Poultry Production

Level-III

Learning Guide-40

Unit of Competence: Perform breeder farm Operations

Module Title: Performing breeder farm Operations

LG Code: AGR PLP3 M10 LO1-LG-40

TTLM Code: AGR PLP3 TTLM 0120v1

LO 1: Conduct preparatory breeding activities

Instruction Sheet	Learning Guide #40

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

- ❖ Obtaining Poultry breeder from reliable source.
- ❖ Determining characteristics of rooster suited for breeding.
- ❖ Maintaining breeder sheds according to established farm practices following.
- ❖ Set-up suitable place nests to established breeding practices.
- ❖ Transferring poultry breeders to appropriate breeder sheds following.
- ❖ Maintaining hygienic environment according to enterprise standard.

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:

- ❖ Obtain Poultry breeder from reliable source.
- ❖ Determine characteristics of rooster suited for breeding.
- ❖ Maintain breeder sheds according to established farm practices
- ❖ Set-up suitable place nests to established breeding practices
- ❖ Transfer poultry breeders to appropriate breeder sheds
- ❖ Maintain hygienic environment according to enterprise standard.

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,-6.
4. Accomplish the “Self-check 1, Self-check 2Self-check 3, Self-check 4, Self-check 5, and Self-check 6” in page -20, 23,26,29,31 and 36 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” in page -37.

6. Do the “LAP test” in page – 37 (if you are ready).

Information Sheet-1	Obtaining Poultry breeder from reliable source

1.1 Introduction

Breed refers to a sub specific group of domestic livestock with definable and identifiable external characteristics that enable them to be separated by visual appraisal from other groups of livestock within the same species (FAO, 1999) or it could be explained as, defined groups within the same species or a group for which geographical and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity (Ilse, 2000).

Specifically Christian et al. (2007) define breed as group of poultry with a characteristic body form and feather contours. Also features such as the comb, color of ear lobes, and shank colors and length are usually determined by breed. These unique characteristics are inherited from one generation to the next. Chickens belonging to one breed are genetically very closely related.

Based on their utility Commercial breeds of chicken can be divided into three groups. These are:-

a. Layer breeds (egg type breed)
b. Broiler breeds (Meat type breed)
c. Dual Purpose breeds (both Meat and Egg type breed)

1. Layer breeds

Layer breeds also termed as light weight laying breeds and these are breed of poultry specifically developed and used for commercial egg production. According to (Grobbelaar et al., 2010) those breeds have the characteristics of:-

- “Boat-shaped” with a long straight back and a big bottom.
- The numbers of eggs produced by a hen in a production cycle exceed 280 eggs.
- Daily hen-housed egg production of 75 to 95 percent.
- Low mortality rate, and an efficient feed conversion ratio.

2. Broiler breeds

- Meat producers (broilers) are long-legged,
- Have a more upright position and wings placed in high position on the body.
- These heavier birds have more muscle.
- They grow fast and can quickly reach a high slaughter weight.
- They requires plenty of high quality feed. It requires special skills to keep this in good supply and balance.

3. Dual purpose Breeds

- Dual-purpose breeds have body forms in between layers and broilers.
- Are kept for both meat and egg production and categorized as dual purpose breeds.
- Those breeds in which hens lay reasonably well and roosters are large enough for meat production

Chickens lay brown eggs and usually have brown feathers, but this can vary per breed

1.2 Selecting Breeders layers

- ❖ Body size and rate of production are inherited traits
- ❖ For layers –the smaller the hen the more efficient
- ❖ Her production –less feed to produce eggs
- ❖ For layers –Leghorn type hens and sex-link hens are
- ❖ Best for producing lots of eggs using little feed
- ❖ Modern meat birds are fast growing and very efficient

1.3 Selecting Breeders meat

- ❖ Growth rate –weight
- ❖ Feed conversion
- ❖ Conformation
- ❖ Health
- ❖ Adult size
- ❖ Select birds that show big appetites

1.4 Identify and characterize common poultry breeds

1.4.1 Leghorn Chickens

- Color and Appearance

➢ Most Leghorn chickens have single combs but there are several color varieties that have rose combs. Recognized colours are white, red, black tailed red, light brown, dark brown, black, blue, buff, columbian, buff columbian, barred, exchequer and silver. Brown Leghorn Chickens

- Origin of Leghorn Chickens

➢ The Leghorn breed was developed in Livorno, Italy. Size of Leghorn Chickens

➢ Leghorns mature into smallish chooks, weighing from

➢ 3 lbs (1.4kg) to 4 lbs (1.8kg).

- Temperament of Leghorn Chickens

➢ Leghorns are nervous types of chickens around humans and can fly, making them less popular as a homestead breed.

- Uses of the Leghorn Chickens

➢ Leghorns are fantastic egg producers, laying around 280 white eggs a year.

Figure, 1 Leghorn Chickens

1.4.2 New Hampshire Chickens

- Color and Appearance
  - The mature birds are a rich chestnut red, of a lighter and more even shade than the Rhode Island Reds.
- Origin of New Hampshire Chickens
  - The New Hampshire originated in the state of New Hampshire in the United States.
- Size of New Hampshire Chickens
  - Roosters weigh in at around 8.5 lb (3.9 kg), whereas hens are lighter at 6.5 lb (2.9 kg). New Hampshire Chickens
- Temperament of New Hampshire Chickens
  - New Hampshire's are competitive and aggressive.
- Uses of the New Hampshire Chickens
  - While it is a fair producer of large brown eggs, the New Hampshire was developed more for meat production than egg production. Medium heavy in weight, it matures early and dresses a nice, plump carcass as either a broiler or a roaster. The hens are prone to go broody and make good mothers.

1.4.3 Orrington Chickens

- Color and Appearance

  The Orpington are large types of chickens with a soft appearance. It has a wide chest, broad back, and small head and tail. They originally came in black, white,

  buff and blue. Other varieties have also been developed including porcelain (speckled), red, mottled and birchen.

- Origin of Orpington Chickens

➢ The original Orpington (the Black) was developed in 1886 by William Cook. He crossed many different breeds of chickens, chiefly Minorcas, Langshans and Plymouth Rocks, to create the new hybrid bird.

- Size of Orpington Chickens

➢ The Orpington is a heavy breed, weighing from 7 lb (3.2 kg) to 10 lb (4.5 kg). Its soft, profuse feathering makes it appear even larger than it is.

- Temperament of Orpington Chickens

➢ Docile, affectionate and easily handled types of chickens.

- Uses of the Orpington

➢ The Orpington was breed as a dual-purpose breed, famous for good egg laying capacity (from 110 to 160 beige eggs/year even through winter), moderately early maturity, and good carcass qualities. Hens may go broody

1.4.4 The bovan goldline breed

The Bovine Gold line Breed is a cross or hybrid breed and can be very friendly and with their strong immune system, they are known for their egg laying. This breed of chickens will eat right out of your hand and can lay up to **330 brown eggs** in their first year. With shades of brown and cream feathering, these chickens are hardy and are easy to handle for first time breeders. They are naturally inquisitive and love to please which is evident from the amount of eggs they can produce, along with their pleasant nature.

1.4.5 Rhode Island Red Chickens

- Color and Appearance
  - These chooks normally have hard rust colored feathers, but may be darker or almost black.
- Origin of Rhode Island Red Chickens
  - The Rhode Island Red are types of chickens originally bred using an infusion of Malay chicken bloodlines in Adamsville, Rhode Island in the USA.
- Size
  - Rhode Island Reds are large: roosters weigh in at around 8.5 lb (3.8 kg), the hens 6.5 lb (3 kg).
- Temperament of Rhode Island Red Chickens
  - They are generally good pets to keep. However the roosters, and sometimes hens, can be quite aggressive.
- Uses of the Rhode Island Red
  - They are a tough utility bird, raised for meat and eggs. Indeed they are among the best laying types of chickens. With good feeding their egg production is excellent, being from 250 to 300 large, light brown eggs a year. They are moderately early maturing. Rhode Island Reds are also used for creating many modern hybrid types of chickens. However, their large comb makes them susceptible to frost bite.

1.4.6 Sussex Chickens

- Color and Appearance
  - The most famous Sussex chooks are the Light Sussex. These are very distinctive types of chickens having a white body with a black tail and black wing tips, neck being white striped over with black. Other colors include Brown, Buff, Light, Red, Speckled, Silver, White and Coronation.
- Origin of Sussex Chickens
  - The Sussex chicken was created over a century ago in the county of Sussex, England.
- Size of Sussex Chickens
  - Cocks should weigh approx 9lbs (4.0 kg), and the hens (females) 7lbs (3.2 kg).
- Temperament of Sussex Chickens

- The Sussex chicken is an alert, docile breed that can adapt to any surrounding, comfortable in both free range and confined spaces.

- Uses of the Sussex

- Sussex are dual purpose types of chickens that are good foragers, and understandably

- Color  and Appearance of Hamburg Chickens

1.4.7 Hamburg Chickens

- Hamburgs come in a wide variety of colors including: Silver-Spangled, Golden-Spangled, Golden-Penciled, Silver-Penciled, White, and Black.

- Origin of Hamburg Chickens

- The Hamburg (or Hamburgh in Britain) was developed in Holland before 1700 and may even date back to ancient times.

- Size of Hamburg Chickens

- Hamburg are small with roosters weighing around 5lb (2.25kg) and hens about 4lb (1.75 kg). There are also bantam Hamburgs, weighing around 1.5lbs.

- Temperament of Hamburg Chickens

- The breed is apt to fly and tends to be nervous around people.

- Uses of the Hamburg

- Hamburgs are hardy, active types of chickens that forage well, mature quickly and are very good producers of small white eggs

1.4.8 Faverolles

- Color and Appearance
  - The Faverolles is a large and cloddy breed. They are unusual types of chickens, sporting beard, muffs, feathered feet, and five toes per foot. The most common color is Salmon which is expressed differently according to sex, hens being cream and coffee colored, and males darker, with black, brown, and straw-colored feathers. Less common colors include white, black, cuckoo, splash, and blue.
- Origin of Faverolles
  - The ancestors of the Faverolles were first developed by French farmers in the early 1800's. However, many different breeds of chickens have been used to develop it further since then.
- Size of Faverolles
  - Roosters are around 10 lb (4.5 kg), hens around 8.5 lb (3.8 kg).
- Temperament of Faverolles
  - Faverolles are friendly, docile and quiet chickens.
- Uses of the Faverolles
  - Originally a dual purpose utility breed, Faverolles mature rapidly into a good quality meat bird. Hens are also above average layers of medium-sized, light brown to pinkish eggs. However, today they are kept primarily for show, which has - as it does in all types of chickens - resulted in deterioration of their utility aspects.

