1-LG-33

TTLM Code: AGR PLP3 TTLM 0120v1

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LO 05: Day-old chick transportation

Instruction Sheet	Learning Guide #-34

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- ☞ Handling chicks with care and the car should have plenty of fresh air not too hot or too cold
- ☞ Placing chicks in good littered cages and transported properly
- ☞ Making sure room for air to move between the stacks of boxes
- ☞ Analysing hatch residue

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to **–**

- ☞ Handle chicks with care and the car should have plenty of fresh air not too hot or too cold
- ☞ Place chicks in good littered cages and transported properly
- ☞ Make sure room for air to move between the stacks of boxes
- ☞ Analyse hatch residue

Learning Instructions:

8. Read the specific objectives of this Learning Guide.
9. Follow the instructions described in number 3 to 7.
10. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
11. Accomplish the “Self-check 1” in page -.
12. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You have to get the key answer only after you finished answering the Self-check 1).

13. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
14. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Handling chicks with care and the car should have plenty of fresh air

Probably the most important aspect to control during chick transportation is temperature. If mortality during transportation occurs, it normally will be caused by excessive temperatures. Our goal should be to keep all birds on a body temperature of approximately 40^{o}C (104^{o}F). At this body temperature, birds seem to be most comfortable. If their body temperature is increased, they first of all will try to lose more heat by spreading out wings and feathers, but if that is not possible or not sufficient, they start to evaporate water by panting.

If the temperature is too low, they will try to safe heat by huddling, but if that is not effective enough their body temperature will quickly drop and their metabolism will be impaired.

Cages/crate should be transported in an upright position protected from the wind, high/low temperatures and inclement weather. Transportation must not exceed 12 hours and birds should be checked regularly during the journey.

Do Not:

- carry poultry by their head, neck, wings or tail
- transport birds in bags
- transport birds with their legs tied
- transport birds in the boot of a car
- mix different species of poultry in a single crate/cage during transport

Figure; Traditional poultry transportation.

Specially designed vehicles must be used to control the chicks' environment throughout the journey from hatchery to growing farm.

The minimum ventilation rate needed to satisfy adequate oxygen is 20 CFM (34 m3/hr) per 1000 chicks during winter weather, and twice this amount during hot weather. The vehicle should be equipped with an auxiliary heating system but may use fresh ambient

air for cooling. If summer air temperatures exceed 86 °F (30 °C), cooling equipment is required.

The vehicle cab should have a display showing the temperature within the load to enable the driver to adjust air vents for cooling.

Chicks should be held at an in-box temperature of about 90 °F (32 °C) that can usually be achieved by a vehicle air temperature of 75 °F (24 °C) with plastic boxes or 71 °F (20 °C) with cardboard boxes.

Chicks delivered in plastic boxes require greater care to prevent overheating or chilling than those in cardboard. Ensure the vehicle has adequate heating and cooling to handle plastic boxes.

Boxes must be correctly stacked and spaced to allow free air movement around them.

Each row of boxes should be locked with a bar running the full width of the vehicle to prevent any movement during the journey.

The vehicles can be provided with a rear plastic curtain to help retain heat while chicks are being unloaded.

Chick delivery drivers must be well trained and conscientious. Each driver should start the day with clean clothing and should change into fresh coveralls/footwear for each delivery. It is preferable for drivers not to enter the poultry house.

Power wash delivery vehicles with detergent/disinfectant on each return to the hatchery.

Vehicles should carry a disinfectant spray so that the wheels can be cleaned between farms if delivering to more than one location in a day.

Chick boxes returning to the hatchery represent a high health risk. They must be kept separate and thoroughly washed and disinfected before re-use.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. what is the optimum temperature for transporting chicks?(5pts)
2. what is the vehicles air temperature for transporting chicks?(5pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

Information Sheet-2	Placing chicks in good littered cages and transported properly

1.1. Litter management of chicken cages

Seldom given sufficient emphasis, litter management is another crucial aspect of environmental management. Correct litter management is fundamental to bird health, performance and final carcass quality which subsequently impacts the profit of both growers.

Chickens need bedding for many different reasons, to keep them warm, to cushion eggs and also to absorb all the mess they make. Get superior bedding for your chickens everywhere today with Little Peckers

Poultry being transported are subject to stress. Stress arises from catching and handling, deprivation of food, water and freedom of normal movement, changes in temperature and unfamiliar surroundings, noises and sensations. When selecting poultry for travel, you must ensure that you only select healthy birds to travel. Sick, injured or weak birds should not be transported.

