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DAY—OLD CHICKS PRODUCTION BUSINESS

TRAINING MODULE FOR YOUTH AGRI-ENTREPRENEURS

Ethiopian Agricultural Transformation Institute

Addis Ababa, Ethiopia

2025

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OVERVIEW OF THE MODULE

Day-old chicks (DOCs) are the foundation of poultry production, serving as the primary source of both meat and egg supply. Proper care and management of day-old chicks represent a critical stage in the poultry value chain. This training module is designed to equip youth enterprises with practical knowledge and hands-on skills necessary to independently undertake DOC production activities.
The module is structured into six comprehensive sections, each focusing on a key component of the DOC production process. It begins with the fundamentals of DOC production, introducing participants to essential inputs such as sources of viable eggs, reliable power supplies, and incubators.
Key topics covered include:

- Site selection and hatchery room management
- Selection, storage, and handling of fertile eggs
- Incubation conditions, including temperature, relative humidity, ventilation, egg placement, and turning
- Incubator operations, such as egg collection, cleaning, fumigation, loading, positioning, candling, and transferring eggs from setter to hatcher
- Chick collection, grading, and vaccination

In addition to technical operations, the module emphasizes biosecurity, waste management, cleaning protocols, and the importance of accurate record-keeping. It also highlights common risks associated with DOC production and outlines mitigation strategies to ensure smooth and sustainable enterprise operations.
Each section includes:

- A section overview
- Clear learning outcomes
- Post-assessment questions
- Key messages to reinforce learning

We firmly believe that, if thoroughly implemented, this training module has the potential to significantly improve the livelihoods of youth engaged in DOC enterprises—enhancing productivity, business sustainability, and job creation within the poultry sector.

MODULE INTRODUCTION

The day-old chick (DOC) production business plays a crucial role in the poultry industry, supplying high-quality chicks to poultry producers. The viability of a DOC production business hinges on effective hatchery management practices, adherence to biosecurity protocols, compliance with regulatory requirements, and a focus on producing high-quality chicks that meet customer demand while maintaining profitability and sustainability. By implementing sound management practices and maintaining a commitment to excellence, hatcheries can achieve success in the competitive poultry industry.

Training Methodology:

- Learning approaches (Presentation, Brainstorming, Group discussion, Exercise, practical attachment/hatchery unit visit, etc.)
- Training materials (projector, flip charts, marker, notebooks, pens, etc.)
- Time required: five days (two days theoretical and three days practical)

Target participants

- This training module targets unemployed youths interested to engage in day-old chick production and hatchery operations.
- It is also beneficial for poultry producers, extension agents, and students pursuing careers in the poultry industry.

The Agriculture-focused Dignified Employment for Youth (ADEY) program is implemented by the Ethiopian Agricultural Transformation Institute in partnership with the Mastercard Foundation to enable 611,343 inclusive and dignified work opportunities for young women and men and support youth entrepreneurship, employability, and sustainable livelihoods in the agribusiness sector.

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SECTION 1. HATCHERY UNIT AND HATCHING EGG MANAGEMENT

Overview of the section:

Starting a day-old chick (DOC) production business requires careful preparation and access to key inputs. A suitable site for incubation, a well-functioning hatchery facility, and fertile eggs in good condition are essential starting points. In addition to these, three basic inputs are critical for successful DOC production:

1. A reliable hatchery machine (incubator)
2. An uninterrupted power supply
3. A consistent source of high-quality fertile eggs

Together, these elements form the foundation for a viable and productive DOC enterprise.

Learning Outcome

At the end of this section participants of this training should know:-

- Appropriate site selection for incubation
- Facilities required in the incubation house
- Transportation and storage of fertile eggs

Time required: 8hours

Learning Questions

- What are the main inputs in day-old chick production?
- What kind of room facilities is required inside hatchery rooms?
- List egg storage techniques before incubation

1.1 SITE SELECTION

- Establishing a hatchery requires careful planning and consideration of various factors.
- Choose a suitable location for the hatchery, considering factors such as proximity to water sources (if raising aquatic species), availability of utilities (electricity, water supply), accessibility for transportation, and environmental regulations.
- The location should also have adequate space for expansion and comply with zoning regulations.

When choosing a site, look out for the following basic local requirements:

- A well-drained site- making sure there is sufficient, available space to extend your hatchery as required in the future
- Preferably not more than 1800 meters above sea level (unless hatching eggs are produced at the same altitude)
- Ideally more than 500 meters away from other poultry farms: check prevailing wind direction does not carry debris or potential pathogens from other poultry farms in the area
- Reliable supply of electricity for main power and heating (with standby generator)
- Reliable, uninterrupted supply of water for cooling, humidifying and cleaning
- Hatchery site is located away from production farms, minimum 150m distance to prevent horizontal transmission of disease from the chicken house to the hatchery.
- Hatchery should not be located near the railway lines; airport and causing earth vibrations and affect embryonic development.
- A smooth access road, rough roads can cause eggs to crack.
- Away from water-logged area is not good passable to do during the rainy season

1.2 HATCHERY LAYOUTS

Unlike commercial hatchery, a mini hatchery requires limited space and rooms to operate various activities in the hatchery unit. A mini-hatchery unit should have at least the following rooms for simple hatchery operations:

- Egg receiving/storage
- Incubation room
- Day old chick deliver room
- Mini office and bathroom

1.3 HATCHING EGG COLLECTION AND SELECTION

Source of fertile eggs

Many hatcheries maintain their own breeding stock to produce fertile eggs for incubation. In Ethiopia,

1. Commercial breeder parent stocks (layer and broiler) supply is solely depended on importation. Therefore, in this module, we are targeting dual-purpose chicken breeds already existed in the country for sustainable supply of fertile eggs.
2. Currently, we have three potential candidate dual-purpose breeds (Potchefstroom Koekoek, Improved Horro and DZ-White) with the ability to produce fertile offspring for successive generations.