1.4.9 Cornish Chickens

- Color and Appearance
  - Cornish chickens are chunky birds with large breasts and thighs, and close fitting feathers. Color varieties include white, white laced red, dark birds with brown patterning on a dark blue-green background (the Cornish Game) or lighter birds with the same patterning on a light wheaten background (Jubilee Cornish Game).
- Origin of Cornish Chickens
  - The Cornish originated in England and was first known as the Indian Game.
- Size of Cornish Chickens
  - Though they may grow heavier, the standard weight for a male is 7.5 lb (3.4 kg) and for a female is 6 lbs (2.7 kg).
- Temperament of Cornish Chickens
  - A loud and active breed that is not especially docile, but takes confinement well.
- Uses of the Cornish Chicken

  Of all the different breeds of chickens, the Cornish are the definitive meat bird, consuming substantial amounts of feed and growing rapidly. Their skin is yellow. Crossed with white Plymouth Rocks, they form the basis to most commercial broiler production. They are poor layers (50/year) of brown eggs of low fertility, are winter hardy and apt to go broody.

1.5 Local (indigenous) chicken breeds of Ethiopia

1.5.1 Phenotypic and genotypic characteristics of indigenous chickens in Ethiopia

As mentioned on the above section Indigenous chickens in Ethiopia are non-descriptive , but are closely related to the jungle fowl and are found in every corner of the country. Tadelle (2003) referred to them as “local chicken ecotypes” and Halima et al. (2007b) as“native chicken populations”, both named on the basis of the geographic region of sampling.

They vary in color, comb type, body conformation and weights and may or may not possess shank feathers.

The characteristics of the indigenous chicken breeds of Ethiopia are summarized as follows:

- Non-descriptive breeds closely related to the Jungle fowl.
- They vary in color, comb type, body conformation
- Vary in weight and may or may not possess shank feathers.
- Broodiness (maternal instinct) is pronounced.
- Slow growth
- Late maturity
- Relatively resistant to disease than exotic breeds
- Low egg production,
- Small sized eggs
- Low survivability of chicks
- Low feed utilization efficiency

The indigenous chickens of Ethiopia have various names and are characterized on different grounds, as in many other parts of Africa. Teketel (1986) classified them on the basis plumage colors and feather cover: as

- Kei (for red)
- Tikur (for black)
- Gebsima/ for greyish mixture (wheaten strips on black background0.
- Netch (white)
- Melata (nacked neck) of the five ecotypes the Melata ecotype was found to be superior.

1.5.2 Local (Ethiopian) chicken ecotypes

1.5.1.1 Farta chickens

- Found in the Amhara regional state in northern Ethiopia.
- The population of these chickens numbers about 123 800, and they are kept by the Amhara community.
- They are maintained under scavenging regimens with occasional supplementation and sheltered in the family house.

The chickens have predominantly white body plumage that occurs at similar frequency in both sexes. Red and ‘’gebsima’’ (wheaten strips on a black background) are the typical plumage colors in males but are not observed in females. The other peculiar feature in males is a black breast (locally referred ‘’libe tikur’’), which is almost absent in females.


1.5.2.2 Mandura chickens

• found in the Benshangul Gumuz regional state in northwest Ethiopia at • They are reared by mixed communities of Amhara, Gumuz and Agaw Brown is the most predominant plumage in the population followed by red, white and kokima (white or grayish strips on brown or reddish background). Complete red is typical of males plumage but absent in females.	

1.5.2.3 Horro chickens

- Found in the Oromia regional state in western Ethiopia.
- The single most important plumage color of males is red (60 percent). Only 3 percent of the females are red and the most frequent color is zigrima, which is totally absent in males. All chickens have feathered necks. Yellow is the dominant skin color in both sexes. The predominant body shape is blocky. However, quite a large proportion of cocks (22 percent) have a triangular body shape. The average shank length of adult males is 8.8 cm and that of females is about 6.8 cm. Adult males weigh about 1 700 g and females 1 372 g

1.5.1.2 Konso chickens

- found in the Southern Nations, Nationalities and Peoples Regional State in south Ethiopia
- Most of the cocks (43 percent) have red body plumage

whereas brown (28 percent), zigrima (17 percent) and black (15 percent) are the prominent plumage colors in hens. About 4 percent of the cocks and less than 2 percent of the hens have naked necks.

1.5.1.3 Sheka chickens

- found in the Southern Nations, Nationalities and Peoples Regional State in south Ethiopia
- They are reared mainly by the Sheka and other very small populations of Kaffa and Menja communities..

Brown is the predominant plumage followed by red, zigrima and black. Cocks (42 percent) have mostly red plumage. A brown breast is typical of both sexes, but black is the second largest breast colour in cocks (22 percent), locally referred to as libe-tikur. Cocks are chiefly red or golden on the neck, and hens are mainly brown necked. Six percent of the hens and 3 percent of the cocks have naked necks. The majority of the chickens in the population have white skin, yellow shank and red earlobes. The population is mainly pea combed (54 percent) with 20 percent single combs. The average shank length of adult males is 9.4 cm and that of females is about 7.8 cm. Adult males weigh about 1 697 g and females

1.6 Selection

Selection-The choice of allowing individuals to become parents for next generation

Genes can be improved by Selection and breeding methods

1.7 Breeding systems in poultry

The breeding systems used in any breeding programme should have the following objectives:

- ✓ Increase in homozygosity which constitutes inbreeding,
- ✓ Increase in heterozygosity which involves outbreeding.

Ultimate result of breeding in term of genetic language is alteration of gene and genotype frequency, either in forward or backward direction as per desire and requirement.

Any breeding system that increases homozygosity within breed

Is known as inbreeding.

Inbreeding is mating of closely related individuals.

Advantages

- ❖ the surest and quickest method of fixing and perpetuating/sustained / a desirable characteristic
- ❖ to create lines or strains of animals that are uniform in type,
- ❖ It keeps the closest possible relationship to a desirable ancestor.

The disadvantages of inbreeding

- Sometimes increases the proportion of undesirable breeding stock, as genetic abnormalities may appear with increased frequency.

Inbreeding can be grouped into three types,

- ❖ close inbreeding,
- ❖ line breeding, and formation of strain

1. Close inbreeding

Breeding animals that are more closely related than the average animals of a given breed, variety or strain, such as

- ✓ sire to daughter,
- ✓ Mother/dame to son,
- ✓ Full-brothers to full-sisters.

- ❖ Breeding of close relatives the heterozygosity can be brought down to 10-12% or even below it in 10-12 generations.

2. **Line Breeding**
   - ❖ Line breeding, is often defined as a breeding method usually directed toward keeping the offspring closely related to some highly admired ancestor.
   - ❖ The daughters of different generations are mated back to outstanding sire,
   - ❖ The sons of various generations are mated back to outstanding dam

3. **Formation of Strain**

- ❖ This involves mating of double cousins, hence it is called as milder form of inbreeding.
- ❖ This is done to establish high productive traits in population to use it for production of commercials.
- ❖ It also reduces heterozygosity but a slower rate than close or line breeding.

4. **Out breeding**:

   Is breeding of unrelated animals. It has two types

   1. **Out crossing**: The mating of unrelated animals within the members of the same breed, variety or strain is outcrossing.

   2. **Cross breeding**: the mating of unrelated animals with different breeds_is referred to as crossbreeding.

1.8 Methods of Mating

- ❖ The methods of mating play major role in obtaining fertility of eggs from breeder birds.
- ❖ There are five commonly used methods of mating, out of which pen mating and flock mating are of commercial importance. While stud mating, shift mating and artificial insemination (AI) are important from research point of view

1. **Pen Mating**

- ❖ More number of females are allowed to mate with single male in small flock in separate pens for each male.

- But fertility may not be as good as of flock mating due to likeness in mating.

2. Flock Mating

- This is the common method of mating used in most of the breeding practises.
- About 20-30 males are run with 250-300 females in flocks in a section of house.
- This reduces the chances of likeness or social order in mating and very good fertility is obtained, but parentage of offspring cannot be known.

3. **Stud-mating**

the male is housed in a pen or coop and females are individually kept one by one with male for mating time only and removed.

The method is excellent for increasing the utility of outstanding males to increase the off springs mating, and therefore, it is more expensive.

4. Shift Mating

- In this method males are shifted from one pen to another after certain period of time, which helps in thorough testing of females as they are exposed to several males for mating.
- But to maintain accuracy of parentage this method is little difficult because fertile eggs can be produced for one to two weeks even after removing male from that pen. The recommendation for overcoming this problem is to discard eggs for one week after shifting of old male and housing of new male in particular pen

1.9 Artificial Insemination

- The method is not commonly used in chicken but it is quite common in turkey breeding due to lower fertility problems.
- The reasons for not becoming it common may be the non- availability of trained personnel, more labour involved and handling stress to birds.
- But if practised, it is excellent method to increase the efficiency of breeding programme.
- Because it increases the

- ✓ utility of outstanding males,
- ✓ eliminates completely social order in mating,
- ✓ minimises risk of disease spread and
- ✓ increases accuracy in parentage determination,
- ✓ it is more advantageous

1.10. inheritance and environment

- ❖ A variation in any flock is not only due to genetic component but environment component is also responsible for it.
- ❖ The expression of each character depends on gene in addition to which environment, hormones, and management conditions are also responsible for producing response.
- ❖ The hatchability, fertility, viability (liveability), resistance to disease, egg production, and flesh production are the characters of economic and fundamental importance, where environment frequently plays its role for full exploitation of these characters.

  For example, from high hatchability genes, poor hatching can be obtained due to faulty incubation conditions or low egg production can be noted in highly genetic potential birds because of imbalanced diet and poor housing conditions

Self-Check -1	Written Test

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

1. Write three Commercial breeds of chicken? .(5 points)
2. List out the Role of Poultry production.(5 points)

Note: **Satisfactory rating - 5 and 10 points** **Unsatisfactory - below 5 and 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- 2	Determining characteristics of rooster suited for breeding

2.1 Introduction to terminology

Rooster: adult male chicken, or adult male of other domestic or non-domestic fowl