Poultry fit for transport should be carefully loaded in to clean cages or crates. The minimum cage and crate dimensions are 20cm wide and 25cm high per bird. Cages/crates should have ridged floors and be designed to prevent any part of the bird protruding during travel. No sharp edges, or protrusions, hinges or latches should project into the cage. Cages/crates should be well ventilated and of sufficient height to allow birds to stand. Locking mechanisms, to prevent birds from escaping during transportation should be fitted**.**

Important functions of litter include the ability:

- To absorb moisture.
- To dilute excreta, thus minimizing bird to manure contact.
- To provide an insulation from cold floor temperatures.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write Important functions of litter(10pts)

Note: **Satisfactory rating - 6points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

___

Information Sheet-3	Making sure room for air to move between the stacks of boxes

However, air temperature in the chick box can be a guideline as well, where 30-33°C is regarded optimal, as in start-up during brooding. Most practical to measure is the air temperature in the truck, but the right air temperature depends on the air speed.

Ventilation

When traveling at higher temperatures, it is critical to keep chicks well-ventilated to allow for more effective thermoregulation. With restricted ventilation (as in an aircraft), when temperatures around the transport container are at or above 34^{o}C (93^{o}F), the temperature inside the crate increases quickly to exceed 40^{o}C (104^{o}F).

At this elevated temperature, the chicks begin panting, which increases the relative humidity inside the container and reduces the amount of heat loss by evaporation—effects that can increase body temperatures up to 43-44^{o}C (109-111^{o}F) within 40-50 minutes, which may induce coma and death in chicks.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the importance of ventilation in chickens transportation?(10pts)

Note: **Satisfactory rating - 6points** **Unsatisfactory - below 6points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____

Information Sheet-4	Analysing hatch residue

Why break out and analyses hatch debris?

It is normal for there to be some embryo mortality during incubation.

Embryo losses tend to follow a consistent pattern (although it will vary slightly with flock age).

Some embryo malposition's and abnormalities have known causes and can be the result of specific problems.

Analyzing embryo mortality patterns and abnormalities can help to identify which aspects of the incubation process need closer investigation in order to improve hatchability and chick quality.

The Procedure for Analyzing Hatch Debris.

- ☞ Record the number of eggs falling into each category for each tray.
- ☞ Add these numbers together to determine the total number of eggs falling within each category.
- ☞ Calculate the total as a percentage of the number of eggs set.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the the Procedure for Analyzing Hatch Debris (10pts)

Note: **Satisfactory rating – 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____

References

- http://en.aviagen.com/assets/Tech_Center/BB_Resources_Tools/Hatchery_How_Tos/05HowTo5-BreakOutandAnalyseHatchDebris.pdf
- https://www.google.com/search?q=Analysing+hatch+residue&rlz=1C1AVFC_enET881ET881&oq=Analysing+hatch+residue&aqs=chrome..69i57.876j0j7&sourceid=chrome&ie=UTF-8
- https://www.google.com/search?q=ventilation+of+chicken+vehicles&rlz=1C1AVFC_enET881ET881&oq=Ventilation+of+chicken+vehicle&aqs=chrome.1.69i57j33l2.37736j0j7&sourceid=chrome&ie=UTF-8

POULTRY PRODUCTION

Level - III

Learning Guide -35

Unit of Competence: - perform Hatchery operation

Module Title: - performing Hatchery operation

LG Code: AGR PLP3 M08 LO6-LG-35
TTLM Code: AGR PLP3 TTLM 0120v1

LO 02: Hatchery Hygiene (cleaning and disinfection)

Instruction Sheet	Learning Guide #35

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Performing routine hygiene maintenance activities
- Cleaning and disinfecting, and storing tools, equipment and machinery
- Removing and disposing of waste materials and chemicals in environmentally aware and safe manner
- Maintaining egg hygiene from laying nest to setter
- Recording and reporting work outcomes to the supervisor

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Perform routine hygiene maintenance activities
- Clean and disinfect, and store tools, equipment and machinery
- Remove and dispose of waste materials and chemicals in environmentally aware and safe manner
- Maintain egg hygiene from laying nest to setter
- Record and report work outcomes to the supervisor

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” in page -.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You have to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Performing routine hygiene maintenance activities