- Koekeok is well adapted dual-purpose chicken breed currently under multiplication by the research system and regional poultry multiplication centres.
- DZ-White is another potential synthetic dual-purpose chicken breed developed by National Poultry Research Program able to produce fertile offspring. DZ-White is a pipeline technology ready for release.
- The Improved Horro, an indigenous chicken breed from Ethiopia, has undergone significant genetic enhancements through a selection program. Plans for its release are also in progress

- The hen will lay her eggs over nesting material. Use of enough clean, dry and mold-free nesting material can avoid cracked and dirty eggs.
- Similarly, hens to be trained to use nests to lay eggs instead of laying on floors by providing enough nest boxes well in advance before the laying starts.
- The frequency of hatching egg collection is very important to maintain quality. Hatching eggs should be collected at least 4 times a day.

Not all eggs laid by a breeding flock are set for hatching.

- Eggs that are cracked, dirty or misshapen are usually not used for hatching. Very small or very large eggs do not hatch.
- Very small eggs don't provide enough nutrient for the growth of the embryo and large eggs may contain double yolks.
- Eggs with thin or very porous shells are not likely to hatch well because of excessive losses of water during incubation.
- very large or double yolk egg are not good for hatchery; select eggs for incubation with uniform sizes, shape and texture

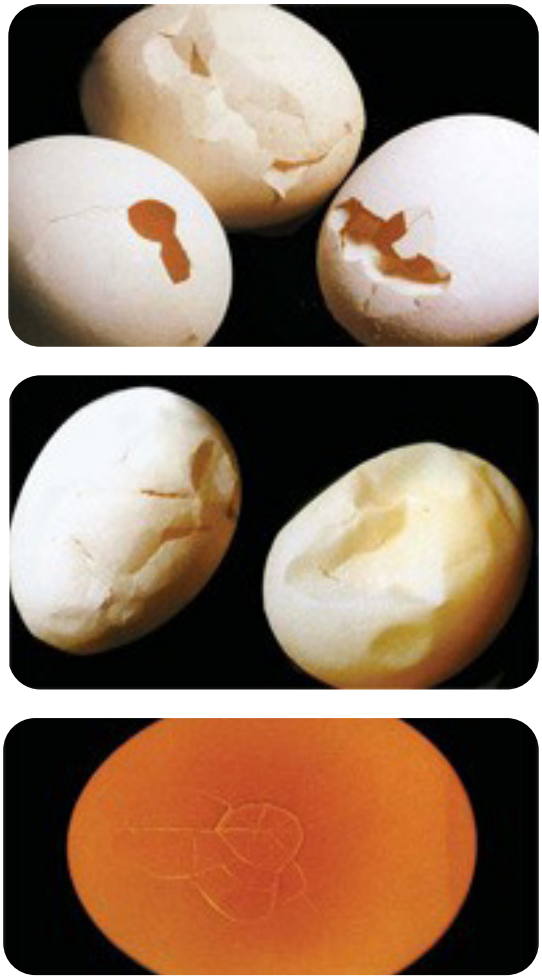


Figure 4. Gross Cracks, Hairline Cracks And Thin Shelled And Shell Less Egg (Right End)

1.4 EGG FERTILITY

- Fertility is the percentages of egg laid that were fertilized.
- Eggs are usually selected from special breeder hens, the healthiest hens with the highest fertility rates.
- Fertility rates vary from 55 to 95 percent, and you can expect at least 50 to 75% of the eggs you purchase to hatch.
- A fertile egg is alive; each egg contains living cells that can become a viable embryo and then a chick.
- Eggs are fragile and a successful hatch begins with undamaged eggs that are fresh, clean, and fertile
- Some factors effecting fertility rate

1. Poor diet (stale food, lack of fresh green stuff, etc.)
2. Unsuitable nutrition (too stimulating a diet)
3. Cold weather
4. Damp and over confined living space
5. Poor health / lack of vitality (internal and external parasites, etc.)
6. Age of breeding birds and others

1.5 FERTILE EGG TRANSPORTATION

- Transporting fertile eggs requires careful handling and consideration to ensure their viability and hatchability upon arrival at the hatchery.
- Avoid bumping white transporting fertile eggs from the source to the hatchery unit. Use sturdy and shock-absorbent materials.
- Maintain proper temperature conditions during transportation to prevent fluctuations that could affect egg viability.
- The ideal temperature range during transportation is typically between 50 to 65oF (10 to 18oC).
- Avoid exposure to extreme temperatures, as both heat and cold can negatively impact embryo development.

1.6 FERTILE EGG STORAGE

- In normal hatchery operations, eggs cannot be set immediately after they are laid.
- Many hatcheries set eggs once or twice in a week.
- If hatching eggs are stored up to 1 week, hatching eggs should be kept in an egg holding room with the temperature ranging between 65 to 68oF (18 to 20oC) and the relative humidity of 75%.
- 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.

Post assessment questions

- What house facilities are required in mini hatchery rooms?
- How do we transport fertile egg from breeder house to the incubation house?
- For how long can we store fertile egg?

Take away messages

- Fertile egg is the future layer or broiler bird and can be sold at high price.

SECTION 2. EGG INCUBATION AND HATCHERY OPERATIONS

Overview of the section

Prepare and adjust both temperature and humidity of the setter 2 to 3 days before setting the egg. Make sure that the adjustments are correct and stable; ensure the machine is clean and sanitized. Before setting eggs, make sure the setter is good working order. Add water to the pan and turn on the setter.

The primary purpose of incubation is to provide a controlled environment for eggs to hatch successfully. It creates optimal conditions, including

temperature, humidity, and ventilation, to support embryo development and facilitate the hatching process. Hatchery operations also needs to set up the incubators according to the manufacturer's instructions.

Closely monitor the temperature, humidity, and turning frequency throughout the incubation period. Some models feature digital displays or built-in alarms to alert you if conditions deviate from the optimal range.

Learning Outcome

At the end of this section the trainees are expected to:

- Optimum requirements of temperature, relative humidity, position of egg in the incubator
- Incubation procedures like egg turning, fumigation of egg, candling, transferring egg, pulling out chick and cleaning the incubator

- **Time required: 12hour**

Learning Questions

- What are the main components and functions of a hatchery?
- How do egg handling, incubation, hatching, and chick processing contribute to hatchery operations?
- How do temperature, humidity, ventilation, and turning frequency affect embryo development and hatchability?
- What criteria are used to assess chick quality, and why is it important?
- How do you visually inspect chicks for size, vigor, and uniformity?
- Why is biosecurity important in hatchery management?