Cockerels: male baby chicks; male young domestic fowl

Hens: female chickens in their second year of lay, or after their first moult

Layers: chickens rose to be egg-layers

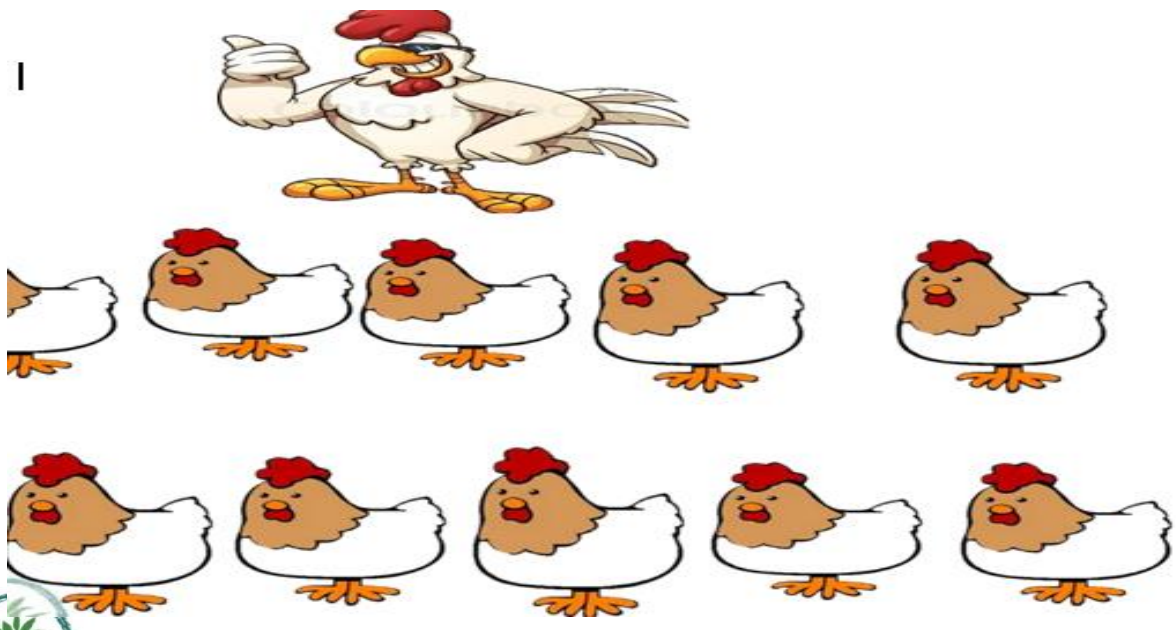
Layer-Broiler: chickens rose to be both egg-layer and to be eaten

Meat birds: old term for broilers

Pullets: female chickens in their first year of lay, or prior to their first moult; female baby chicks

2.2 characteristics of rooster

- Make deliberate mating's that lead to your goal
- Keep good records
- Keep track of birds
- Keep the best and remove the rest
- Select only healthy birds
- Don’t select birds with physical abnormalities
- You will only need a few males compared to females
- 1male for every 10 females



Figure, 1male for every 10 females

2.3 Criteria for selecting poultry breeds

1. Carcass Quality and Other Uses
2. Feather Color
3. Temperature Tolerance
4. Disposition
5. When you crowd birds, like is the case in a small coop or moveable pen, aggressive tendencies result in more injuries, infections, broken eggs, and even dead chickens, so consider this before you put aggressive breeds in with overly docile ones.
6. Considering the space you may have your birds in, disposition is key to keeping birds healthy
7. Size Matters
8. Egg Color and Laying Ability
9. A good laying record

2.4 Selection

The choice of individuals from the population to become parents for next generation is selection.

It is necessary to maintain or increase variation in population and one of the important force for genetic improvement. Males are needed for fertile eggs to produce chicks

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 characteristics of rooster? (5 points)
2. Write at list five Criteria for selecting poultry breeds? (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

1. _____
   _____
   _____
   _____
2. _____
   _____
   _____
   _____
   _____

Information Sheet- 3	Maintaining breeder sheds according to established farm practices following

3.1 Poultry housing

Poultry production systems should provide fresh air, clean feed and water, protection against Predators, shelter from cold, rain, wind, sun and excessive heat; as well as a source of heat When birds are young. Basically, the birds need a good house to be able to grow, sleep, lay Eggs in comfort, free from stress and disease. The basic requirements for free range poultry Housing are:

Protection from weather

- ❖ Protection from predators
- ❖ Enough space
- ❖ Adequate ventilation
- ❖ A clean environment

3.2 Poultry accommodation construction

1. Site selection

If one is seriously considering the establishment of a special poultry business, it will be well for him to study the various sections of the different site in order to determine just which offers best opportunities for poultry rising. Before constructing the free range poultry house, it is advisable to watch the following conditions.

A. Weather: - The most desirable temperature for a poultry house is 11 to 26 c^{o} in tropics. The use of insulation with straw pack or other materials can keep house warmer during cold time & cooler during the hot time.

B. Feed source: - The house site should be near to feed sources especially green feeds. Farm site with enough space for green feed establishment is preferable.

C. Veterinary service: - The house should be near for veterinary service.

D. Water supply:- The site must have adequate and clean water supply to satisfy the needs of entire flock or should be near a water source & the water have no disease causing germ, bacteria & poison.

E. Analyzing the risk of predators:- Identifying the presence or the absence of predators around the area is essential to protect the bird from risk.

F. Market: - The site should be closer to the market and there must high market accessibility.

G. Road accessibility:-Year round road access is necessary to transport the inputs and the outputs easily

The following point should be considered during poultry house construction:-

- ✓ Location against wind direction
- ✓ Orientation of poultry house
- ✓ Adequate space according to the number of poultry
- ✓ need for specifying foundation, well- drained area and good drainage system
- ✓ Adequate aeration
- ✓ Adequate light

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 The basic requirements for poultry Housing are?(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

1._____

_____

_____

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_____

_____

Information Sheet- 4	Set-up suitable place nests to established breeding practices

4.1Laying Nests equipment

As much as 50%of an attendant's time may be spent in handling and collecting eggs.

Well designing nest can reduce the time needed to care for laying flock and its eggs.

The interior part should be dark and contain 2.5to 5.0cm dept5h of nesting materials.

Individual nests

- Are just large enough to hold one hen.
- They are 25cm to 30cm wide30cm to 55cm high and about 25cm deep.

  Community nests
- Are accommodating several layers at a time.
- Nesting space of 0.1$m^2$is needed for 4hens.

One nest of0.6mwide by 1.2m long with an entrance of 0.2m in diameter is adequate for 40 hens

4.2 Nest arrangements

- With individual nest boxes, 1 nest per 5 hens should be provided

  (30 cm deep, 35 cm long and 40 cm high)
- The nests, if not automatic or semi-automatic, should have clean litter. Add new if the layer of litter decreases or becomes dirty.
- Keep hens from roosting in the nest at night and remove all broody hens quickly.
- Broken eggs and dirty litter must be removed promptly since their contents must be considered as a potential source of parasitic micro-organisms.
- Since it is the desire of a hen to lay her eggs into a quiet dark spot, the nests need to be sufficiently deep and not located in full light

4.3 Nest Requirements

- Clean and parasite free brooding coop.

- Nest consisting of straw, hay a dry leaves.

- placing the coop in a dark place

Place good feed and fresh water in the vicinity of the brooding hen

Figure-1, Laying Nests

Self-Check -4	Written Test

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

1. Write types of nests? (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

1. _____

_____

_____

_____

_____

Information Sheet- 5	**Transferring poultry breeders to appropriate breeder sheds following.**

5.1 Transferring poultry breeders to appropriate breeder sheds following.

The following point should be considered during poultry house construction.

5.2 Location against wind direction

The house should be placed at the back faces the direction from which wind and storms usually come, and so that it receives as much sunshine as possible.

5.3 Orientation of poultry house

The poultry house should face south or east in most localities. A southern exposure permits more sunlight in the house than any of the other possible exposures. And the house should have:-

- ✓ Adequate space according to the number of poultry need for specifying foundation, well- drained area and good drainage system
- ✓ Adequate aeration
- ✓ Adequate light

The size of poultry house depends on the number of fowls, and on whether they are to remain indoors all day, or are allowed to roam about and are shut up at night only. The measurement varies according to the production purpose, growth stage of the poultry. The main aim should be to provide a type of house that has plenty of space. Example for layers 5 /m2 ,for broiler's, 10/m2,for pullets 10/m2

In intensive poultry production either closed loose house system or caging could be used

The deep litter principle in intensive loose house system is characterized by:-

- ✓ The floor is covered with litter to a suitable depth
- ✓ Does not become too damp, decomposition of material by bacteria takes place
- ✓ The heat produced in the decomposition process dries up the birds' urine
- ✓ Bacterial Decomposition
- ✓ Keeps litter dry
- ✓ Dehydrates droppings

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 Orientation of poultry house (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

1._____

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Information Sheet- 6	Maintaining hygienic environment according to enterprise standard

6.1 Maintaining hygiene standards

Hygiene is a set of practices performed to preserve health. According to the World Health Organization (WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases." Many people equate hygiene with 'cleanliness,' but hygiene is a broad term.

Disease is always a hazard in poultry rearing with the establishment of large farms the risk of disease increases. The first requirement for good hygiene is effective cleaning with good cleaning one can eliminate more than 90% of all disease. The following hygienic measures are used to protect poultry against diseases.

1. Isolation of the farms. Locate them as far away from other poultry farms as practical.
2. No admittance of visitors. The poultry house has to be closed properly. If any person is to be admitted to the poultry house he must be made to change his footwear and clothes and should disinfect his hands.
3. Get feed in bulk transport or in proper houses.
4. Prevent entry of wild birds into poultry house.
5. Keep one category of poultry on the farm at any one time and if possible keep birds of one age. Young chicks are more sensitive to diseases than older birds. Microorganisms can be transmitted easily from adults to chicks and vice versa.
6. Prevent children, dogs, cats or other animals from entering poultry house.
7. Poultry house personnel should not be allowed to keep poultry at home.
8. All poultry equipment in the poultry house should be cleaned and disinfected before use .
9. Good housing solid floor e.g. cement and smooth walls are essential for cleaning and disinfection.
10. All insects' rats and mice should be destroyed since they are carriers of diseases. Rats are vicious predators of young chicks.
11. Good ventilation is essential to maintain temperature and humidity.

12. Use of healthy stock all the time is very important.
13. A scheme of vaccination based on sound veterinary advice is essential.
14. Cull all sick birds at the first sign of disease.

15. An immediate removal of dead birds is necessary and all dead birds should be disposed of either by burning or by burial.
16. Avoid overcrowding and overheating of the birds.
17. Buy chicks or hatching eggs from pull rum free flocks.