Effective cleaning and disinfection programmes are vital in the poultry hatchery. These programmes control key organisms, such as Salmonella spp., Pseudomonas spp., Proteus spp., E. coli, Staphylococcus spp., Streptococci spp. and Aspergillus spp. And concentrate on four key areas of concern: the egg, surfaces which can contaminate the egg, air-borne contaminants, and movable equipment and personnel. Washing is necessary prior to disinfection, as the presence of organic matter (e.g. soil, dust, feathers and litter) protects harmful organisms from the action of chemical disinfectants. In some instances, this organic matter will actually inactivate certain types of disinfectants. An adequate supply of water is therefore necessary for the cleaning of hatching areas and machines, the chick boxing area, and some permanent and movable equipment. Cleaning of floors, walls and equipment requires adequate and suitably located drainage for waste water. Incubators must be cleaned after each transfer of eggs. This can be accomplished by scraping, vacuuming and mopping the floors, and wiping down wall areas and fan blades at the same time. Exterior surfaces require damp mopping at least once a week. The top surfaces of incubators should never be used for storage. Once yearly, each machine should be emptied and thoroughly cleaned. To avoid incubator contamination, eggs should be transferred before egg piping starts. Avoid moving or transferring chicks and cleaning hatchers at the same time in the same hatcher room. Cleaning should not begin until all chicks have been removed from the hatcher room.

Under certain conditions, it may be beneficial to sanitize hatching eggs. It is recommended that fumigation with formaldehyde be used, but for alternative methods contact your technical service representative.

No procedure will be effective unless the correct chemical concentration, temperature and humidity are maintained. Remember that dirty eggs will reduce the effectiveness of the sanitation more quickly than clean eggs

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the benefit to sanitize hatching eggs?(5pts)
2. What is the importance of cleaning and disinfection programmes?(5pts)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____
2. _____
   _____
   _____

Information Sheet-2	Cleaning and disinfecting, and storing tools, equipment and machinery

CLEANING AND DISINFECTION

Performed properly, scrubbing, rinsing and disinfection will yield a clean machine. Humidity wicking should be replaced after each hatching, and hatcher gaskets should be checked and replaced if necessary. Extra attention should be paid to fan blades, as dirty, rough blades cannot move the correct amount of air. Hatcher fan blades become easily worn, even in normal use, and should be replaced annually. A bent blade causes excessive vibration and does not move the air properly. Some fresh air from outside is necessary to aid the drying of the room and thus prevent the growth of mould and bacteria. The air compressor should be located in a clean, dust-free room, as this air is channelled to all areas of the hatchery through hoses and humidifiers. Humidifiers in all areas must be kept sanitized to prevent the spread of harmful organisms. Evaporative coolers should be cleaned every week. Sumps on these coolers must be drained and scrubbed, and disinfectant should be added to the sumps when refilling. Heaters should be washed or 'blow-cleaned' to prevent dirt and dust from collecting.

All equipment must be properly cleaned and disinfected. Certain equipment (e.g. fiber egg trays and boxes) cannot be cleaned with water under pressure. Plastic egg trays, wooden egg boxes and plastic chick containers can be cleaned easily with water and detergents and, if necessary, these pieces of equipment may be given a final disinfection or fumigation. Another necessary precaution against the dissemination of disease agents involves labelling egg boxes and egg trays with an identification code, so that these may be returned to the flock which produced the hatching eggs when cleaning has been completed. Washer nozzles should be removed and cleaned frequently to ensure that these are in good working order. Washer pump motors should be switched off whenever filter screens are removed for cleaning, as running the pumps with the screens out allows debris to pass through the pump, blocking the nozzles. All flats, trays and racks should be wetted down and soaked for an adequate period prior to washing, thus enabling the washer to perform a more effective cleaning job. Water in the washer tank should be at 47-52°C (120-130°F) and should be changed frequently during the day to prevent equipment from being washed in dirty water.

Requirements for proper fumigation

The following requirements must be met if maximum germicidal activity is to be obtained from formaldehyde:

a) Temperature: the maximum effect is achieved in the temperature range of 24-38°C.
b) Humidity: this is essential for maximum effect, and a 'wet bulb' reading of 20°C or higher is recommended.
c) Time: the time required to kill the microorganisms depends on the temperature, the humidity and the concentration of formaldehyde.
d) Concentration: the use of potassium permanganate to liberate formaldehyde gas is desirable, as this produces an instantaneous expulsion of gas, giving maximum concentration. To produce the fumigant, potassium permanganate should be mixed with formalin in a ratio (w/v) of 2:3. When the correct ratio of formalin and potassium permanganate is used, a dry brown powder remains after the reaction is completed. Recommended application rate of 53 ml formalin and 35 g potassium permanganate per m3 of space is recommended. These amounts are effective in fumigation for 20 minute

at the recommended temperature and humidity. To calculate the amounts of chemicals necessary, the internal dimensions (i.e. length x width x height) of the incubator, fumigation cabinet or fumigation room should be measured. The space occupied by trays of eggs or articles to be fumigated need not be taken into consideration. Neutralization of formaldehyde gas Formaldehyde gas may be neutralized in 10-15 minutes using ammonium hydroxide at an amount equal to half the volume of formalin used.