2.1. Temperature

Of all factors, temperature is the most critical – even small deviations from the optimum can affect hatchability. Maintaining optimum and uniform temperature inside the incubator is very essential for obtaining satisfactory results.

- Optimum temperature for chicken egg in the setter (for first 18 days) ranges from 37.5-37.8 °C,
- Optimum temperature for chicken egg in the hatcher (last 3 days) ranges from 36.9- 37.2 °C.
- Overheating (above 40 oC) will harm the growing embryo while under heating (below 32 oC) will slow down the chick's metabolic rate and consequently growth
- These temperatures must be maintained throughout the incubation period.
- In normal hatchery operations, eggs cannot be set immediately after they are laid.
- Many hatcheries set eggs once or twice in a week.
- If hatching eggs are stored up to 1 week, hatching eggs should be kept in an egg holding room with the temperature ranging between 65 to 68oF (18 to 20oC) and the relative humidity of 75%.
- 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.

Backup power source: (Solar energy)

Ensure that your incubator has a reliable power source. To prevent disruptions in incubation caused by power outages, it's advisable to have a backup power source such as a generator or battery backup system. This ensures that the incubator remains operational and maintains stable conditions during unexpected power failures. In this module, solar energy will be used to power the mini hatcheries.

2.2 RELATIVE HUMIDITY

- The amount of moisture in the air is often expressed as relative humidity or RH.
- • Maintaining proper humidity levels is also

crucial for successful egg incubation.

- Humidity levels should be managed carefully to prevent the eggshells from drying out and to facilitate the hatching process.
- Many modern incubators come with built-in humidity controls or trays for adding water to adjust humidity levels.
- The egg needs to lose moisture 13%- 15% of its weight between the time of laying and pipping.
- To enable egg loss the correct weight, the recommended relative humidity is:-

1. For the first 18 days ranging between 55%- 60%, and
2. The last 3 days ranging between 65%- 75%.
3. After more than 50% hatching decrease the relative humidity to 55% to make the chicks dry

2.3 VENTILATION

- Proper ventilation is essential to ensure a constant supply of fresh air and prevent the buildup of harmful gases (i.e., carbon dioxide) and helps to remove excess moisture inside the incubator.
- Proper ventilation helps create an optimal environment for the hatching chicks and reduces the risk of suffocation or developmental issues.
- As the embryo grows, it takes up oxygen and releases carbon dioxide through the pores in the eggshell
- Generally, the oxygen content of the air in the setter remains at about 21%. For every 1% drop in oxygen there is 5% reduction in hatchability.
- Carbon dioxide is a natural by-product of metabolic processes during embryonic development and is released through the shell.
- The tolerance level of Co2 for the first 4 days in the setter is 0.3%. Co2 levels above 0.5% in the setter reduce hatchability and completely lethal at 5.0%.

2.4 POSITION OF EGGS

- Eggs set broad-end-up position (in setter).
- Under normally incubation egg are set with the sharp end down for the 18 days (in the setter) and in a horizontal position for the last 3-4 days in the hatcher, depend on the size if the eggs
- It is natural for the head of the chick to develop in the large end of the egg near the air cell.

2.5 EGG TURNING

Chicken eggs need to be turned regularly during the incubation process. Automatic egg turners are commonly integrated into incubators, gently rotating the eggs at regular intervals.

Turning of eggs: - Why?

- Turning is done up to 18th day of incubation.
- Turning prevents embryos from sticking to the eggshell membranes.
- Turning allows the proper utilization of growth nutrients in the inner white.
- Embryo doesn't emit wastes, and wastes are moved away from the embryo by turning.
- Turning angle and turning frequency are very important.
- Eggs must be turned at an angle of 450.
- Maximum hatch is obtained when eggs are turned 96 times daily, but 24 times daily is more practical.

The mini-hatchery units to be run by youth groups are not expected to manage their own breeding stock, since it requires additional investment for breeder farm establishment which may not be viable at this level.

Therefore, the source of fertile eggs will be Model Poultry Village (MPV) Project which currently under implementation in different regions and regional multiplication centres. To ensure sustainable supply of fertile eggs we might need to prepare a certain working modality between mini-hatchery units and MPV project and regional poultry multiplication centres.

Mini-hatchery (Incubator) and related equipment

A mini hatchery is a smaller-scale facility designed for the incubation and hatching of eggs on a limited

scale. It's often used by small-scale poultry farmers for hatching small batches of eggs.

Here are some common components and related equipment found in a mini hatchery:

Incubator: The heart of the mini hatchery is the incubator, which provides controlled conditions for the development of embryos within the eggs. Mini incubators are typically smaller in size compared to commercial-scale models but still include features such as temperature control, humidity control, air movement and automatic egg turning.

Automatic mini-incubator with different incubation capacity

Figure 1. Homemade incubator with both solar and electric power source

2.6 COLLECTING AND STORING HATCHING EGGS

- In normal hatchery operations, eggs cannot be set immediately after they are laid. Many hatcheries set eggs once or twice in a week.
- If hatching eggs are stored up to 1 week, hatching eggs should be kept in an egg holding room with the temperature of 65oF (180C) and the relative humidity of 75%.
- 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.

2.7 TRAYING HATCHING EGG

Traying is a crucial step in the hatching process and involves careful handling to ensure the eggs remain properly positioned and oriented for successful hatching.

- Before traying the eggs, make sure that the trays are clean and free from any debris or contaminants.
- Be sure to wash your hands or wear clean gloves before you touch the eggs to prevent the transfer of skin oils or germs to the developing chick
- The selected egg for incubation/setter were disinfected by using mixing denature alcohol 75% with water ratio of 50 : 50 per cent (water : denature alcohol 75%) then clean using soft cloth like towels.
- Place each egg into a designated slot or compartment within the tray, ensuring that the air cell (located at the larger end of the egg) is positioned upward. Proper orientation helps the chicks position themselves correctly for hatching and reduces the risk of developmental issues.
- Once all the eggs are trayed or set, monitor the temperature and humidity levels in the setter and hatcher to ensure they remain within the optimal range for the development of the embryo. Make any necessary adjustments to maintain the desired conditions throughout the hatching process.