Give well balanced and adequate feed from a reputable mill or give fresh home mixed concentrate.9Provide a footbath of disinfectant at the entrance of poultry houses

6.2 **Maintaining a safe working environment involves the following**

- Regular housekeeping
- Periodic inspection to detect and correct physical hazards
- Preventive maintenance of equipment, machinery and structures Self-inspection checklists
- Identify areas and items that need scheduled housekeeping, inspection and maintenance
- Clean, maintain, dispose and store materials, tools and equipment
- After performing all activities, consumables materials should be discarded(avoid) if their period of use is expired
- Permanent equipments and materials should be maintained, cleaned, disinfected and stored in to appropriate place.
- Tools and equipments should be maintained (including replaced or cleaned as appropriate) in an efficient state, in efficient working order and in good repair.
- Responsibilities, procedures (including frequencies) should be established
- Appropriate records should be kept and stored in formal manner.
- Attention must be given to cleanliness and hygiene around the farm, the removal of pollutants and dangerous objects from the animals' environment (Plastic, metal and paper-based materials
- The quality of drains and waste disposal systems, the removal of drug and soiled bedding, the provision of good housing ,

- The routine disinfection of housing to remove parasites and reduce risk of infections, the disinfections of houses before new stock are introduced and the maintenance of clean milking utensils, milking machines (if used) and other equipments.
- Secondly a regular husbandry routine should be maintained so that animals are not subjected to unpredictable and unsettling changes.
- If an animal is found dead, the meat should not be sold or eaten. Neither should you leave the body somewhere to rot. Preferably, it should be burnt. Otherwise it can be buried deep (3 to 4 meters) under the ground.
- If a diseased animal is killed in plain on farm (just before natural death), it is also not recommended that you sell or eat the meat. The body should be disposed of as described above.
- If you decide to slaughter a sick animal because you think it will not recover, the best is to ask for veterinary advice.
- Unless the disease is highly contagious, slaughtering should be done in recognized slaughterhouses.
- If you slaughter on farm, veterinary personnel should be present to help on examination the infected parts of the animal.
- Be aware of diseases dangerous to man, such as anthrax. In suspected cases of anthrax, do not open the body (the blood is highly contagious), and burn or bury the animal

6.2 Undertake work safe and environmentally

Procedure is a safe work procedure that must carried out in a given work place for effectiveness of work and manual handling. Some of these may include but not limited to:

- Safe animal handling system and procedures
- Identifying hazards and zoonosis
- Safe system and procedures for outdoor work including protection from solar radiation
- Appropriate use of PPE
- Following work procedure for every activity

6.3.1 Maintaining a safe working environment involves the following:

- Regular housekeeping

• Periodic inspection to detect and correct physical hazards

• Preventive maintenance of equipment, machinery and structures Self-inspection

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 five Undertake work safe and environmentally? (5 points)

2. Maintaining a safe working environment involves? (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

1._____

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2.

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Operation sheet-1	identifying and characterizing common poultry breedsTechniques

Techniques to Identify and characterize common poultry breeds

Steps /procedures

Step 1- Wear PPE.

Step 2 List the poultry breeds that you have learned.

Step 3- Characterize poultry breeds

Step 4- Select working site.

Step 5Categorize poultry breeds that you have learned into dual purpose, egg type and meat purpose

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 4 hours.

Task 1: identifying and characterizing common poultry breedsTechniques?

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

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

Poultry Production

Level-III

Learning Guide -41

Unit of Competence: Perform breeder farm Operations

Module Title: Performing breeder farm Operations

LG Code: AGR PLP3 Mo10 LO2-LG-41

TTLM Code: AGR PLP3 TTLM 0120v1

LO 2: Carry-out breeding to in- lay activities

Instruction Sheet	Learning Guide # 41

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

1. Leaving Male (rooster) with the females (hens) to mate.
2. Training birds to lay in nests with recognized industry standards.
3. Keeping temperature of the hen shed constant.
4. Doing maintenance of breeder poultry in line with egg production objective.
5. Prevented any drafts from entering the building.
6. Conducting in-lay activities according to enterprise protocol and production plan.
7. Employing safety practices according to Occupational Safety and Hazard Standards.

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:

- ☞ Leave Male (rooster) with the females (hens) to mate.
- ☞ Trainee birds to lay in nests with recognized industry standards.
- ☞ Keep temperature of the hen shed constant.
- ☞ Doing maintenance of breeder poultry in line with egg production objective.
- ☞ Prevent any drafts from entering the building.
- ☞ Conduct in-lay activities according to enterprise protocol and production plan.
- ☞ Employee safety practices according to Occupational Safety and Hazard Standards.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below in page 40.
3. Read the information written in the information “Sheet 1- 7”.
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3, Self-check 4, Self-check 5, Self-check 6, and Self-check 6” in page -43, 46, 52, 55, 58, 63 and 69 respectively.

5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1,” in page -70.
6. Do the “LAP test” in page – 70 (if you are ready)

Information Sheet-1	**Leaving Male (rooster) with the females (hens) to mate**

1**.1 Male to female ratio**

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

1.2 **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

Self-Check -1	Written Test

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

1. Write the Male to female ratio?(6 points)
2. List out 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._____

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2.

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Information Sheet-2	Training birds to lay in nests with recognized industry standards

2.1 Training birds to lay in nests

The amount of time it takes for chickens to sexually mature varies by the breed Usually start laying between 18 and 22 weeks of age Some breeds may start laying as early as 16 weeks Lighter breeds usually mature faster than heavier breeds

Feed and water need to be provided at all times Water is particularly important as it is a major component of the egg In many villages, nests are not provided for the hens and eventually the hens will lay their eggs on the ground, in high grass or in natural shelters, where it may be difficult to find. Some chicken farmers build nests on the ground outside the chicken houses. This should be avoided, as eggs outside houses are more exposed to predators and thieves. Nests should be placed inside the chicken house and preferably above the ground. For laying you may have a battery of nests where more hens can lay at a time. Nests should be of the right size for the hen to feel comfortable. The size and length as well as the number Collect eggs at the same time every day in the morning and the evening. Removing eggs continuously is important if you want to avoid that the hens become broody In many villages, nests are not provided for the hens and eventually the hens will lay their eggs on the ground, in high grass or in natural shelters, where it may be difficult to find. Some chicken farmers build nests on the ground outside the chicken houses. This should be avoided, as eggs outside houses are more exposed to predators and thieves. Nests should be placed inside the chicken house and preferably above the ground. For laying you may have a battery of nests where more hens can lay at a time. Nests should be of the right size for the hen to feel comfortable. If water is restricted or unavailable for long times during the day, egg production will drop Housing is the same as growing with the exception of nest boxes Need one nest box for every 4-6 hens 12x12x12 is a good size for average size hens Make them a little bigger for large size breeds Place in a shaded area to encourage the hens to lay eggs in them. Provide nests in the hen house for laying makes it easier to collect eggs and they can be kept clean. There should be adaptation period of the hen for the laying nest before start of laying eggs which is important to prevent the hen not to lay their eggs outside

the laying nest. If you mark the eggs properly, you will know which eggs are new and should be collected. You may avoid dirty and cracked eggs, if the eggs are collected twice a day.

Collect eggs at the same time every day in the morning and the evening. Removing eggs continuously is important if you want to avoid that the hens become broody. The size and length as well as the number of compartments of the laying nest to be prepared should consider the number of hens. A nest box will typically measure 30 x 30 x 30 cm. The laying nest prepared by this size is enough for 5 layers. It is advisable to place the laying nests in the dark part of the house to prevent exposure to the sun. Don't make them too big, as the hen will not feel comfortable. A calabash or nest basket may measure 40 x 20 x 25 cm (upper diameter x height x lower diameter). A clay pot is made more or less the same as calabash.

To avoid the number of eggs laid by hens on the ground and loss of product, we have to consider the following points:

- Place enough nest and introduce nests one week before onset of lay
- Collect ground eggs many times a day and use a comfortable nest
- don't feed when the hens are on the nest
- Avoid dark corners in the house and do not collect the first eggs
- Divide the nests uniformly over the house and place nests on a wind free place

Figure-2, Training birds to lay in nests

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 Characteristics of good laying nests? (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. _____

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Information Sheet-3	Keeping temperature of the hen shed constant

3.**1 The highest and lowest critical temperature depend very much on:**

- ✓ age (young –old)
- ✓ bodyweight (small –large)
- ✓ housing system (litter –slatted floor)
- ✓ feeding level (low –high)
- ✓ relative humidity
- ✓ air velocity
- ✓ health

3.2 **Possibilities in heat regulation include:**

Physical

1. Tissue insulation (fat)
2. Feathers
3. Changing body position and huddling.
4. Vaporization of water
5. Flow of blood through skin and mucous membranes

Chemical

1. Increase of feed intake (low temperature)
2. Decrease of feed intake (high temperature)

Effect of temperature on broilers	
Too high temperature	To low temperature
Less feed intake	Extra feed intake
Less growth	Wet litter
Increased mortality	High risk for diseases
	Breastblisters
	Leg problems
	Increased mortality

Effect of temperature on broiler breeders	
Too high	Too low
Less egg production	Less eggs
Less fertility of eggs	Less fertility
More mortality	Higher disease risk.
More 2nd class eggs	

Effect of temperature on layers	
Too high	**Too low**
Less feed intake	Increased disease risk
Smaller eggs	More feed intake (1.5 gr/bird/day/ C)
More second class eggs	Increased mortality
Increased mortality	

3.3 Assessing **temperature by way of the chickens**

- ✓ Behavior of the **chickens**

- ✓ Abnormal body position
- ✓ External abnormalities
- ✓ Abnormal plumage may point to mistakes in-house climate
- ✓ Coughing/sneezing frequencies
- ✓ Activeness, increased or decrease activity