Important rules for the disinfection

1. To have success in disinfecting be sure all objects are thoroughly cleaned.
2. Keep a suitable detergent and select the disinfectants with the suitable properties
3. When using a combination of a detergent and a disinfectant remember each combination does not improve the effectiveness of the disinfection.
4. Quaternary ammonium compounds get inactive with residues of soap which is in contrast with chlorine compounds
5. Read and apply strictly the manufacture's recommendations (concentration, temperature, humidity, time)
6. Observe precautionary measures and follow directions (mask gloves)
7. The best hygiene for hands is washing them with ordinary alkaline soap
8. Prevent re-contamination.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the rules for disinfection?(5pts)

2. What is requirements for proper fumigation?(5pts)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
2. _____
   _____

Information Sheet-3	Removing and disposing of waste materials and chemicals in environmentally aware and safe manner

A major source of contamination within the hatchery is the poor sanitary condition of the hatching eggs on arrival at the hatchery. The level of cleanliness of the hatchery therefore depends to a large extent on the hygienic standards of the laying flocks and, in particular, on the regular and frequent collection of eggs. In each hatchery, it should be mandatory that only clean eggs be set. These eggs should be fumigated on the farm as soon as possible after collection to enable destruction of microorganisms before these have time to penetrate through the eggshell. The fumigated eggs must be packed in cases and 'filler flats' which are also free from dust and dirt. Hatchery personnel should adopt routine sanitary procedures, both in the hatchery and on the supply farms, to prevent the development of hatchery sanitation problems, rather than attempting to solve such problems after they have arisen. All outside hatchery doors should be kept closed and locked to prevent unwanted visitors from entering. Staff and authorized visitors should shower and change clothes (putting on hair nets, overalls, boots, etc.) prior to entry. Contamination of the hatchery can also occur from the immediate environment. The spread of Newcastle disease virus from contaminated vehicles has been recorded. Consequently, the importance of locating the hatchery as far as possible from other buildings which house livestock, and poultry in particular, requires special emphasis. The disinfection of vehicles and outdoor equipment must also be an integral part of routine hatchery sanitation. There are many areas in the hatchery where dust and dirt readily accumulate, e.g. the spaces between, behind and on the top of incubators and hatching machines. Dust and dirt can often be found inside air ducts. In hatcheries with poor ventilation systems, moulds and pathogenic bacteria (usually originating in the washing and disposal areas) can be carried by the ventilation system into the incubator rooms. Spores of moulds may remain viable at room temperature for

18 months or more in hatchery dust. Embryos may become infected with bacteria and moulds during incubation, and newly hatched chicks are very susceptible to infection with various microorganisms (e.g. Salmonella spp., Escherichia coli, Pseudomonas spp., Proteus spp. and Aspergillus fumigatus) . Cracked eggs facilitate a marked increase in eggshell penetration by Salmonella spp. A single infected egg can contaminate large batches of clean eggs when the egg is accidentally broken, or as hatching occurs. Infection by E. coli can also occur in a similar manner.

Hatchery waste can be separated into solid and liquid components and then treated separately. For example the liquid in hatchery waste can be separated from the solid hatchery waste by spinning. In addition inclined screens, followed by the use of belt or filter presses can be used for separation of solid and liquid portions of the waste. These methods produce about 45% of solid materials. In other industries a flexible multi-layer filter can be used to separate liquid wastes from sludge wastes. The principle of this process relies on liquid waste passing through the liner into the container by gravity.

Another system for separating liquid and solid waste is to use a conveyor with an upper and lower conveyor roller and an endless conveyor belt extending around the conveyor rollers. A waste deflector extends above and along the lowest portion of the upper run. Liquid and solid wastes are separated and placed in collectors which are located near the upper and lower rollers. The separator can be set up for different solid separating rates.