Traying hatching eggs

Traying hatching eggs Figure 5. Traying hatching eggs

2.8 FUMIGATION

Fumigation help to remove/kill microorganism load on the surface of the hatchery room and eggs. Fumigation helps to disinfect the eggshells, reducing the microbial load on the surface of the eggs. This is particularly important for preventing the spread of pathogens such as bacteria (e.g., Salmonella) and fungi that may be present on the eggshell surface.

Disinfection can help minimize the risk of contamination during the incubation process and improve hatchability rates. It can be done either by alone formaldehyde 40% boiling method or fumigate by formaldehyde 40% and potassium per manganite. It Fumigation with formaldehyde 40% is a widespread and highly effective tool in the battle against contamination by viruses, bacteria and mould in hatcheries

Fumigation procedure:

Eggs should be clean and free from debris or contaminants before fumigation.

1. Arrange the eggs in trays or racks suitable for fumigation, ensuring proper spacing between eggs to allow for adequate fumigant penetration.
2. Select an appropriate fumigant approved for use in egg fumigation, such as formaldehyde or hydrogen peroxide.
3. Use concentrated formaldehyde solution (Formalin), which contains a high percentage of formaldehyde (e.g., 37% to 40%). Formalin is a liquid form of formaldehyde that readily vaporizes when heated. Or for the selected egg for incubation/setter will be disinfected by using mixing denature alcohol 75% with water ratio of 50 : 50 per cent
4. Place the trays or racks of eggs inside a sealed fumigation chamber or enclosure designed for egg fumigation.
5. If fumigation by boiling, put measured amount of formaldehyde (7 ml concentrated formaldehyde for 1 square meter area, 14 ml for 2 square meter area and so on) into electrical fumigator (also known as a formaldehyde vaporizer) and turn it on. The heating element heats the formaldehyde solution to its boiling point, causing it to vaporize and form a dense fog of formaldehyde vapor.
6. Fumigation will be placed based on scenario like if the setter single stage, possible to fumigate with incubator simultaneously the eggs and the setter, but if the setter is multi-stage it is recommended fumigate in the candler room.
7. When fumigate the setter the system of the machine must stop and ensure no eggs settled unless it damages embryo start to develop.
8. If fumigation with formaldehyde with potassium permanganate fumigate the by using 30ml of formaldehyde with 20g of potassium permanganate per care meter
9. Allow the eggs to remain inside the sealed chamber for the prescribed fumigation period (for 20 minutes) to ensure sufficient exposure to the fumigant.
10. After the fumigation period is complete, ventilate the fumigation chamber to remove residual fumigant gases and allow for dissipation of odors.
11. Transfer the fumigated eggs to the incubator. Monitor incubation parameters such as temperature, humidity, and egg turning to ensure optimal conditions for embryo development.

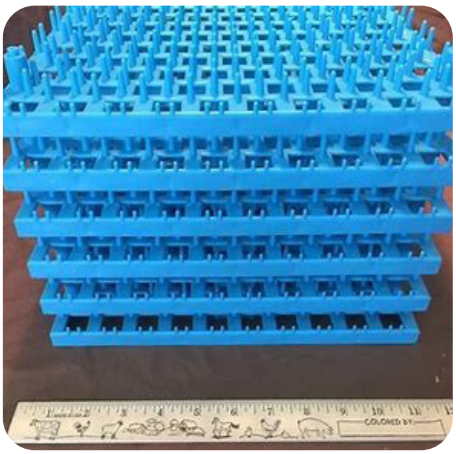
Figure 6. Fumigating incubating eggs

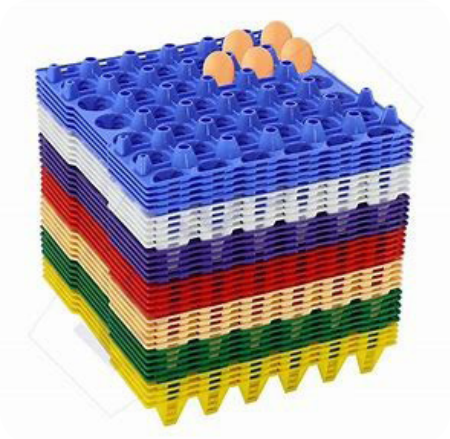
Safety Precautions: Follow appropriate safety precautions and use personal protective equipment (PPE) when handling fumigants to minimize exposure risks. Wear appropriate personal protective equipment (PPE), such as gloves, goggles, and a respirator, to protect against exposure to fumes and vapours. Ensure adequate ventilation in the fumigation area to prevent the buildup of fumigant vapours and maintain a safe working environment for hatchery personnel.

2.9 LOADING OF EGGS

Placing of eggs in the setter is called “loading of eggs”. Eggs can be set in the setter either all-in all-out basis or batch basis. Most of the commercial hatcheries are practicing batch system of loading eggs in the setter that will minimize the initial time taken to reach normal incubation temperature in the setter. The arrangement system is fresh batch is in corridor, the meddle age in middle and the old batch around the fun. In this case, each setter is having hatching eggs with different stages of embryonic developments.

Egg Trays or Racks: Eggs are placed on trays or racks inside the incubator for incubation. These trays or racks provide support and organization, allowing for efficient egg handling and space optimization within the incubator.





2.10 EGG CANDLING

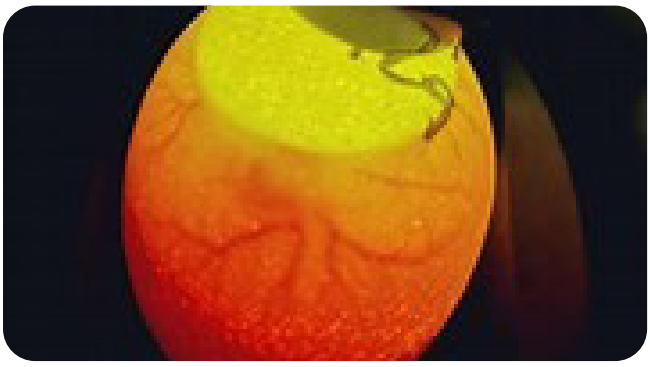
- Candling is a process in which eggs are kept in front of a light source to find out the defects in eggshell, embryonic development etc.
- Candling is a means of identify infertile and early dead embryo. Tray of eggs are passed over a strong light source which clearly show infertile and early dead embryos
- Candling can be done as early as five days of incubation, but errors in candling often occur at this time. Under commercial operations, candling is done when the eggs are transferred from setter to hatcher (at 19th day for chicken eggs).
- However, it is recommended to candle a sample of each flock weekly to monitor the status of the breeder, if candling percentage 10%, then all egg should be candled, the clear removed and hatcher trays refiled to 95-100%. Do not keep the egg out of the incubator for more than 5-10 minutes
- There are two methods of candling that can be used. The fastest method involves the use of a table or mass candler. An entire tray of hatching eggs may be placed on the mass candler and examined with one observation.
- Candling with a spot candler or individual candler is a little slower, but it is more accurate.