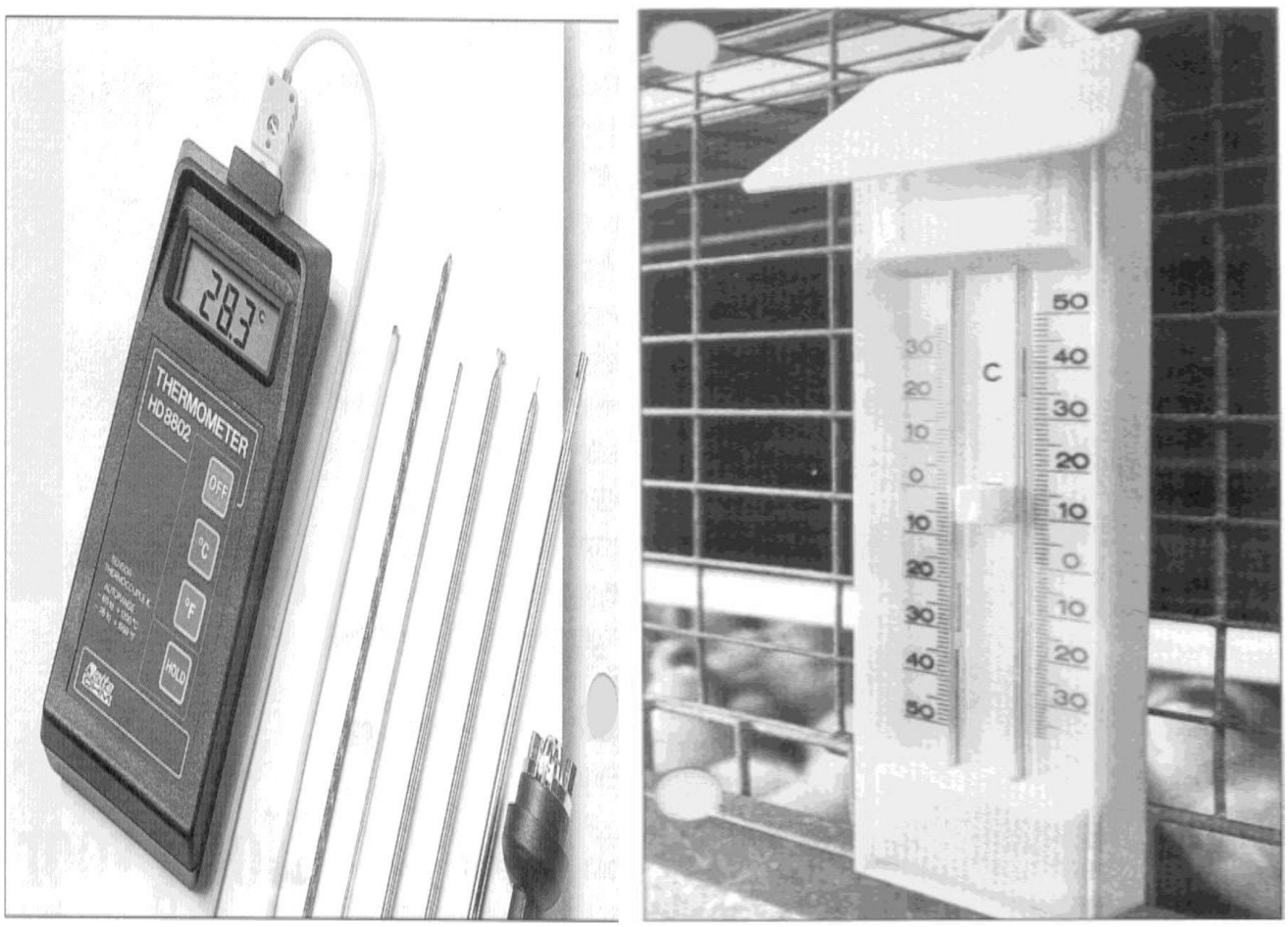

Figure-3, **assessing temperature by way of thermometers**

3.4 Recommended temperatures

Recommended temperatures for poultry

- Rearing + Broilers
- First day 32-34°C
- 1st week decrease to 30°C
- 2nd week decrease to 26°C
- 3rd week decrease to 22°C
- 4th week decrease to 20°C
- Layers + Breeders18-24°C

These temperatures are recommended temperatures and should be adapted to local situation if necessary.

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 highest and lowest critical temperature depend very much? (12 points)

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

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

- _____
- _____
- _____

_____

Information Sheet-4	Doing maintenance of breeder poultry in line with egg production objective.

4.1 Ideal breeding programme

Ideal breeding programme consists of combination of various selection systems, and method can be better used along with individual, family and pedigree selection systems.

The traits like egg production, viability, fertility, etc. which have low heritability can be improved by adopting family selection.

On the other hand successful improvement in characters like egg weight, shell quality, sexual maturity, growth rate, confirmation can be achieved by using individual selection.

Therefore, a wise breeder fixes required characters in his bird by combining useful methods for his operation.The amount of time it takes for chickens to sexually mature varies by the breed Usually start laying between 18 and 22 weeks of age Some breeds may start laying as early as 16 weeks

Lighter breeds usually mature faster than heavier breeds Feed and water need to be provided at all times Water is particularly important as it is a major component of the egg If water is restricted or unavailable for long times during the day, egg production will drop Housing is the same as growing with the exception of nest boxes Need one nest box for every 4-6 hens 12x12x12 is a good size for average size hens Make them a little bigger for large size breeds Place in a shaded area to encourage the hens to lay eggs in them.

4.2 Selecting Breeders layers

During selection of layers the following features are considered. Some of them are:

- Should lay many eggs
- Should be free from broodiness characteristics
- Start laying early
- Have small body size (1.5-2.5Kg)
- Body size and rate of production are inherited traits
- For layers –the smaller the hen the more efficient
- Her production –less feed to produce eggs
- For layers –Leghorn type hens and sex-link hens are
- Best for producing lots of eggs using little feed
- Modern meat birds are fast growing and very efficient

4.3 Culling Hens

Culling hens refers to the identification and removal of the non-laying or low producing hens from a laying flock. Low performing broilers

Unless the birds are diseased, they are suitable for marketing or home cooking.

4.4 The purpose of culling

Removing the inferior birds reduces the cost of producing eggs

Reduces the incidence of disease, and increases the available space for more productive hens.

Hens eat feed whether or not they are laying. Removing the cull birds will make more feed and space for more productive birds.

Self-Check -4	Written Test

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

1. Write Selecting Breeders layers?(5 points)
2. Define Culling Hens?(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	Prevented any drafts from entering the building

5.1 Building systems

Accommodation construction -The design, airflow, and materials used, internal layout of shed, site selection, space requirements per bird

- General
- Foundation
- Floor
- Walls
- Roof
- . Doors
- Wire mesh
- Maintenance
- Bill of quantity

2.2 Ventilation

- Inlet of fresh air
- Outlet of dirty air
- Outlet of heat (m^3 and speed

5.3 The housing of the flock

- The parent stock flock needs to be housed in well ventilated houses with correct indoor temperatures, litter in good condition (dry, not dusty, not crusty, without moulds), a well-adjusted lighting program, sufficient feeder and watering space per bird.

- Ventilation is the most efficient method to reduce the amount of micro-organisms in the air, which may contaminate the hatching egg (clean egg contains 1000-10,000 bacteria on the surface)

- A correct control of the fans-eliminates draught, maintains an ambient temperature & supplies sufficient fresh air in the house.

- Concrete floors (asphalt) are essential for a good disinfection and the prevention of repeating worm infestation

- Biosecurity - System of procedures and other means to reduce or eliminate exposure of poultry flocks to any type of infectious agent, whether it is viral, bacterial, fungal, or parasitic in nature.

2.3 Principles of Housing

- Selection of site
- Housing Design
- Housing Environment
- Housing Equipment's
- Housing Space
- Light
- Housing hygiene and sanitation
- Biosecurity

Self-Check -5	Written Test

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

1. Write the Principles of Housing? (6 points)

2. Write the Recommended Accommodation construction? (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	Conducting in-lay activities according to enterprise protocol and production plan

6.1 Developing and documenting Enterprise plan for production

Planning is very important to start a free range poultry enterprise. If any interesting body decides to Enter in poultry production, consider the following parameters.

6.2 The type of production

Based on your consumer demand, you should plan your production either egg production, meat Production /broiler/ or both egg and meat production. Decide which type of production brings More profit within consumers' satisfaction

Example: if you decide to start your own business by layers for egg production, you have to Know Subdividing the yard of a fixed house permits pasture rotation and rest. The use of bird netting on top can reduce contact with wild birds.

Laying percentage and length of the laying period:

In countries where the poultry industry is well-developed, the hens start laying when they are about 20 weeks. The production of the whole chicken stock then rises quickly to a peak after another eight weeks. At that point, most of the chickens lay an egg almost every day. Each day there are almost as many eggs to be gathered as there are chickens. This ratio of number of chickens to number of eggs gathered on one day is the so-called "laying percentage". When the peak in production is reached, for example when the chickens are 28 weeks, the laying percentage can be as high as 90%.

The general characteristics of poultry stock which is productive are the following: Production rises quickly to a peak. Peak production is high. The high peak production is maintained for some time, and then only slowly decreases.

This means that there is a high average laying percentage over the whole laying period.

Depending on the production level, the price of eggs and of non-productive chickens at the end of the laying period, the laying period lasts 12-14 months for a well-developed poultry business. After this the chickens are sold or slaughtered. This can be shown on a so called production curve.

The weight of the eggs:

In many countries eggs are sold by weight, so the weight of eggs is also of importance. The first

Eggs at the start of the laying period are small. The weight of the eggs increases until the end of the laying period. The egg weight depends partially on the chicken breed. It can also be influenced by the feed given and the environment, in particular the temperature. The egg weight is measured by weighing a number of eggs from time to time.

Chicken losses:

During the laying period chickens will regularly die. In general, a reasonably well running poultry farm loses a total of about 6-8% of its chickens each year, or just over ½% per month. If you lose more than this, it is important to find out what the cause is.

6.3 The number of birds /flock size/

To determine the number of birds, first study the consumers demand, the general market

Condition and the trends of the market throughout the year. Based on the feasibility study the

Number of birds will be determined.

For both meat and egg production, the number of chickens in the flock is the most important factor. Flock size changes constantly as eggs hatch and hens are sold or eaten. Usually the main cause of flock depletion is mortality, particularly in chicks. Local birds lay an average of three to four clutches of 12 to 15 eggs in a year, with more eggs laid at crop harvest time because more feed is available. Given most traditional farming systems, keeping the flock number constant requires eight to ten eggs for reproduction, leaving an average of 35 to 40 eggs per layer for sale or consumption. In village flocks, income derives from the sale of eggs and live birds. For example, a flock of 15 local hens laying 30 eggs/hen/year (with one local cock) will produce 450 eggs in a year. Of these 450 eggs, 120 may be incubated by broody hens (in ten clutches of 12 eggs each), of which 100 chicks may hatch, and 30 eggs may be cracked and consumed in the household, leaving a balance of 300 eggs for sale. Of the 100 day-old chicks, 30 may reach maturity (with rearing losses of 70 percent), to yield 15 cockerels and 15 pullets. The 15 pullets will replace the older hens, of which ten remain after the sale of cull hens, and one new cockerel will replace the old cock. The annual income from the flock can therefore be calculated as follows:

300 eggs + 10 old hens + 1 old cock + 14 cockerels = income

6.4 Sexual maturity

- The age of laying first egg or the distance between day of hatch and first egg laid, is termed as sexual maturity.

- Earlier is the sexual maturity, more productive the bird is because it gets additional period to lay in its laying cycle of year.

Precosity:

- It can be defined as early sexual maturity.

Intensity of lay:

- It is capacity of bird to lay in defined period of time. It can also be termed as rate of lay and what breeder is interested is high intensity of lay, which is the ability to lay at rapid rate.
- The better is intensity of lay, the more will be financial returns.
- In this connection the size of clutch is important. The number of eggs laid on consecutive days without gap, is known as clutch.
- The longer is the clutch size, the higher will be the intensity of lay. One way of measuring intensity of lay is to calculate simple percentage of production while other way is the size of clutch.
- It is important genetic trait but management also governs intensity of lay.

Persistency:

- The ability of hen to continue laying for longer period in her first laying cycle.
- In other words it is measure of length of laying year of hen
- The longer is the length of laying cycle, more persistent the hen is.
- Once again it is important genetic trait associated with egg production.
- Persistency is highly correlated with annual egg production and hence important contributing factor to hen-housed egg production of bird

Self-Check -6	Written Test

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

1. Define Sexual maturity?(5 points)

2. Define Persistency? (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

1.

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- _____

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2.

- _____
- _____

Information Sheet-7	Employing safety practices according to Occupational Safety and Hazard Standards

7.1 General Safety Rules

- No smoking on working areas
- Walking/working surface above ground level
- not wear loose clothing
- follow procedures
- proper housekeeping
- Proper lifting
- Fire protection and prevention-emergency action plan
- Use of tools
- Prompt report of accidents
- Use of ladders
- When in doubt, ask first
- Welding safety procedures
- Discussion of other special farm rules

7.2 Hazard: is the term that refers to dangerous conditions that can results risks in the working place. This can be physical, mechanical, chemical, and Biological factors which affect or harm the health and safety of all people and animals in the working place.