Storage of Waste on Site; Bio-Bins and Skip Bins

Most of the hatchery waste is stored in dump bins before disposal to land fill or to composting sites. Some hatcheries use Bio-bins for waste storage. This is a container which enables initial composting of the hatchery waste (Bio-bin Technologies Pty Ltd.). Hatchery waste is placed into the Bio-bin, it is closed and made air tight and air is pumped through the bin to start the composting whilst removing odours and bacteria. The bins are also used in the chicken meat industry to compost dead birds. The

composted material is used as a soil conditioner. The contents of Bio-bin are then taken to the waste sites for completion of the composting cycle. It can also be used temporarily for hygienic storage of hatchery waste. Bio-bins have the following advantages:

- The collection system satisfies biosecurity requirements.
- Odours are removed or significantly reduced.
- No fly and rodent contamination.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the advantages of bio-bin?(10pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____

Information Sheet-4	**Maintaining egg hygiene from laying nest to setter**

Cleaning and disinfection are key components of routine biosecurity in poultry farming The most likely route for microbiological contamination to enter the hatchery is with the eggs. Therefore it is important that the laying farms produce clean eggs that have been properly sanitized (figure.1). The biggest risk of introducing a large microbial load into the hatchery comes from dirty eggs or eggs laid on the pen floor rather than in a clean nest box.

Figure 1. Cleaning and sanitizing eggs on the laying farm.

Disinfection of hatching eggs

The contamination with micro-organisms of hatching eggs starts immediately after an egg has been laid. The on-the-farm disinfection of each day's production is necessary. This disinfection should take place in a specially designed cabinet in which temperature, humidity and the period of disinfection as well as the ventilation can be controlled. Disinfect on trays, not in boxes.

The disinfection aims to kill bacteria, molds and some viruses on the eggshell to prevent these microorganisms penetrate the egg through the hundreds of tiny pores of the eggshell.

As disinfectant formalin can be used either as a powder or as a solution with potassium permanganate.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the aim of disinfection? (5pts)
2. Why Cleaning and disinfection are key components of routine biosecurity? (5pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____

2. _____

_____

Information Sheet-5	Recording and reporting work outcomes to the supervisor

Hatchery records have three (3) main purposes:

- to assist in daily or weekly management decisions
- to monitor and control egg and chick flow through the hatchery
- to assist in overall policy decisions

This necessitates two levels of record keeping.

- Individual flock and incubator performance data on fertility, hatchability, number of culls, rots etc.
- The total cost of producing a chick, which should be broken down into labor, electricity, vehicles, etc.

Record sheets should be:

- easy to complete
- easy to understand and interpret
- easy to check for accuracy
- easy to compare with expected values

Analysis of records is essential in supplementing the manager's skill in monitoring incubator performance. This means searching for differences between actual and projected results.

Reviewing flock records after each hatch will highlight any problem areas and allow corrective action to be taken at an early stage.

Individual machines can be accurately logged using computerized equipment.

A typical embryo diagnosis report will supply the needed information for evaluating your hatchery.

The most important aspect of record keeping and data analysis: KEEP IT SIMPLE!

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the main purposes of Hatchery records?(5pts)
2. What is a good features of record sheet?(5pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____
2. _____
   _____

References

- https://www.google.com/search?rlz=1C1AVFC_enET881ET881&sxsrf=ACYBGNQ40RP8Hy5S64FhouO5F4H7DWtz9g%3A1578983987557&ei=M2IdXqnYIcz5wALqiaSACA&q=routine+hygiene+maintenance+activities+of+hatchery&oq=routine+hygiene+maintenance+activities+of+hatchery&gs_l=psy-ab.3..0i71l8.7908.18388..19286...0.2..0.0.0.....0....1..gws-wiz.ZcKEBVmA0lg&ved=0ahUKEwjpvbzdvYLnAhXMPFAKHeoECYAQ4dUDCAs&uact=5
- https://www.google.com/search?q=egg+hygiene+from+laying+nest+to+setter&rlz=1C1AVFC_enET881ET881&oq=egg+hygiene+from+laying+nest+to+setter&aqs=chrome..69i57.1041j0j7&sourceid=chrome&ie=UTF-8
- https://www.google.com/search?q=Removing+and+disposing+of+waste+materials+and+chemicals+in+hatchery&rlz=1C1AVFC_enET881ET881&oq=Removing+and+disposing+of+waste+materials+and+chemicals+in+hatchery&aqs=chrome..69i57.22477j0j7&sourceid=chrome&ie=UTF-8

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