Egg candler: A candler is a device used to inspect the internal contents of eggs during incubation. It emits a bright light that allows the user to see inside the eggshell and check for signs of embryo development, such as veins and movement. Candlers are useful for monitoring egg fertility and viability.

Individual egg candler

Mass candler

Figure 2. Individual (left) and mass egg candler (right)



Mass candling

Individual candling

Figure 7. Mass candling (left) and individual candling (right)

2.11 EGG TRANSFERRING

- After candling if the egg is clear and no black/opaque visibility in the egg, it should be discarded or kept for inspection.
- In modern incubators, eggs are transferred from setter to hatcher at 19th day of incubation.
- Hatcher baskets must be clean and dry
- Basket is best warmed inside the hatchers and taken out directly before use.
- Only transfer eggs into a clean, dry, disinfected and heated up hatcher

- Transfer the egg carefully protecting egg breakage, and put on flat hatcher try.

2.12 PULLING THE HATCH

- The process of removing the chicks from the hatcher is often called pulling the hatch.
- Chicks should be removed from the hatcher as soon as all are hatched and about 95% are dry.
- Excessive drying in the hatcher should be avoided.
- Hatchery wastes like shell, unhatched egg, dead chick, weak chicks should be discarded as hatchery wastes

2.13 SORTING AND GRADING CHICKS

Chick grading is a process that occurs shortly after hatchery operations, where newly hatched chicks are sorted and categorized based on various criteria such as health, size, weight, and vigor. No chick below the minimum standard must be allowed to go to a customer.

Follow the following procedure for chick grading after hatch:

- Visual Inspection: Visually inspect each chick for signs of health, vitality, and physical abnormalities. This includes checking for any deformities, malformations, dehydration, unhealed navel or injuries that may affect the chick's ability to thrive.
- Vitality Assessment: Chicks are assessed for their level of activity, alertness, and responsiveness. Healthy chicks typically exhibit vigorous movements, chirping sounds, and attempts to stand or walk shortly after hatching.
- Uniformity: Chicks are graded for uniformity within each batch or group to ensure consistent size, weight, and quality. This helps to standardize production and optimize performance in later stages of poultry rearing.
- Documentation: Grading results are documented, including the number of chicks in each category, reasons for any culling decisions, and any notable observations or abnormalities observed during grading. This documentation serves as a record of hatchery operations and provides valuable information for quality control and performance monitoring.

No chick below the minimum standard must be allowed to go to a customer. Some standards for quality are, 1) No chick deformities 2) No unhealed navels 3) Above a minimum weight 4) Not dehydrated and 5) Stand up well.

2.14 SEXING

Layer type day-old chicks are needed to be sex separated either by vent sexing or auto-sexing (feather sexing), it is different method from breed to breeds. In lohmann tierzucht by feathering method where male is slow feathering while female is fast feathering. Other identified by color method, male is mostly pure, sometimes lighted colored showing one dark stripe or 4 narrow brown strips on the back while female mostly uniform or predominately brown with one light stripe in the middle of the back.

In case of meat-type day-old chicks sexing is not practiced. Dual purpose chicken both sexes also practice like Potchefstroom Koekoek identified by white dot on the head.

2.15 MAREKS VACCINATION AND CHICKS DELIVER

- Marek's disease vaccination is done shortly after hatching, usually within the first day of life. The vaccination is done at the hatchery before the chicks are delivered to customers.
- Using skilled personnel for Marek's vaccination is crucial to ensure that the vaccination process is performed accurately, efficiently, and safely.
- The vaccine must be refrigerated until it is used to be effective. If it arrives warm, it is no longer effective.
- Once the vaccine is reconstituted, it must be disposed of after one hour. It cannot be stored for later use as the vaccine is no longer effective after one hour.
- The vaccine must be injected under the skin usually on the back of the neck to be effective.

2.16 BREAKOUT ANALYSIS

Breakout analysis in the hatchery refers to the process of evaluating the hatchability of eggs and the quality of chicks that hatch from eggs set. It involves examining the percentage of eggs that successfully hatched (hatchability rate) and assessing the condition of eggs failed to hatch.

Breakout analysis plays a critical role in hatchery management by providing actionable insights into hatchery performance, chick quality, and operational effectiveness. By continuously monitoring and analyzing hatchery data, hatcheries can drive continuous improvement, enhance productivity, and ensure the production of high-quality chicks.

Importance of breakout analysis in the hatchery:

I. Hatchery Performance Evaluation

Breakout analysis provides valuable feedback on the overall performance of the hatchery in terms of hatchability rates and chick quality.

By analyzing hatchery data, hatchery managers can identify trends, patterns, and potential areas for improvement in hatchery operations.

II. Quality Control

Breakout analysis allows hatchery personnel to assess the quality of chicks produced and identify any issues or abnormalities that may affect chick health and performance.

III. Optimization of Incubation Conditions

Breakout analysis helps optimize incubation conditions to maximize hatchability rates and chick quality.

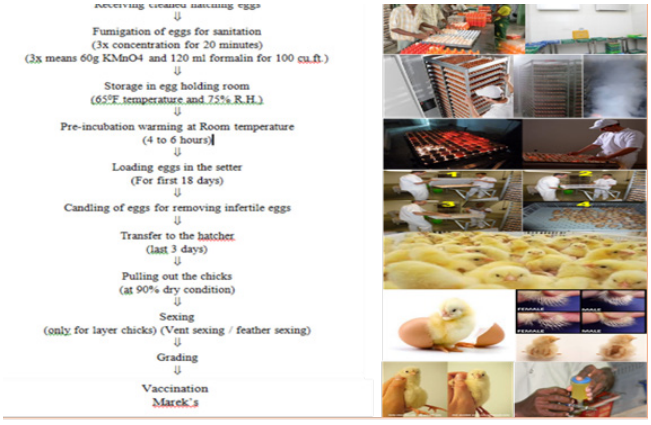
By monitoring factors such as temperature, humidity, ventilation, and egg turning, hatchery managers can fine-tune incubation parameters to create optimal conditions for embryo development and hatchability.