7.2.1 Physical hazards

- Exposure to high noise levels from mechanical equipment
- Callosities on hands caused by continuous strenuous work with hand tools
- Eye strain due to poor illumination in the tannery

7.2.2 Chemical hazards

- Skin rashes and dermatomes as a result of exposure to cleaners, solvents, disinfectants, Pesticides, leather-processing chemicals, etc.

- Allergies - contact and systemic - caused by many of the chemicals used in tanneries

7.2.3 Biological hazards

- Raw hides and skins may be contaminated with a variety of bacteria, molds, yeasts, etc., and various diseases (e.g., anthrax, leptospirosis, tetanus, Q-fever, brucellosis, etc.)

7.2.4 Ergonomic hazard

- Acute musculoskeletal injuries caused by physical over exertion and awkward posture while moving heavy or bulky loads, in particular bundles of hides, skins and leather,
- Low back pain due to prolonged working in a standing or semi-bending posture and
- Heat stress, in particular when working on warm days in premises lacking good ventilation or air Conditioning.

7.3 Preventive measures

- Wear safety shoes with non-slip soles
- Erect fences and post warning signs round open pits in the tannery call a qualified electrician to examine and repair faulty or suspect electric equipment
- Wear protective goggles and respiratory protection during buffing work
- Do not ever enter a confined space when you are alone. To enter such a space, use respiratory protection equipment with autonomous air supply, and have a co-worker stand-by to call a rescue team in case of weakness, asphyxiation or poisoning
- Seek medical attention if skin rashes develop; consult an allergy specialist on
- Keep a high level of personal hygiene; change clothes at the beginning and end of shift; do not take work-soiled clothes home
- Learn correct lifting techniques and work postures, to avoid low back pain use mechanical aids for the lifting and transport of heavy loads how to deal with sensitivity to solvents and adhesives
- Install effective exhaust ventilation to remove hazardous gases and vapors, and eliminate obnoxious odors from the tannery.

Figure-4, Fore OHS

7.4 Occupational Health and Safety (OHS)

Work task is provided according to Occupational Health and Safety (OHS) requirements and supervisor instructions

- Apply OHS requirements in accordance with regulations/codes of practice and enterprise safety policies and procedures. This may include:
  - Using of relevant protective clothing and equipment,
  - Use of tooling and equipment,
  - Workplace environment and safety handling of material,
  - First aid kit
  - Hazard control and hazardous materials and substances.
  - Using gowns, rubber boots of appropriate size, goggles, gloves etc.,
  - Following OHS procedure designated for the task

- Checking and fulfilling required safety devices before starting operation

- Apply safe operating procedures regarding:
  - Electrical safety,
  - Machinery movement and operation,
  - Working in proximity to others and site visitors.
- Apply emergency procedures:
  - Emergency shutdown and stopping of equipment,
  - First aid application and site evacuation. electrical safety,
  - Machinery movement and operation,

  Occupational Health and Safety (OHS): Any occurrence which results in personal injury, disease or death, or property damage

A hazard: A hazard is anything that has the potential to harm the health or Safety of a person.

Risk: Risk is the significance of the hazard in terms of likelihood and severity of any possible injury.

Safety The provision and control of work environment systems and human behavior which together give relative freedom from those conditions and circumstances which can cause personal injury, disease or death, or property damage. A hazard: A hazard is anything that has the potential to harm the health or Safety of a person.

Risk: Risk is the significance of the hazard in terms of likelihood and severity of any possible injury. Work plays a central role in people's lives, since most workers spent at least eight hours a day in the workplace, whether it is on a farm observation(poultry feeding, watering or cleaning), in an office, factory, etc. Therefore, work environments should be safe and healthy. Yet this is not the case for many workers. At the time of poultry health control program many risks and hazards may be occurred It includes

- hazardous noise
- dust
- solar radiation
- veterinarian chemicals
- zoonotic diseases

Figure-5, for hazard indication

Self-Check -7	Written Test

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

1. List the time of poultry health control program many risks and hazards occurred includes? (5 points)
2. Write the d/t b/n hazed and risks? (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

1.

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- _____
- _____

_____

2.

- _____
- _____

Operation Sheet- 1	Selecting Breeders layers criteria’s

Steps/ procedures

- Wear PPE
- Should lay many eggs
- Should be free from broodiness characteristics
- Start laying early
- Have small body size (1.5-2.5Kg)
- Body size and rate of production are inherited traits
- For layers –the smaller the hen the more efficient
- Her production –less feed to produce eggs
- For layers –Leghorn type hens and sex-link hens are
- Best for producing lots of eggs using little feed
- Modern meat birds are fast growing and very efficient

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 4 hour.

Task 1. Selecting Breeders layers criteria’s?

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

Poultry Production

Level-III

Learning Guide -42

Unit of Competence: Perform breeder farm Operations

Module Title: Performing breeder farm Operations

LG Code: AGR PLP3 M10 LO3-LG-42

TTLM Code: AGR PLP3 TTLM 0120v1

LO3.Collect eggs

Instruction Sheet	Learning Guide # 42

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

- Collecting fertile eggs according to established enterprise protocol and requirement.
- Identifying and grading of egg carried out in accordance with production requirements.
- Handling livestock during egg collection.
- Doing eggs cleaning and sanitation in company requirements
- Maintaining hygienic environment procedures and requirement.
- Completing records of all collections accurately monitor production.

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:

- Feed materials are select and feed as per the standard practices
- Collect fertile eggs according to established enterprise protocol and requirement.
- Identify and grade of egg carried out in accordance with production requirements.
- Handle livestock during egg collection.
- eggs cleaning and sanitation in company requirements
- Maintain hygienic environment procedures and requirement.
- Complete records of all collections accurately monitor production

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below in page 72 and 73.
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 -80, 83, 87, 92, 96 and 103 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” in page -104.
6. Do the “LAP test” in page –1104 (if you are ready).

Information Sheet-1	Collecting fertile eggs according to established enterprise protocol and requirement

1.1 Collecting fertile eggs according to established enterprise protocol and requirement

A fertile egg is a self-contained supper system for the developing embryo successful chick development depends on

- ✓ Temperature
- ✓ Humidity
- ✓ Gas concentration
- ✓ Orientation and farming

The following factors are of major importance for the production of hatching eggs that produce high quality chicks:

- ✓ Genetic makeup of the parent stock
- ✓ Housing of the flock
- ✓ Flock health and applied vaccination program
- ✓ Feed and water
- ✓ Male to female ratio
- ✓ Age of the flock
- ✓ Flock performance
- ✓ Egg weight
- ✓ Shell quality
- ✓ Nesting arrangements
- ✓ Gathering of the eggs
- ✓ Egg storage

- ✓ Grading and cleaning of the eggs
- ✓ Disinfection of the eggs

1.2. Collect Eggs Early and Often

- ✓ Most flocks will lay a majority of their eggs by 10:00 am.
- ✓ It is best to collect the eggs as soon as possible after they are laid.
- ✓ The longer the egg is allowed to stay in the nest, the more likely the egg will get dirty, broken or will lose interior quality.
- ✓ Collecting eggs at least twice daily is advisable, especially during extreme weather temperatures

1.3 Proper Egg Cleaning and Handling

1. Collect eggs in an easy to clean container like coated wire baskets or plastic egg flats.
2. Do not stack eggs too high.
3. Never cool eggs rapidly before they are cleaned.
4. Wash eggs as soon as you collect them. This helps limit the opportunity of
5. Wash eggs with water 10 degrees warmer than the egg.
6. Cool and dry eggs quickly after washing. Store eggs, large end up, at 50-55°F and at 75%relative humidity.

1.4 Sorting and Grading Eggs

It is best that you sort the eggs before you store, sell, or consume them. The easiest way to sort eggs is to candle them with a bright light.

1. How to Candle Eggs: Hold the egg up to the candling light in a slanting position
2. Identifying Cracks: Cracked eggs will appear to have a white line somewhere on the shell.

1.5 Storage of Eggs

1) Store eggs small end down in an egg carton to keep the air cell stable.
2) Date carton so you can use or sell the oldest eggs first and rotate your extra eggs.

3) Store eggs at 50-55°F and 70-75% relative humidity.
4) Never store eggs with materials that have an odor. Eggs will pick up the odors of apples, fish, onions, potatoes and other food or chemicals with distinct odors.
5) Never hold eggs at or above room temperature or at low humidities more than necessary.

1.6 Sale of Eggs

There are no laws which prevent the sale of eggs from a home laying flock. However, you should take some basic steps to ensure that the eggs you sale have uniform quality.

1) Follow the suggestions about collection, washing, storage, and sorting above.
2) For marketing it is usually best to size the eggs. Medium, large and extra large eggs sell best.
3) Never sell eggs in cartons with another egg producer or store name on the carton.
4) Most small flock producers base their prices on the current store prices in the area they live.

1.7 Care of Eggs on the Farm

Immediately after it is laid, an egg begins to lose quality, even if it is removed from the nest, cooled, packed, and marketed promptly. Keeping temperature and humidity conditions at an optimum level retards this loss in quality to a large degree. Although most eggs are produced by large in-line integrated operations, some are still produced from off-line production facilities. At off-line sites, certain steps are necessary to maintain egg quality at the highest level. Some of these steps are:

1) Gather eggs frequently (at least 3 times a day).
2) Handle the eggs carefully to prevent breakage.
3) Cool the eggs promptly and store them under the optimum temperature and humidity.
4) Pack the eggs in clean, cool packing materials.
5) Pack clean eggs separately from dirty eggs.
6) Washing, Grading, and Packing

1.8 Operations and Equipment

Even with good farm-management practices and careful handling, a small percentage of dirty eggs will be produced.

Producers must bear in mind that dirty eggs are covered with bacteria that will cause spoilage if they enter the egg.

Whether conducted at the production or processing site, washing must be performed in a manner that will minimize the chances of bacterial penetration of the shell. If these important facts are forgotten, and eggs are washed carelessly, more damage can be done than by leaving the dirt on the shell. Wetting a dirty shell provides moisture in which bacteria may breed and assists their growth and penetration through the shell. A washing solution colder than the egg causes the egg content to contract and thus allows polluted water to be drawn through the shell. When washing eggs the following precautions should be followed:

1) Wash eggs with water at least 20 °F (11.1 °C) warmer than the internal temperature of the eggs and at a minimum of 90 °F (32.2 °C).
2) Select a detergent or detergent sanitizer that is compatible with the wash water and one that will not give off foreign odors that may be imparted to the egg.
3) Use only potable water with an iron content of less than 2 parts per million (p/m) for washing and keep wash water as clean as possible.
4) Rinse by spraying with water slightly warmer than the wash water.
5) Use an approved sanitizer in the spray rinse.
6) Dry the eggs to remove any excess moisture prior to packaging.