2.17 WASHING AND CLEANING

- Cleaning the hatchery between hatches is of primary importance. Therefore, after the hatch is complete, clean and disinfect the trays thoroughly to prepare them for the next hatch.
- Proper cleaning and sanitization of equipment are essential for maintaining hygiene and preventing the spread of diseases within the mini hatchery.
- Supplies such as disinfectants, brushes, and cleaning agents may be needed to clean the incubator, egg trays, and other equipment between hatchings.

Washing and cleaning

Figure 8. Photos depicting washing and cleaning hatcheries



Post assessment questions

1. For how many days, at what temperature and relative humidity can we store hatching eggs?
2. What is candling and when do we apply candling?
3. How do we sort chicks for grading?

For how many days, at what temperature and relative humidity can we store hatching eggs?

What is candling and when do we apply candling?

How do we sort chicks for grading?

Take away message

Incubator is the heart of hatchery operation

SECTION 3: HATCHERY WASTE MANAGEMENT AND BIOSECURITY MEASURES

Overview of the section

Incubation and hatchery operations disposes different wastes, and these wastes should properly be disposed to protect environmental pollution and disease transmission. Biosecurity measures and techniques will be applied after pulling out the chicks. Marek's disease vaccination is applied before distributing the chicks.

Learning outcome

At the end of this section participants of this training should know:

- Understand the principles of biosecurity and its importance in hatchery management.
- Describe the types of waste generated in the hatchery and their sources
- Hygienic measures for egg and incubator.

Time required: 10 hours

Learning question

1. What are the main biosecurity risks in hatcheries, and how can they be mitigated?
2. What types of waste are generated in the hatchery, and how should they be managed?

3.1 HATCHERY WASTE MANAGEMENT

Hatchery waste management is crucial for maintaining hygiene and minimizing environmental impact. Waste materials generated during hatchery operations include eggshells, unhatched eggs, chick mortalities, and hatchery debris. Therefore, implementing effective hatchery waste management practices can reduce the risk of contamination and minimize environmental pollution.

To properly manage hatchery wastes, do the following:

- Separate different types of waste generated in the hatchery and use designated containers or bins for each type of waste.
- Properly dispose of waste materials in designated containers or disposal areas. Using pit disposal or incineration is effective hatchery waste disposal methods.
- Disinfect waste containers and handling

- equipment regularly to minimize the risk of cross-contamination.
- Regularly clean and disinfect waste disposal areas to prevent the attraction of pests and rodents to minimize environmental contamination risks.
- Ensure that waste handling personnel adhere to strict hygiene practices, including handwashing and wearing appropriate personal protective equipment (PPE).

Figure 10. Hatchery waste disposal

3.2 IMPLEMENT BIOSECURITY MEASURES

Biosecurity procedures are crucial in hatcheries to prevent the introduction and spread of diseases, pathogens, and contaminants that can jeopardize chick health and hatchery operations.

Marek's vaccination immediately after hatch

Marek's vaccination immediately after hatch is a common practice in the hatchery unit. Therefore, make sure that you have access to Marek's vaccine and related equipment (i.e, refrigerator, automatic syringe) in the hatchery unit.

Related equipment like refrigerator and automatic syringe necessary to properly store and administer the vaccine.

Biosecurity procedures commonly implemented in hatcheries:

Visitor Control

- Restrict access to the hatchery premises to authorized personnel only.

Personnel Hygiene

- Require all personnel to adhere to strict hygiene practices, including handwashing, changing footwear, and wearing designated clothing or protective gear.
- Provide handwashing stations, hand sanitizers, and footbaths at entry points to the hatchery.

Equipment and Vehicle Sanitation

- Implement protocols for cleaning and disinfecting equipment, vehicles, and tools entering the hatchery premises.
- Ensure that delivery vehicles and equipment suppliers comply with biosecurity requirements before entering the hatchery to minimize contamination risks.

Pest and Rodent Control

- Implement pest control measures to prevent the entry and proliferation of pests and rodents in the hatchery.
- Seal entry points, maintain cleanliness, and use traps or bait stations to manage pest populations effectively.

Egg Handling and Storage

- Implement strict protocols for handling, washing, and sanitizing eggs to minimize the risk of microbial contamination.
- Store eggs in clean, sanitized trays or containers, and maintain proper temperature and humidity levels to preserve egg quality.

Incubator and Hatchery Hygiene:

- Clean and disinfect incubators, hatchers, hatchery rooms, and equipment regularly to prevent the buildup of contaminants and pathogens.
- Implement sanitation schedules and procedures for cleaning surfaces, floors, walls, and air ducts in the hatchery.
- Use disinfectants approved for use in hatcheries and follow manufacturer recommendations for dilution, contact time, and application methods.

Post assessment questions

- What are the wastes in hatchery operations?
- How do we control entrance of rodents in the hatchery rooms?

Take away message

Biosecurity principles is a base in hatchery operations as well as in all poultry production business.

SECTION 4: RECORD KEEPING

Maintaining accurate records is essential for efficient hatchery management and ensuring the production of high-quality chicks.

Important parameters a hatchery manager need to record:

Egg Parameters

- Number of eggs set: Record the total number of eggs placed in the incubators for hatching.
- Egg source: Document the source of eggs.
- Egg weight: Monitor the weight of eggs to assess egg quality and track changes over time.

Incubation Parameters

Incubator settings: Record temperature, humidity, ventilation rates, and egg turning frequency in each incubator.

Environmental conditions: Monitor ambient temperature, relative humidity, and air quality in the hatchery.

Incubation duration: Track the length of time eggs spend in the incubators from setting to hatching.

Hatching Parameters

Hatchability rates: Calculate the percentage of eggs that successfully hatch to assess hatchery performance.

Chick quality: Assess chick vitality, weight, and uniformity through visual inspections and grading.

Vaccination and Health Monitoring

Vaccination records: Document vaccine type, administration dates, and batch numbers.

Health status: Record any health issues, disease outbreaks, or mortality events observed in the hatchery.

Customer Orders and Delivery

Customer orders: Record order quantities, delivery dates, and customer contact information.

Others

Resource usage: Track water and energy consumption, hatchery consumables (detergents and disinfectants, waste generation, and environmental impact.

Hatchery consumables: Vaccine, detergent, disinfectant, protective clothing's, etc.

Time Required: 2 hours

SECTION 5: FINANCIAL FEASIBILITY

Overview of financial feasibility

Financial feasibility describes whether agri-business is financially viable. It involves determining initial investment (resource) requirement to start the business, estimating production cost, operation expenses, and sales revenue. These are used to determine the initial investment requirement, profitability of the business, break-even point (minimum level of production) to attain the profit zone and pay-back period (number of years required to recover initial investment). These series procedures are used to make wise decisions to accept or reject the agribusiness investment alternative.

Learning outcome

At the end of this section participants of this training should know:-

- How to determine initial investment requirement to start the business
- How to estimate periodical production costs, operating expenses, and sales revenue of the business
- How to determine profitability and cash flow of the business
- How to calculate break-even point (minimum level of production) to recover total cost and generate profit.
- To calculate payback period (time requirement to recover initial investment and
- How to make decision to accept or reject the investment alternative

Time Required: 6 hours

Learning question

1. Do you know how to determine financial feasibility of the given specific agri-business to make wise investment decision?

5.1 INITIAL INVESTMENT

Initial investment is the minimum capital requirement to start the business.

Fig 7. Incubator with both solar and electric power source

Example of initial investment requirement to start day-old chick production business includes incubator, fertile egg, incubation house, candlers, setter and hatcher try, egg storing and grading house, working capital, etc.

Table 1: Template to estimate initial investment requirement for agri-business

DESCRIPTION	TOTAL COST	REMARK
Incubator (setter and Hatcher)		
Fertile egg		
Incubation house		
Egg storage and grading house		
Day old chick receiving house		
Candling equipment		

Setter and Hatcher try		
Marek's vaccination syringe		
Waste disposing baskets		
Fumigation equipment		
Chemical sprayers		
Working capital		
Etc.		
Total		

5.1.1 LONG-TERM INVESTMENT

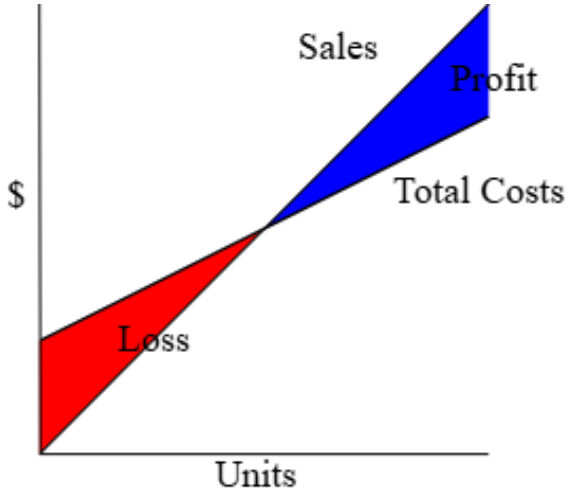
Long-term investment in agri-business involves all asset requirement for the business which can serve for more than one year.

Example Feeders and waterers, house, storage, land, etc.

Table 2: Template to calculate total cost for acquisition of long-term investment

TYPES OF INVESTMENT	UNIT OF MEASUREMENT	QUANTITY	UNIT COST	TOTAL COST
Incubator				
Egg storing and grading house				
Day old chick receiving house				
Candling equipment				
Setter try				
Hatchery try				
Marek's vaccination syringe				
Waste disposing baskets				
Electric installations				

TYPES OF INVESTMENT	UNIT OF MEASUREMENT	QUANTITY	UNIT COST	TOTAL COST
Water tankers				
Creates				



5.1.2 WORKING CAPITAL

Working capital for the planned agri-business includes all payments requirement for day-to-day operating activities such as production costs and operating expenses.

Example

- Production costs include cost of fertile egg, vaccines, chemical, labor cost etc.
- Operating expenses includes administrative salary, sales commission, promotion, etc.

Working capital excludes long term investments such as stores, incubators, egg storage house, candlers, etc.

a. Production cost

Production costs are a key component in agri-business.

It includes all costs associated with production including value addition to make the product ready for sale.

Table 5: Template for estimating production cost per one DOC production

TYPE OF COSTS	UNIT OF MEASUREMENT	QUANTITY	UNIT COST	TOTAL COST
Fertile egg	No			
Vaccines	Dose			
Bedding material	Kg			
Fumigation chemicals	Lit			
Working capital	Person			
House rent	Month			
Transporting	Create			
Total				

b. Operating expenses

- Operating expenses are all costs not directly associated with production.
- They are common costs incurred for administrative and selling activities.

Example administrative salary, promotion cost, sales commission, transport cost to sale, etc.

Table 6: Template to estimate operating expenses for agri-business

TYPES OF COSTS	TOTAL COSTS
Administrative salary	
Utility (electric, water, tele.)	
Interest	
Promotion	
Sales commotion	
Tax	
Etc.	

5.2. ESTIMATED PRODUCTION AND SALE REVENUE

- Production volume is the main source of revenue for the agri-business to generate profit.
- Producers should determine the estimated average production volume from the planned production period.

FORMULA 1
Total production volume = Average production per hectare X Land size (ha)

- After determining the estimated volume of production, it is possible to determine the expected sales revenue for the planned production.

FORMULA 2
Total sales revenue = Total production volume X unit selling price

5.3 PROFIT AND LOSS STATEMENT

- The primary objective of any business is to generate profit.
- Profit and loss statement is the main tool to calculate profitability of the business.
- It is used to accept or reject the investment based on estimated profit.