1.9 Abnormalities

Double-yoked eggs result when two yolks are released about the same time, or when one yolk is lost into the body cavity for a day and is picked up by the funnel when the next day's yolk is released.

Yolkless eggs are usually formed around a bit of tissue that is sloughed off the ovary or oviduct. This tissue stimulates the secreting glands of the oviduct and a yolkless egg results.

An egg within an egg is due to the reversal of direction of the egg by the wall of the oviduct. One day's egg is added to the next day's egg and the shell is formed around both.

Blood spots are caused by a rupture of one or more small blood vessels in the yolk follicle at

Self-Check -1	Written Test

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

1. Mention the egg Abnormalities?(5 points)
2. Write Care of Eggs on the Farm? .(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

1.

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Information Sheet-2	**Identifying and grading of egg carried out in accordance with production requirements.**

2.1Egg selection

2.1.1 Eggs Weighing

There are considerable advantages in weighing a sample of eggs each day to establish the trend in egg weight. The analysis of this trend is a useful guide to flock performance and will give an early indication of problems. The egg weight shown in the table should be expected from normal parent flocks where our recommendations for body weight, feed levels and feed specifications have been followed. Weigh at least 90 eggs immediately following the mid-morning collection, excluding only double-yolk and cracked eggs. Daily egg weights when plotted on a graph will give an indication of potential problems that should be investigated immediately.

1. Underweight eggs

- Underfeeding
- Low levels of energy or protein feeds
- Inadequate water supply
- Disease
- Extreme house temperatures
- Underweight birds

2. Overweight eggs

- Overfeeding
- High levels of energy or protein feeds
- Overweight birds
- Egg size is largely determined by the body weight of the female at photo stimulation. Delayed
- Lighting will give larger eggs initially and probably throughout the life of the flock.

1.2 Egg grading

Egg grading should be carried out with care to prevent damage to hatching eggs Remove and discard eggs unsuitable for hatching. These are:

Dirty as defined by company policy Cracked Small - depending on hatchery policy Very large or double yolk Poor shells grossly misshapen Rejected eggs should be stored well away from hatching eggs. It is essential to place hatching eggs carefully into the setter or transport tray with the small (pointed) end facing down.

The egg handling room must be kept clean and tidy. Maintain good vermin control in the egg store. The egg handling room is the first stage of egg cooling and it is an advantage to keep it cool – cooler than the laying house, but warmer than the egg store

2.4 Egg Selection

- Eggs that weigh between 55–60 grams are selected for incubation toavoid an uneven distribution of heat, relative humidity and oxygen.
- Eggs must be fertilized (presence of a cock)
- The cocks must be two weeks before the period of hatching.
- Use undamaged, clean, neither too small not too large. (Best if medium sized).
- Collect eggs regularly /e.g. 3 times a day/.
- Preferably store eggs not more than a week

2.4.1 Egg selection criteria

- Eggs that weigh medium weight are selected for incubation to avoid
- an uneven distribution of heat, relative humidity and oxygen
- Eggs must be fertilized (presence of a cock)
- Use undamaged, clean, neither too small not too large. (Medium size).
- Collect eggs regularly /e.g. 3 times a day
- Preferably store eggs not more than a week.
- Handle hatching eggs carefully because they are costly!
- NB: Any Dirty or Cracked Egg is Lost as a Hatching Egg

Self-Check -2	Written Test

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

1. Mention the Egg selection criteria?(5 points)
2. Write causes under and overweight of eggs? (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

1.

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Information Sheet-3	Handling during egg collection

3.1 collection /Gathering eggs

- 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

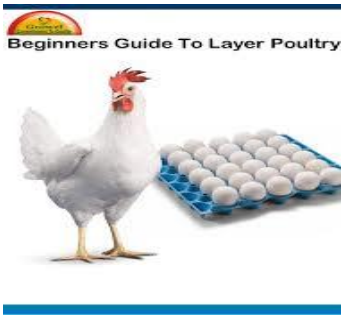
3.2 Egg Storage

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. The color of the egg shell does not affect the egg Eggs shells can be many colors including: white, brown, blue, green and olive.



Figure, The color of the egg shell does not affect the egg

Figure, Egg collection Conveyor belt system

Self-Check -3	Written Test

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

1. Write criteria's of collection /Gathering eggs? (6 points)
2. Write criteria's Egg Storage? (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.

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Information Sheet-4	Doing eggs cleaning and sanitation in company requirements

4.1 Cleaning

Cleaning refers to removal of matter from a surface on which it is not acceptable. Soil surface should be contact with a cleaning agent for adequate time and sufficient pressure should be applied, if required, to remove the soil. Cleaning involves two steps: wash step and rinse step. Equipment should be carefully selected and, washed, and maintained before they can be sanitized.

4.2 Sanitation

Sanitation is the processes of destruction of micro-organisms on surface after washing and rinsing. The purpose of sanitizing is to reduce the microbial count to a safe level. It is achieved through heat and application of chemical compounds. Both cleaning and sanitizing from the basis of poultry health treatment program sanitation and their purposes are: 1). Reduce health hazards by avoiding contamination 2). Prevent the spread of diseases, and food & water contamination, 3). Control abnormal odors, and Create conducive environmental conditions 5). Disposing wastes materials to dispose waste material following waste disposal instruction is the first thing it include

- Enter information as waste is added to container
- Keep waste containers closed
- Keep soil waste separate from liquid waste
- Do not place incompatible wastes in same container
- Place leaking containers in secondary container and call the ORCBS as soon as possible for disposal
- Store animals carcasses in an appropriate freezer walk in cooler/or refrigerator
- Autoclave and /or incinerate infectious wastes

- Place autoclaved biohazard waste bags in an opaque bag prior to disposal

Majority of the disease in poultry farm are raised from improper cleaning and disinfecting

I. Cleaning;-The first requirement for good hygiene is effective cleaning.

II. Disinfection; - during disinfecting the poultry farm the following important points should be considered. These are: They should kill all pathogens. Should not be poisonous to birds and persons operating.

- ✓ Do not cool eggs rapidly before they are cleaned, as the shell will contract and pull any dirt or bacteria on the surface into the pores of the egg.
- ✓ Clean the eggs as soon as you collect them. This eliminates sources of contamination and loss of interior quality. Wash eggs with potable water 10 degrees warmer than the egg. This will make the egg contents swell and push the dirt away from the pores of the egg. If the eggs are extremely dirty a mild detergent approved for egg washing can be used. NEVER let eggs sit in water,as once the temperature equalizes the egg can absorb contaminants from the water.
- ✓ Dry and cool eggs quickly after washing, store in a refrigerator at <10°C.
- ✓ Separate floor eggs from nest/cage eggs.

4.3 Grading and cleaning of hatching eggs

In most cases grading and cleaning of hatching eggs is a simultaneous operation in the hatchery. In selecting hatching eggs, the requirements regarding shell quality and egg shape will be higher for layers than for broilers.

- ✓ eggs with abnormal spaces - loose or floating air cells -to large air cells
- ✓ eggs with large blood or meat spots
- ✓ Dirty eggs (if not too dirty) may be dry-cleaned with sand paper or wire wool.

- ✓ Washing of hatching eggs is possible too, but do it in a correct way.
- ✓ Do not use a cloth which has been dipped into water or vinegar.
- ✓ For egg washing one should have at one's disposal a well-constructed egg washing machine, which should be operated
- ✓ Egg washing if well done is not harmful to the hatchability.

Self-Check -4	Written Test

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

1. Mention the advantages of Grading and cleaning of hatching eggs? (6 points)
2. Define cleaning and sanitation? (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.

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2.

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Information Sheet-5	**Maintaining hygienic environment procedures and requirement**

1.1 Egg Hygiene

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

5.2 Disinfection of hatching eggs

- The contamination with micro-organisms of hatching eggs starts immediately after an egg has been laid.
- 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

5.2.1 The disinfection aims to

Kill bacteria, moulds and some viruses on the eggshell to prevent these microorganisms penetrate the egg through 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:

a. 6 grams of formaldegen which is heated to $400^{O}F$ in special electrical pans.
b. 20 grams potassium permanganate and 30 cc formalin 40%

Fumigation:

- ✓ It is most effective against shell surface contamination. Fumigation occurs during the formation of the air cell. The most frequently used and their dose rates are:
- ✓ Para-formaldehyde powder: 8-10 grams per m3.
- ✓ 53 ml of formalin (37.5%) and 35 grams of potassium permanganate per m3.
- ✓ 43 ml of formalin (37.5%) and 21 grams of potassium permanganate per m3.
- ✓ Mixture of 40% formalin and potassium permanganate: 45 ml and 30 grams per m3 respectively.
- ✓ The maximum germicidal effect of formalin is when the ambient temperature is between 24°C and 35°C and humidity is 85-90% for 20 minutes

Summary of 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

Self-Check -5	Written Test

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

1. Write the disinfection aims to egg? (6 points)

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

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

Answer Sheet

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

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Information Sheet-6	**Completing records of all collections accurately monitor production**

6.1 What is it to 'keep records'?

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.

Records can be about

- Any performance of the animals,
- 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.

The 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.

6.2 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.

Records are important in poultry production because:

- To keep track of all animals (Identification records)
- Evaluation of livestock for selection (breeding records; financial records; production records)
- Control of inbreeding and aid in breeding planning (breeding records)
- Aid in selecting animals with the right characteristics for breeding (production, health, feed efficiency) to improve the herd or flock
- To rationalize labour
- Aids in feed planning and management
- Aids in disease management; keeping track about treatment (disease records)
- Aids in finding the effective treatments
- To assess profitability/losses (financial records)
- Improves bargaining power on products, because you can see the investment and the price of the production (financial records)
- Credit/loan access (financial records)

6.3 Types of Records

The following are major types of records which are all described below:

1. Identification Records

- Used for identifying individual chickens

2. Breeding Records

- The importance of breeding records is to measure the productive efficiency of the herd and to enable culling and selection.
- The most important data in breeding records include:
  - Pedigree/parentage (name or other identification of parents and grandparents)
  - Fertility (dates of all services (this also allows calculating the number of services per conception), dates of giving birth (allows to calculate the age of first calving/giving birth and the period between successive birth)
  - Birth details (number and weight of newborns, was assistance necessary? Stillborn / perinatal deaths / vitality score).

3. 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.

4. Feeding Records

- Feeding records give information about the amount, type and quality of the feed
- Feeding records can be used both for day to day management and adjustment of the feed ration.
- The important feeding records are:

- Produced and available fodder on farm; quantity and if possible quality of the different feeds. Including content of energy, protein and minerals
- A feeding plan which tells how much feed is required per day per animal in different age groups (grown-ups, newborn, pregnant the first time etc.) or per group of animals (hens):
- Left-over feed if any (per head and per feed, if possible) Spoilage (per batch)

5. Disease and treatment records

- Disease and treatment records are necessary to keep track of the disease events in which each animal is involved during its lifetime. This can guide to better management practices by leading the attention to repeated events or certain vulnerable groups of animals over time (e.g. it can show how animals almost always need disease treatments during weaning).
- Disease and treatment records can for example involve:
  - ✓ Disease occurrence and date.
  - ✓ All handlings to cure diseases (also non chemical treatment)
    -Vaccination
    -Dipping/spraying
    -Treatment
    -De-worming
    -Postmortem

6. Financial Records

- The records of the costs and earnings related to the animal farming are kept for cash analysis and enterprise appraisal.
- In most households, the most necessary records are simple overview over the family cash flow, that is, the total economy in the household: what comes in? and what do we buy?