FORMULA 3
Gross profit = Total sales revenue - Cost of goods sold

Table 8: Template for profit and loss statement preparation

DESCRIPTION		
Sales Revenue		
Sale of day-old chicks		
Sale of hatchery wastes		
Total Sales revenue		
Cost of goods sold		
Day-old chicks production cost		
Ending inventory		
Cost of goods sold		
Gross profit		
Operating Expenses		
Salary if any		
Utility (electric, water, tele.)		
Interest		
Promotion		
Depreciation		
Tax if any		
Total operating expense		
Net profit		

Balance sheet used to know the total resource owned, amount of claim by creditors and amount of owners' equity

Balance sheet contains asset, liability, and own capital

- Assets are all resources available for use or for sale
- Example cash, inventory, warehouse, incubator, equipment etc.
- Liabilities are all debts obtained from bank, microfinances, individuals or others
- Own equity/capital involves own/member contribution, grant/donation, etc.

FORMULA 4
Total Asset = Total liability + Total own capital

Table 9: Template for balance sheet preparation

DESCRIPTION		
Asset		
Current asset		
Cash		
Inventory		
Total current asset		
Fixed asset		
Tools and equipment		
Warehouse		
Land		
Total fixed asset		
Total asset		
Liability and Capital		
Liability		
Bank loan		
Debt from relative		
Total liability		
Owners capital		
Own capital contribution		
Grant/donation		
Total owners' capital		
Total liability and capital		

5.5. CASH FLOW STATEMENT

Cash flow is all cash inflow and outflow for any purpose in the business operation

Example:

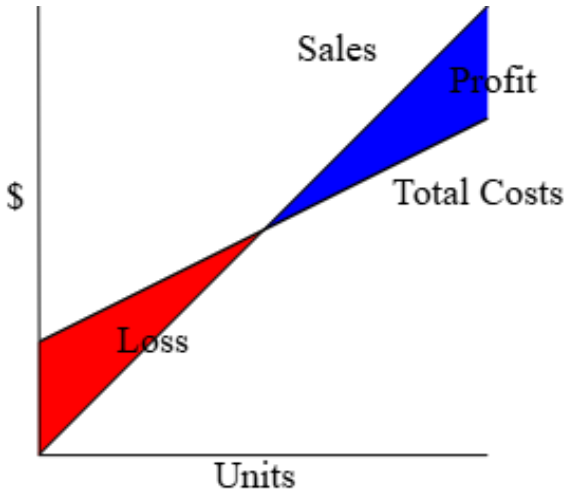
- Cash inflows include sale of seed/seedling, debt obtained from banks, members capital contribution, etc.
- Cash out flow includes purchase of input, payment for construction, repayment of debt, payment for salary, etc.

FORMULA 5
Beginning cash balance + total cash inflow = ending cash balance + total cash out flow

Table 10: Template for cash flow statement preparation

DESCRIPTION	AMOUNT OF OUTFLOW	AMOUNT OF INFLOW
Owners' investment		
Debt		
Grant		
Sale of broiler		
Wate house construction cost		
Purchase of equipment		
Purchase of input		
Land rent		
Fertile egg cost		
Labor cost		
Cash Operating costs		
Ending cash balance		
Total		

5.6. BREAK EVEN ANALYSIS



- Break even analysis is used to determine the minimum level of production to cover total cost.
- At break-even point no profit no loss.
- To make profit, level of production and sale should exceed/greater than breakeven point.
- Fixed costs are fixed in total amount regardless of increase/decrease in volume of production.
- Example depreciation, warehouse rent, administrative salary, promotion cost, etc
- Variable costs varied in total in response to increase/decrease in level of production
- Example production costs, packaging cost, loading and unloading, etc

FORMULA 6
Break-even point = Fixed cost/(Unit selling price – unit Variable cost)

5.7. PAYBACK PERIOD

Payback period is used to determine number of years/ periods it takes to recover initial investment.

FORMULA 7

1. When the annual profit of the business is uniform/equal

Payback period = Initial investment/annual profit

2. When the annual profit fluctuate/vary from year to year

Post assessment questions

1. Which of the following is part of working capital
   a. Purchase of fertilizer
   b. Purchase of tractor
   c. Transportation cost
   d. Purchase of chemical

2. Which of the following should include in profit/loss statement
   a. Purchase of tools and equipment
   b. Sales revenue
   c. Debt
   d. Owner investment

3. Which of the following is variable cost
   a. Purchase of seed
   b. Administrative salary
   c. Depreciation
   d. Rent of storage

Key message

Analyzing financial feasibility of agribusiness enables to pre-determine the applicability of the business in terms of initial investment requirement, profitability, and sustainability.

Potential Risk and Mitigation Strategy

No.	Potential Risk	Mitigation Strategy
1	Sustainability of mini-incubator	Developing local incubator
2	Sustainability of fertile eggs	Proper Scheduling with the source
3	Unable to get customers to receive day-old chick	Promotion work
4	Power Interruption	Use generator
5	Hatchery failure	Regular inspection and maintenance

ANNEX

Hatchery Record Sheet

Breed of Chicken: _____.....
Hour of Set: _____

No of Eggs Set: _____.....
Date of Candling: _____

Date of Set: _____ .....
Date of Transfer: _____

DAY	INCUBATION TEMPERATURE				HUMIDITY	VENTILATION		TURNING	D/M/Y
	Incubation Set Temperature (0F) Egg Shell Temperature	Egg Shell Temperature			%	Co2	Valve		
		Min	Med	Max					
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
HATCHERY									
19									
20									
21									
22									
Chicken Breed		Number of Eggs Set	Total Infertile Egg	Total Hatched	% of Hatch	% of Infertile	Place of Distribution	Remark	

Daily Egg Collected Record Sheet

Breed:_____

Date of Hatch: _____/_____/_____ E.C .....
.....

Point of Lay: _____/_____/_____ E.C

DATE (E.C)	NUMBER OF BREEDING STOCK			NUMBER OF EGGS COLLECTED			EGG COLLECTOR/ ATTENDANT		EGGS RECEIVED (HATCHERY UNIT)		REMARK
	Female	Male	Total	Normal	With defect	Total	Name	Sign	Name	Sign	

DOC Dispatch Record Sheet

Breed:_____

				Name of Applicant	Address (Region/ District/ Town)	Phone number	Male	Female	

Homemade Incubator

Ethiopian ATI

Agricultural Transformation Institute

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