- Economic records are of paramount interest in providing the farmer with information concerning the profitability of his farm. Moreover they are of great help in decision making at the right time.

Self-Check -6	Written Test

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

1. Enumerates types of record and discuss? (6 points)

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

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

Answer Sheet

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

1.

- _____
- _____
- _____

_____

Operation Sheet-1	Egg selection

Procedure/steps of egg selection

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 4 hours.

Task 1: **Egg selection**?

List of Reference Materials

1. Amhara National Regional State Bureau of Agriculture and Rural Development (ANRS BoARD), 2006. Poultry Development and Marketing Strategy. Bahir Dar, Ethiopia

2. Statistical Authority (CSA), 2014. Agricultural Sample Survey Vol. II. Statistical Bulletin No. 331, Addis Ababa, Ethiopia.

3. EARO (Ethiopian Agricultural Research Organization), 2000. Summary of Livestock Research Strategy, EARO (unpublished).

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

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7. 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.

8. Dawit Alemu, Tamirat Degefe and Setotaw Tefera. Overview and background paper on Ethiopia's poultry sector: Relevance for HPAI research in Ethiopia. Ethiopian

Poultry Production

Level-III

Learning Guide -43

Unit of Competence: Perform breeder farm Operations

Module Title: Performing breeder farm Operations

LG Code: AGR PLP3 M10 LO3-LG-43

TTLM Code: AGR PLP3 TTLM 0120v1

LO4. Care for hatching eggs

Instruction Sheet	Learning Guide # 43

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

1. Selecting hatching eggs following standard enterprise protocol.
2. Storing eggs in accordance to industry standard procedures.
3. Neglecting eggs that by hens are took for incubation purposes.
4. Minimizing floor egg problems 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:

- ☞ Select hatch eggs following standard enterprise protocol.
- ☞ Store eggs in accordance to industry standard procedures.
- ☞ Neglect eggs that by hens are took for incubation purposes.
- ☞ Minimiz floor egg problems procedures.

Learning Instructions:

7. Read the specific objectives of this Learning Guide.
8. Follow the instructions described below in page 106.
9. Read the information written in the information “Sheet 1- 4”.
10. Accomplish the “Self-check 1, Self-check 2, Self-check 3 and Self-check 4” in page - 109, 114, 119, and 122 respectively.
11. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” in page -.
12. Do the “LAP test” in page – (if you are ready).

Information Sheet-1	**Selecting hatching eggs following standard enterprise protocol**

1.1 Selecting hatching eggs following standard enterprise protocol

The basic raw material of the hatchery is the fertile hatching egg supplied from the breeder farm. The quality of the chick all depends on the quality of the egg. The quality of hatching egg cannot be improved after lay but one can reduce the loss in hatching egg quality by adopting some standard procedures. Therefore, it is essential that care is taken in the storage and handling of the eggs till incubation

1.2 Grade and Select Hatching Eggs

In most cases grading, selection and cleaning of hatching eggs is a simultaneous operation in the hatchery. Use the following guidelines in grading and selecting eggs for incubation

1.3 Select Hatching eggs that are:

- ✓ Clean (not dirty and cracked),
- ✓ Thick and smooth shell,
- ✓ oval shape,
- ✓ medium sized eggs (55 - 65 g in weight), air cell < 3 mm in depth,
- ✓ free from defect (meat and blood spot internally),
- ✓ clear and firm egg white (albumen) as shown on

Self-Check -1	Written Test

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

1. Mention the Selecting hatching eggs following standard enterprise protocol? (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

1.

- _____
- _____
- _____

_____

Information Sheet-2	**Storing eggs in accordance to industry standard procedures.**

2.1 Storing eggs in accordance to industry standard procedures

- ✓ Sort UN cracked, undamaged eggs on clean surfaces, and store them in clean containers.
- ✓ Store eggs in a refrigerator (<10°C and 70-75% relative humidity) as soon as possible after collecting and cleaning.
- ✓ Store cleaned eggs with the small end down to keep the air cell stable during storage.
- ✓ Label cartons with the farm name and address so you can identify your eggs.
- ✓ Date the tray/carton so you can use or sell the oldest eggs first. Try to use or sell all eggs before they are three weeks old.
- ✓ Never store eggs with odorous materials, as eggs absorb odours from other foods (e.g. fish, onions) or from chemicals.
- ✓ Never leave eggs at room temperatures as warm, dry environments will cause decreased interior quality and increases food safety risks.
- ✓ Store empty egg trays off the floor 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. Hatching eggs storage management includes:
- ✓ 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

- ✓ 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.
- ✓ 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
- ✓ Temperature- ideal storage temperature is between 12-19ºC. If storage temperature is high then development of embryo can commence but at the wrong rate.
- ✓ 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,
- ✓ 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.

2.2 The storage of hatching eggs

- ❖ 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.
- ❖ 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
- ❖ For each square meter one may store 22 boxes (each of 360 eggs = 7920 eggs). If practicable, place the boxes on wood-slat platforms
- ❖ 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.

- eggs stored at an angle of 50° and turned daily 180°, showed better hatch than non-turned eggs
- 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

- Optimal hatchability is achieved in fresh eggs <10 days old, but reasonable hatchability can be obtained in eggs up to 14 days of age.
- During storage loss of moisture from the egg takes place due to water evaporation.
- Storing conditions however must never reach the dew-point when condensation on the shell surface would provide favourable conditions for microbial growth.

- During the transportation of hatching eggs avoid shocks in order to prevent cracks. Exercise special care in loading and unloading.

- 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-6, checking egg store environment using a temperature and humidity sensor.

Self-Check -2	Written Test

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

1. Mention the criteria of storage of hatching eggs? (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.

- _____
- _____
- _____

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Information Sheet-3	Neglecting eggs that by hens are took for incubation purposes

3.1 Neglecting eggs that by hens are took for incubation purposes

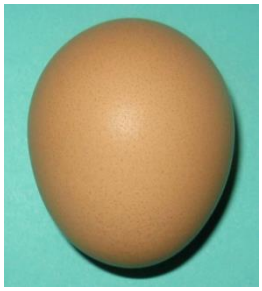
3.2 Reject eggs that are:

- ✓ cracked shell, dirty and stained eggs,
- ✓ misshaped (irregular shape such as long, circular and deformed),
- ✓ very small (< 45 g) or very large eggs (> 65 g) eggs,
- ✓ Eggs with shells which are rough and not uniform,
- ✓ thin or porous shelled eggs (are not likely to hatch well because of excessive losses of water during incubation),

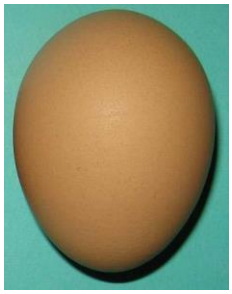
3.3 Eggs unfit/out of shape / for hatching are:

- ✓ dirty eggs
- ✓ cracks
- ✓ thin shelled eggs
- ✓ eggs with rough shell and not uniform
- ✓ Misshapen/deformed/ eggs
- ✓ eggs with abnormal spaces - loose or floating air cells-to large air cells
- ✓ eggs with large blood or meat spots
- ✓ Dirty eggs (if not too dirty) may be dry-cleaned with sand paper or wire wool.
- ✓ Washing of hatching eggs is possible too, but do it in a correct way.
- ✓ Do not use a cloth which has been dipped into water or vinegar.

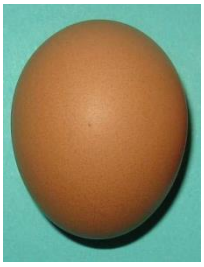
- ✓ For egg washing one should have at one's disposal a well-constructed egg washing machine, which should be operated
- ✓ Egg washing if well done is not harmful to the hatchability



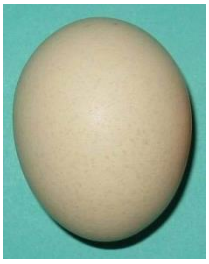
A. Ideal Egg



B. Large Egg



C. Small Egg



D. Pale Egg

E. Wrinkled Egg

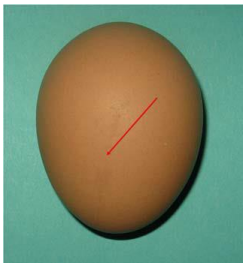
F. Dirty Egg

G. Perforated Egg

H. Round Egg

I. Stained Egg

J. Deformed Egg



K. Cracked Egg

L. Calcified Egg

Figure-8, External egg qualities

3.4 Egg abnormalities

There are two kinds of egg-abnormalities: internal and external.

1. **Internal**

- Loose yolk: the chalazae does not hold the yolk
- The yolk sticks to the eggshell: the yolk is loose or the egg has become old. Thick white has been transformed into thin white whereby it becomes easy for the yolk to start floating.
- Broken vitelline membrane: the contents of the yolk have penetrates the white. In old eggs the yolk absorbs moisture, becomes larger whereby the vitelline membrane may burst.
- Loose air cell: the shell membrane does not remain in contact with the shell.

The egg contains blood or meat spots. This is due to the bursting of blood vessels in the ovary.

2. External

- off size of the egg
- poor shape
- rough, not uniform shell surface
- cracks in the shell
- eggs without calcareous shell
- double yolk egg

Self-Check -3	Written Test

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

1. Enumerates two kinds of egg-abnormalities and discus? (6 points)

Note: **Satisfactory rating – 6 points** **Unsatisfactory - below 6 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-4	Minimizing floor egg problems procedures

4.1 Systems of Minimizing floor egg problems procedures

- ✓ Do not cool eggs rapidly before they are cleaned, as the shell will contract and pull any dirt or bacteria on the surface into the pores of the egg.
- ✓ Clean the eggs as soon as you collect them. This eliminates sources of contamination and loss of interior quality. Wash eggs with potable water 10 degrees warmer than the egg. This will make the egg contents swell and push the dirt away from the pores of the egg. If the eggs are extremely dirty a mild detergent approved for egg washing can be used. NEVER let eggs sit in water, as once the temperature equalizes the egg can absorb contaminants from the water.
- ✓ Dry and cool eggs quickly after washing, store in a refrigerator at <10°C.
- ✓ Separate floor eggs from nest/cage eggs

Self-Check -4	Written Test

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

1. Mention systems of Minimizing floor egg problems procedures? (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.

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- _____
- _____

_____

2.

- _____
- _____
- _____

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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.

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